FEDERAL REGISTER

Vol. 80 Monday,

No. 85 May 4, 2015

Part II

Department of Labor

Occupational Safety and Health Administration

29 CFR Part 1926

Confined Spaces in Construction; Final Rule

DEPARTMENT OF LABOR

Occupational Safety and Health Administration

29 CFR Part 1926

[Docket ID–OSHA–2007–0026]

RIN 1218–AB47

Confined Spaces in Construction

AGENCY: Occupational Safety and Health Administration (OSHA), Labor.

ACTION: Final rule.

SUMMARY: OSHA is adding a new subpart to provide protections to employees working in confined spaces in construction. This new subpart replaces OSHA's one training requirement for confined space work with a comprehensive standard that includes a permit program designed to protect employees from exposure to many hazards associated with work in confined spaces, including atmospheric and physical hazards. The final rule is similar in content and organization to the general industry confined spaces standard, but also incorporates several provisions from the proposed rule to address construction-specific hazards, accounts for advancements in technology, and improves enforceability of the requirements.

DATES: The final rule becomes effective on August 3, 2015.

ADDRESSES: In accordance with 28 U.S.C. 2112(a), the Agency designates Ms. Ann Rosenthal, the Associate Solicitor of Labor for Occupational Safety and Health, Office of the Solicitor of Labor, Room S4004, U.S. Department of Labor, 200 Constitution Avenue NW., Washington, DC 20210, to receive petitions for review of the final rule.

FOR FURTHER INFORMATION CONTACT:

General information and press inquiries: Mr. Frank Meilinger, Office of Communications, Room N3647, OSHA, U.S. Department of Labor, 200 Constitution Avenue NW., Washington, DC 20210; telephone (202) 693–1999; email *meilinger.francis2@dol.gov*.

Technical information: Ms. Jessica L. Douma, Directorate of Construction, Room N–3468, OSHA, U.S. Department of Labor, 200 Constitution Avenue NW., Washington, DC 20210; telephone (202) 693–2020 or fax (202) 693–1689; email *douma.jessica@dol.gov*.

For additional copies of this **Federal Register** document, contact: OSHA, Office of Publications, U.S. Department of Labor, Room N3101, 200 Constitution Avenue NW, Washington, DC, 20210; telephone (202) 693–1888. Electronic copies of this **Federal Register** document are available at *http://www.regulations.gov*. Electronic copies of this **Federal Register** document, as well as news releases and other relevant documents, are available at OSHA's Web page at *http://www.osha.gov*.

SUPPLEMENTARY INFORMATION:

Table of Contents

I. Executive Summary
A. Introduction
B. Need for Regulation
C. Affected Establishments
D. Benefits, Net Benefits, and Cost Effectiveness
E. Compliance Costs
F. Economic Impacts
G. Final Regulatory Flexibility Analysis
II. Background
A. Record Citations
B. History
C. Need for a Rule Regulating Confined Spaces in Construction
III. Summary and Explanation of the Final Standard
1926.1201—Scope
1926.1202—Definitions
1926.1203—General Requirements
1926.1204—Permit Required Confined Space Program
1926.1205—Permitting process
1926.1206—Entry permit
1926.1207—Training
1926.1208—Duties of Authorized Entrants
1926.1209—Duties of Attendants
1926.1210—Duties of Entry Supervisors
1926.1211—Rescue
1926.1212—Employee Participation
1926.1213—Provision of Documents to the Secretary
IV. Agency Determinations
A. Legal Authority
B. Final Economic Analysis and Regulatory Flexibility Analysis
1. Introduction
2. Need for Regulation
3. Profile of Affected Industries
4. Benefits and Net Benefits
5. Technological Feasibility
6. Costs of Compliance
7. Economic Feasibility and Regulatory Flexibility Determination
8. Final Regulatory Flexibility Analysis
9. Sensitivity Analysis
10. References
C. Office of Management and Budget Review Under the Paperwork Reduction Act of 1995
D. Federalism
E. State-Plan States
F. Unfunded Mandates Reform Act
G. Consultation and Coordination With Indian Tribal Governments
H. Applicability of Existing Consensus Standards
V. Authority and Signature
VI. Amendments to Standards

I. Executive Summary

A. Introduction

OSHA last issued rules addressing work in confined spaces in 1993; however, those provisions applied only to general industry work. A single training provision, issued in 1979, applies to confined space work in construction. Following the promulgation of the general industry rule, OSHA agreed to propose a standard for confined spaces in construction as part of a settlement of a legal challenge filed by the United Steelworkers of America. After consulting with the Advisory Committee for Construction Safety and Health (ACCSH) on a draft, and holding several stakeholder meetings in locations across the country, OSHA developed a draft and conducted a Small Business Advocacy Review Panel (SBAR Panel) in 2003. The Agency published its proposed rule for confined spaces in construction on November 28, 2007 (72 FR 67351). The proposal incorporated feedback from ACCSH, the stakeholder meetings, and the SBAR Panel, and addressed issues unique to the construction industry, such as higher employee turnover rates, worksites that change frequently, and the multi-employer business model that is common on construction worksites.

During the SBAR Panel, some small entity representatives expressed a preference for the general industry rule and requested that OSHA consider adopting that rule for the construction industry. When the proposed rule was published, OSHA requested comment on how the Agency could adapt a standard similar to the general industry rule for the construction sector. Commenters indicated that they had been following the general industry rule for quite some time and suggested adopting that standard with some modifications for the construction industry. OSHA considered the unique challenges faced by the construction industry as well as the requests by commenters for more consistency between the general industry and construction standards. The final rule reflects the organization, language, and most of the substantive requirements of the general industry rule. Some of the aspects of the construction industry that are not present in general industry work are addressed by modifications such as information exchange requirements to ensure that multiple employers have shared vital safety information. OSHA also adjusted the construction rule to account for advances in technology and equipment that allow for continuous monitoring of hazards. Other differences between the regulatory text of the general industry rule and this standard reflect improvements in clarity of language and enforcement considerations that have been addressed in interpretations of the general industry rule.

B. Need for Regulation

Prior to the promulgation of this rule, OSHA had one provision in its construction standards for a general training requirement when employees work in confined spaces. This provision at 29 CFR 1926.21(b)(6) provided limited guidance, instructing employers to train employees as to the nature of the hazards involved, the necessary precautions to be taken, and in the use of protective emergency equipment required. OSHA has determined that this final rule, which provides a higher level of guidance and safety information to employers engaged in this kind of work, will reduce the average number of fatalities and injuries in confined spaces covered by this standard by 96 percent.

C. Affected Establishments

The final rule affects establishments in several sectors of the construction industry, including work involving buildings, highways, bridges, tunnels, utility lines, and other types of projects. Also potentially affected are general contractors, as well as specialty-trade construction contractors and employers engaged in some types of residential construction work.

D. Benefits, Net Benefits, and Cost Effectiveness

OSHA expects the final rule to improve the safety of workers who encounter confined spaces in construction. The programmatic approach of the final rule includes provisions for: Identifying confined spaces and the hazards they may contain; allowing employers to organize the work to avoid entry into a potentially hazardous space; removing hazards prior to entry to avoid employee exposure; restricting entry through a permit system where employers cannot remove the hazard; providing appropriate testing and equipment when entry is required; and arranging for rescue services to remove entrants from a confined space when necessary.

An estimated 6 fatalities and 812 injuries occur annually among employees involved in construction work in confined spaces addressed by the provisions of this rulemaking. Based on a review and analysis of the incident reports associated with the reported injuries and fatalities, OSHA expects full compliance with the final rule to prevent 96 percent of the relevant injuries and fatalities. Thus, OSHA estimates that the final rule will prevent approximately 5.2 fatalities and 780 additional injuries annually. Applying an average monetary value of $62,000 per prevented injury and a value of $8.7 million per prevented fatality (value of statistical life) results in estimated monetized benefits of $93.6 million annually.

OSHA estimated the net monetized benefits of the final rule to be about $33 million annually when costs are annualized at 7 percent ($93.6 million in benefits minus $60.3 million in costs). Table IV–1 summarizes the costs, benefits, net benefits, and cost effectiveness of the final rule.

TABLE IV–1—NET BENEFITS

[Millions of 2009 dollars]

	7% discount rate	3% discount rate
Annualized Costs		
Evaluation, Classification, Information Exchange and Notification	$12.4	$12.2
Written Program, Issue Permits, Verify Safety, Review Procedures	4.2	4.2
Provide Ventilation and Isolate Hazards	2.8	2.7
Atmospheric Monitoring	11.4	11.3
Attendant	3.6	3.6
Rescue Capability	8.2	7.6
Training	11.3	11.3
Other Requirements	6.4	6.3
Total Annual Costs	60.3	59.2
Annual Benefits		
Number of Injuries Prevented		780
Number of Fatalities Prevented		5.2
Monetized Benefits		93.6
Net Annual Monetized Benefits (Benefits Less Costs)		
	33.3	34.4

Totals may not equal the sum of the components due to rounding.
Source: Office of Regulatory Analysis, OSHA. Details provided in text.

E. Compliance Costs

The estimated costs of compliance with this rule represent the additional costs necessary for employers to achieve full compliance. They do not include costs for employers that are already in compliance with the new requirements imposed by the final rule; nor do they include costs employers must incur to achieve full compliance with existing applicable requirements.

OSHA based the Preliminary Economic Analysis and Initial Regulatory Flexibility Analysis for the proposed rule, in part, on a report prepared by CONSAD Corp. [2] [1] under contract to OSHA. For the final economic analysis (FEA), OSHA updated data on establishments, employment, wages, and revenues, and updated the analyses in the final rule with these new cost inputs. OSHA estimated the total annualized cost of compliance with the present rulemaking to be between about $59.2 million (when costs are annualized at 3 percent)

[1] References are available at the end of this section of the preamble.

and $60.3 million (when costs are annualized at 7 percent). The final rule's requirements for employers to evaluate, classify, and exchange information account for the largest component of the total compliance costs, at approximately $12.2 million to $12.4 million (when costs are annualized at 3 and 7 percent, respectively). Other compliance costs associated with the final rule include costs related to atmospheric monitoring—($11.3 million to $11.4 million), training ($11.3 million), rescue capability ($7.6 million to $8.2 million), written programs, permits, and review procedures ($4.2 million), attendants ($3.6 million),—and ventilation and hazard isolation ($2.7 million to $2.8 million).

F. Economic Impacts

To assess the economic impacts associated with compliance with the final rule, OSHA developed quantitative estimates of the potential economic impact of the requirements in this rule on entities in each affected industry. OSHA compared the estimated costs of compliance with industry revenues and profits to provide an assessment of potential economic impacts.

The costs of compliance for the final rule are not large in relation to the corresponding annual financial flows associated with the regulated activities. The estimated costs of compliance (when annualized at 7 percent) represent about 0.08 percent (less than 1 percent) of revenues and 1.6 percent of profits, on average, across all entities. One industry, NACIS 23621 Industrial Building Construction, showed the potential for compliance costs to exceed 10 percent of annual profits (10.5 percent), but the Agency concludes that the final standard is still feasible for this industry because it affects less than 2 percent of all firms in that industry sector each year, and OSHA believes that firms engaged in confined spaces work are larger and more profitable than average. Moreover, OSHA does not believe that industries will absorb all or most of the final standard costs in lost profits, as the price elasticity of demand in construction is sufficiently inelastic for minor price increases to offset costs—here, a price increase of less than 0.5 percent (or one-half of 1 percent).

OSHA concludes that compliance with the requirements of the final rule is economically feasible in every affected industry sector.

In addition, based on an analysis of the costs and economic impacts associated with this rulemaking, OSHA concludes that the effects of the final rule on international trade, employment, wages, and economic growth for the United States are negligible.

G. Final Regulatory Flexibility Analysis

The Regulatory Flexibility Act, as amended in 1996 by the Small Business Regulatory Enforcement Fairness Act, requires the preparation of a Final Regulatory Flexibility Analysis for certain rules promulgated by agencies (5 U.S.C. 601–612). Under the provisions of the law, each such analysis must contain: (1) A statement of the need for, and objectives of, the rule; (2) a statement of the significant issues raised by the public comments in response to the initial regulatory flexibility analysis, a statement of the assessment of the agency of such issues, and a statement of any changes made in the final rule as a result of such comments; (3) a response to any comments filed by the Chief Counsel for Advocacy of the Small Business Administration, and a detailed statement of any change made to the proposed rule in the final rule as a result of those comments; (4) a description and an estimate of the number of small entities to which the rule will apply or an explanation of why no such estimate is available; (5) a description of the projected reporting, recordkeeping, and other compliance requirements of the rule, including an estimate of the classes of small entities that will be subject to the requirement, and the type of professional skills necessary for preparation of the report or record; and (6) a description of the steps the agency took to minimize the significant economic impact on small entities consistent with the stated objectives of applicable statutes, including a statement of the factual, policy, and legal reasons for selecting the alternative adopted in the final rule, and why the agency rejected each one of the other significant alternatives to the rule considered by the agency which affect the impact on small entities.

OSHA analyzed the potential impact of the final rule on small and very small entities, as described further under the heading ''Final Regulatory Flexibility Analysis,'' later in this preamble (see Section IV). OSHA concludes that the compliance costs are equivalent to approximately 1.64 percent of profits for affected small entities generally, and less than approximately 0.10 percent (less than 1 percent) of annual revenues for very small industries, though the inelasticity of demand in construction would allow the costs to be offset by price increases in most industries.

II. Background

A. Record Citations

References in parentheses are to exhibits or transcripts in the docket for this rulemaking. Documents from the subpart AA rulemaking record are available under Docket OSHA–2007–0026 on the Federal eRulemaking Portal at *http://www.regulations.gov* or in the OSHA Docket Office. The term ''ID'' refers to the column labeled ''ID'' under Docket No. OSHA–2007–0026 on *http://www.regulations.gov*. This column lists individual records in the docket. This document will identify each of these records only by the last three digits of the record, such as ''ID–032'' for OSHA–2007–0026–0032. Identification of records from dockets other than records in OSHA–2007–0026 will be by their full ID number. In addition, the transcripts for the public hearings OSHA held on July 22–23, 2008 are identified by the docket number in the record under Docket No. OSHA–2007–0026–0210 and –0211. To aid readers in locating citations to the transcripts, this document refers to these citations using the abbreviation ''Tr.'' and the corresponding page numbers, such as ID–201, Tr. pp. 10–15.

B. History

On March 25, 1980, OSHA published an Advanced Notice of Proposed Rulemaking (ANPR) on confined spaces for the construction industry (45 FR 19266). The ANPR posed 31 questions concerning confined-space hazards in the construction industry, and the Agency received 75 comments in response to these questions. However, OSHA took no further action on this regulatory initiative at the time.

The Agency subsequently published a Notice of Proposed Rulemaking (NPRM) for a general industry confined spaces rule on June 5, 1989 (54 FR 24080). OSHA issued the general industry confined spaces rule (29 CFR 1910.146) on January 14, 1993 (58 FR 4462).

The general industry standard requires employers to classify hazardous confined spaces as ''permit-required confined spaces'' and to implement specific procedures to ensure the safety of employees who enter them. It contains detailed procedures for developing a written confined-space program, monitoring atmospheric hazards, isolating physical hazards through lock out tag out procedures, training employees, preventing unauthorized employees from entering these spaces, providing rescue (both non entry and entry rescue), and maintaining records. The general industry standard specifies a limited exception from some of the permit-required confined-space requirements when the only hazard in a confined space is an atmospheric hazard and ventilation equipment will control the atmospheric hazard at safe levels. It also provides protection to employees from non-atmospheric hazards (for example, physical hazards) in confined spaces. However, the general industry standard does not apply to construction employers, and, as such, does not specify the appropriate level of employee protection based on the hazards created by construction activities performed in confined spaces.

In 1993, as part of the litigation activity associated with the newly promulgated general industry standard, OSHA agreed in a settlement with the United Steel Workers of America to issue a proposed rule to extend confined-space protection to construction employees. On February 18, 1994, OSHA submitted a draft proposed standard for confined spaces in construction to the Advisory Committee for Construction Safety and Health (ACCSH) for comment. ACCSH established a work group on March 22, 1994, to address the OSHA draft proposed standard and report its findings to the full committee. ACCSH adopted the work group report on May 17, 1994 and recommended that OSHA incorporate it into a rulemaking docket. In this report, ACCSH noted that the general industry standard did not meet the needs of the construction industry. ACCSH found that employers often do not identify or classify confined spaces encountered or generated at construction worksites prior to the beginning of a construction project, and noted the difficulties faced by employers generally on construction worksites, where conditions often change rapidly and many different subcontractors may perform work simultaneously.

Consequently, ACCSH established a work group to draft a proposed standard that would meet the unique needs of the construction industry. The draft proposed standard emphasized identifying different types of confined spaces encountered in construction (for example, spaces in which the employer isolates all hazards or controls atmospheric hazards at safe levels, and spaces that are permit-required spaces), as well as inter-contractor information exchange and the detailed protections necessary to eliminate or control specific hazards.

As the result of the ACCSH work group review, ACCSH submitted a draft proposed standard for confined spaces in construction to OSHA in 1996. ACCSH recommended that OSHA use the draft as a proposed confined spaces standard. OSHA determined that the ACCSH draft proposed standard needed revision to make it easier to understand, especially for small employers that do not employ a separate safety staff. The Agency also determined that the draft proposed standard did not address adequately certain hazards, such as hazards encountered in sewer-construction work. Consequently, OSHA determined that it was necessary to develop a new draft proposed standard.

In 1998, OSHA completed a new draft proposed standard, but discovered that there were several issues that the Agency needed to resolve before it could finalize the draft proposed standard. To get feedback from the construction community, OSHA held three stakeholders meetings in October of 2000 across the country. The topics discussed at the stakeholder meetings were: (1) Typical confined spaces encountered in construction; (2) whether the proposed standard should require an early-warning system for spaces in which the employer could not isolate an engulfment hazard (such as in some sewer situations); (3) the need for, and cost of, continuous monitoring for atmospheric hazards; (4) how a confined spaces standard for construction could accommodate the needs of small businesses; and (5) whether the proposed standard should permit an attendant to perform his or her duties for more than one confined space at a time.

In late 2003, OSHA completed drafting the proposed standard and convened a panel under the Small Business Regulatory Enforcement Fairness Act (SBREFA) to solicit comments on the proposal from small business entities. The SBREFA panel conducted two conference-call discussions, which were open to the public, in which small entity representatives expressed their concerns about the draft proposed standard; these representatives also submitted written comments to the record that covered the issues. The SBREFA panel then submitted its recommendations to the Agency in November 2003.

The Agency published a proposed rule for confined spaces in construction on November 28, 2007 (72 FR 67351). The proposed confined spaces standard for construction reflected input from stakeholder meetings, ACCSH, and the SBREFA review process. For example, OSHA removed a provision that addressed working in hazardous enclosed spaces (*i.e.,* spaces designed for human occupancy but subject to a hazardous atmosphere), which small business entities participating in the SBREFA review process considered burdensome and unnecessary; OSHA removed this provision because it believes that existing construction standards (for example, 29 CFR 1926.55) adequately address these hazards. The proposed standard used a confined-space classification approach consistent with the ACCSH recommendations. OSHA organized the proposed standard chronologically to guide the employer from its initial encounter with a potential confined space through the steps necessary to ensure adequate protection for employees. In addition, it addressed the need for coordination and information exchange at construction sites, which typically have multiple employers.

The Agency recognized that a number of requirements in the proposed standard for confined spaces in construction duplicated, or were similar to, the provisions of the general industry standard for permit-required confined spaces. Nevertheless, OSHA had concerns about whether the general industry standard adequately addressed the unique characteristics of confined spaces in construction. The feedback that OSHA received from ACCSH, stakeholders, and the SBREFA process indicated that, compared to general industry, the construction industry experiences higher employee turnover rates because construction employees often work at multiple worksites performing short-term tasks. Unlike most general industry worksites, construction worksites are continually evolving, with the number and characteristics of confined spaces changing as work progresses. Also, multiple contractors and controlling contractors are more common on construction worksites than general industry worksites. Therefore, a construction standard for confined spaces, even more so than the general industry standard for confined spaces, must emphasize training, continuous worksite evaluation, and communication requirements

Decision to abandon the proposed new classification system and adapt an alternative that is more similar to the general industry standard.

During the SBREFA review process, some small entity representatives urged OSHA to consider adopting the general industry standard for construction, and to solicit comment on how the Agency could adapt an alternative standard similar to the general industry standard to the construction sector. When the Agency published the proposed construction standard, it requested public comments on how to adapt an alternative standard similar to the general industry standard for the construction industry (72 FR 67352, 67401 (Nov. 28, 2007)). During the comment period and the public hearings OSHA held on July 22–23, 2008, OSHA received many comments and much testimony regarding the issue of using an adapted version of the general industry standard as the basis for the final rule rather than the new classification systems proposed in the NPRM. A clear majority of comments were in favor of finalizing a confined spaces in construction standard that more closely resembles the general industry standard for confined spaces. (See, *e.g.,* ID–032; –047; –075; –088; –092; –095; –105; –106; –115; –117; –118; –119; –120; –121; –125; 150; –152; –153; 185; –189; –210, Tr. pp. 54–60, 74–76, 174–175, 282–284; –211, Tr. pp. 73, 172, and 238–239.) Several commenters proposed adopting the general industry standard with some adaptations for the construction context, though not all of these commenters specified, or agreed on, what specific adaptations were appropriate (see, *e.g.,* ID–092; –117; –125). The Agency received a number of comments suggesting that many construction employers were currently following the general industry confined spaces standard (see, *e.g.,* ID–075; –085; –088; –092; –095; –112; –117; –118; –120; –121; –125; –147).

For the reasons discussed in the preamble to the proposed rule, and in light of the comments and testimony the Agency received, OSHA remains convinced that the general industry standard does not adequately address confined-space hazards as these hazards arise in the construction industry. Moreover, the 19 years of experience that employers have working with the general industry rule, and that OSHA has enforcing the general industry rule, highlight several areas in which additional clarification in the language of the general industry standard could improve the effectiveness of a new construction standard. Therefore, OSHA is not simply incorporating the general standard by reference into the construction standards.

OSHA believes that the particular duties and obligations in the general industry standard and the proposed construction standard are similar, and that the public's confusion over the re-organized structure in the proposed rule is the result of the degree of detail in the proposed rule, as well as its organization. Most notably, compared to the general industry rule, the proposed rule added specificity to the general industry standard's broad, performance-based requirements, and defined a larger number of confined-space classifications.

Nevertheless, in recognition of the commenter requests for more consistency between the two standards, OSHA is using the organization, language, and most of the substantive requirements in the general industry confined spaces standard as the basis for the final confined spaces in construction rule. However, differences in employee and worksite characteristics between the construction industry and general industry, as well as the comments and testimony of the regulated community indicating the need for consistency and continuity in OSHA requirements, prompted OSHA to develop a final rule for confined spaces in the construction industry that contains important requirements from the proposed rule and some additional changes. Many of these changes, such as the information exchange requirements, are designed to address the heightened need, on constantly evolving construction worksites for communication, worksite evaluation, and training for confined spaces in construction. In addition, several regulatory provisions in the general industry rule differ from the regulatory provisions of this final rule because the provisions of this final rule: (1) Address construction-specific issues; (2) account for advancements in technology; (3) address concerns raised by the regulated community through comment and at the hearing; or (4) reflect improvements in language for modern regulatory drafting (''must'' in place of ''shall''), clarity and enforcement considerations. In most cases, the preamble that follows this introductory section explains the differences between the provisions of the final rule and the general industry rule.

The Agency believes that it provided adequate notice of the substantive terms of the final rule, as well as an extensive description of the subjects and issues involved. Accordingly, the Agency fairly apprised interested persons of the content of the rulemaking, and the comments and hearing testimony provide ample evidence that interested parties to the rulemaking understood the issues and potential outcomes of the rulemaking. See, *e.g., Nat'l Mining Ass'n* v. *Mine Safety & Health Admin.,* 512 F.3d 696, 699 (D.C. Cir. 2008); *Miami-Dade County* v. *U.S. E.P.A.,* 529 F.3d 1049, 1059 (11th Cir. 2008); *United Steelworkers of America, AFL–CIO–CLC* v. *Marshall,* 647 F.2d 1189, 1221 (D.C. Cir. 1980) (''a final rule may properly differ from a proposed rule and indeed must so differ when the record evidence warrants the change. . . . Where the change between proposed and final rule is important, the question for the court is whether the final rule is a 'logical outgrowth' of the rulemaking proceeding''). The resulting final standard is a logical outgrowth of the proposal, and the number of comments urging an adapted version of the general industry standard provides a clear indication that the affected members of the public are not only familiar with the general industry standard, but also viewed the inclusion of part or all of the general industry standard's structure and language as a potential outcome of this rulemaking. The confined-space issues the Agency addresses in the final rule are the same as in the proposed rule, and the Agency addressed the criticisms and suggestions made by interested parties in response to the proposed rule. In short, the combination of OSHA's request for comment on the approach that it ultimately adopted in the final rule, the explanation of the hazards it sought to address in proposal, and the comments and testimony received in response to the proposal provided the regulated community with adequate notice regarding the outcome of the rulemaking. Therefore, the Agency concludes that there is no basis for further delaying promulgation of the standard to obtain comment on the approach adopted in this final rule.

Many of the comments OSHA received on the proposal related to specific requirements included in the detailed procedures of the proposed standard. As a result of finalizing a confined spaces in construction standard that closely resembles the general industry standard, much of this detailed language does not appear in this final rule. In some cases, OSHA addressed the substance of the comment in the discussion of the most relevant preamble section in this final rule. In other instances, the issue raised in the comment became moot as a result of OSHA's decision not to include the proposed text in the final rule. Therefore, OSHA is not directly responding to each of these particular comments in the summary and explanation of the final rule.

OSHA considered, but ultimately rejected, several other regulatory alternatives based on the comments submitted to the Agency. For example, some commenters suggested that employers should have the option of following either 29 CFR 1910.146 or this final rule (ID–089, p. 2; –147, p. 4). This suggestion relates to some commenters' concern that having separate rules for confined spaces in construction and general industry makes it confusing for employers that perform both construction and maintenance inside a confined space to comply with the different requirements of each rule based on the type of the work they are performing (see, *e.g.,* ID–119, p. 3). OSHA developed this standard because of the unique hazards of confined-space work in construction and, although this final rule is similar to § 1910.146, there are differences when certain procedures are necessary to protect employees from the unique hazards of construction confined-space work. Therefore, an employer does not have the option of bypassing the procedures that are unique to this final rule by complying instead with § 1910.146. Such a policy would severely undermine OSHA's effort to protect employees from the unique hazards present during confined-space operations in construction.

OSHA recognizes that the differences between § 1910.146 and this final rule can make it more complicated for employers to comply with two different sets of procedures if they perform maintenance and construction work at the same time in the same confined space. In order to ease the compliance burden on these employers, OSHA will consider compliance with this final rule as compliance with § 1910.146. This enforcement policy was suggested by at least one commenter (ID–211, Tr. p. 303).

Another commenter suggested that OSHA issue a directive on confined-space work in construction instead of a final rule (ID–100, p. 5). OSHA generally issues a directive on a particular work practice after the Agency issues a rule, not in lieu of a rule; accordingly, the directive provides guidance as to how the Agency will enforce a standard. The rulemaking process, on the other hand, provides the public with notice and an opportunity to comment on the Agency's proposed action, and the Agency may use the information gathered during this process to impose substantive duties on employers, such as employers engaged in confined-space construction work. The information gathered by the Agency during the rulemaking process for this final rule supports issuing a final rule for confined-space work in construction. Therefore, OSHA rejects the alternative approach suggested by the commenter.

A different set of commenters focused on individual states' confined spaces standards. One commenter asserted that several State-Plan States have effective confined space standards and that this rule will unnecessarily force those states to change these standards (ID–135, p. 3). A similar comment discussed Virginia's confined spaces rule, but did not suggest OSHA adopt that rule (ID–047, p. 1). Another commenter suggested OSHA adopt the majority of California's confined spaces rule (ID–077, p. 1). OSHA notes that the Occupational Safety and Health Act of 1970 (OSH Act) allows for different regulatory schemes to address the hazards of confined-space work provided those standards are at least as effective as the Federal OSHA standard. The record indicates that, by issuing a final rule that is similar to § 1910.146, OSHA is not drastically changing industry practice for addressing confined-space hazards. (See, *e.g.,* ID–047; –075; –085; –088; –092; –095; –112; –117; –118; –120; –121; –125; –147; –189.) Therefore, OSHA believes that State-Plan States that have standards applicable to construction work in confined spaces that are similar to § 1910.146 will not have to make major changes to their existing rules to ensure that these rules are at least as effective as this final rule. When a State-Plan State's confined spaces rule is not as effective as this final rule, OSHA believes that the record warrants a change in the State-Plan State's rule so that it will provide construction employees with the same level of protection afforded to them by this final rule. For a full discussion of State-Plan States, see Section IV.E (''State-Plan States'') later in this preamble.

C. Need for a Rule Regulating Confined Spaces in Construction

Before promulgating this final rule, OSHA had one existing provision in its construction standards that included a general training requirement for employers working in confined spaces. A broad ''safety and training'' requirement in 29 CFR 1926.21(b)(6), adopted by the Agency in 1979, provided limited guidance: Under this provision, employers were only required to instruct employees required to enter into confined or enclosed spaces as to the nature of the hazards involved, the necessary precautions to be taken, and in the use of protective and emergency equipment required. Fatality and injury data, OSHA enforcement experience, and advice from ACCSH indicate that § 1926.21(b)(6) did not adequately protect construction employees in confined spaces from atmospheric, physical, and other hazards. Even when § 1926.21(b)(6) applied, it required employers only to train employees who work in confined spaces—it did not address how to protect trained employees while they are working in such spaces, nor did it address the actions of employers outside the spaces engaged in activities that might harm employees inside the spaces. For situations in which none of the construction standards apply, the employer was still required to comply with the general-duty requirement of the OSH Act to ''furnish to each of [its] employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to [its] employees'' (29 U.S.C. 654), but this ''general duty'' is often more difficult for OSHA to enforce and does not provide the same level of guidance and safety information provided in a standard.

As noted in the economic analysis section of the preamble to this final rule, OSHA determined that employees in the construction industry who perform work in confined spaces face a significant risk of death or serious injury, and that this final rule would substantially reduce that risk. At present, OSHA estimates that 20,479 establishments annually have employees entering at least one confined space as defined by this final rule. OSHA estimates that, each year, 6 fatalities and 900 injuries occur among employees working in confined spaces covered by this final rule. OSHA determined that the final rule, when implemented properly by employers, will reduce the average number of fatalities and injuries in confined spaces covered by this standard by 96 percent (5.2 fatalities prevented annually, and 780 injuries prevented annually). (For further explanation of the significant-risk calculations, see section V.B. (''Final Economic Analysis and Regulatory Flexibility Analysis'') of this document.)

III. Summary and Explanation of the Final Standard

Explanation of Changes to Subpart V—Power Transmission and Distribution

Subpart V of part 1926 governs construction work involving power transmission, generation, and distribution. OSHA recently updated subpart V (79 FR 20316 (April 11, 2014). When it did so, OSHA required compliance with the general industry confined-spaces standard at § 1910.146 in several provisions of subpart V. OSHA did so because at that time there was no comprehensive confined-spaces standard for construction, but the Agency explained in the subpart V preamble that ''the references to the general industry standard in final § 1926.953 are included as a placeholder pending the promulgation of the confined spaces in construction standard. OSHA intends to change these references to refer to the construction standard when it promulgates that standard.'' (79 FR 20376) OSHA is, therefore, amending subpart V in this rulemaking to replace references to the general industry confined spaces standard with references to this final construction rule, because OSHA specifically tailored this final rule to construction work, making the confined spaces in construction rule more appropriate than the general industry standard for construction work addressed by subpart V.

Amendments to Definition of ''Enclosed Space'' in § 1926.968

An ''enclosed space'' is a term of art under subpart V and the corresponding general industry standard for electric power generation, transmission, and distribution (§ 1910.269) describing a workspace such as a manhole or vault that is designed for periodic employee entry under normal operating conditions, and that, under normal conditions, does not contain a hazardous atmosphere, but may contain a hazardous atmosphere under abnormal conditions (§ 1910.269(x) and § 1926.968). There is overlap between an enclosed space and a ''permit-required confined space'' (permit space) as defined in the confined spaces standards for general industry (§ 1910.146) and construction (new subpart AA): An enclosed space meets the definition of a permit space—while it is not expected to contain a hazardous atmosphere, it has the potential to contain one—but the definition of permit-space is broader than the definition of enclosed space. For instance, if a space contains a hazardous atmosphere under normal conditions, that space is a permit space under § 1910.146 or new subpart AA, but it is not an enclosed space under final § 1910.269 or subpart V.

The note to the definition of ''enclosed space'' in § 1910.269(x) states that enclosed spaces expected to contain a hazardous atmosphere meet the definition of permit spaces in § 1910.146, and entry into them must conform to that standard. Subpart V, however, did not have any definition of ''enclosed space'' until OSHA amended it in 2014 by adding a definition that matched the general industry definition in § 1910.269(x) except that it did not include the note. OSHA explained in the preamble to the subpart V amendments that it did not include the note at that time because there was no comprehensive corresponding confined spaces construction standard to reference in place of § 1910.146, but OSHA intended to add a corresponding note to § 1926.268 when it promulgated the new construction confined spaces standard (see 79 FR 20376–20377). As part of this rulemaking, OSHA is therefore adding a note to the definition of ''enclosed space'' in § 1926.968 that corresponds to the note in § 1910.269(x), replacing the reference to § 1910.146 with a reference to subpart AA.

Amendments to § 1926.953

Prior to this rulemaking, § 1926.953(a) in subpart V, as amended in 2014, required that entry into an enclosed space to perform construction work meet the permit-space entry requirements of paragraphs (d) through (k) of § 1910.146 when the precautions taken under §§ 1926.953 and 1926.965 were insufficient to eliminate hazards in the enclosed space that could endanger the life of an entrant or interfere with escape from the space. Similarly, § 1926.953(g) stated that employees may not enter any enclosed space while it contains a hazardous atmosphere, unless the entry conforms to the permit-required confined spaces standard in § 1910.146. OSHA is amending §§ 1926.953(a) and 1926.953(g) by replacing each reference to § 1910.146 with a reference to subpart AA so that the appropriate construction standard, rather than a general industry standard, will apply.

OSHA is also adding a sentence to § 1926.953(a) to clarify that employers may comply with the requirements of § 1926.953 ''in lieu of'' most of the requirements in new subpart AA when the entry into the enclosed space is a routine entry for subpart V work and there is no hazardous atmosphere in the space. Without this clarifying sentence, employers could have been confused about which standard applied. OSHA determined that § 1926.953 provides adequate protection to employees in that situation and announced in the subpart V preamble that it intended to add the sentence when it issued this final rule (see 79 FR 20376).

The new ''in lieu of'' sentence in § 1926.953(a) corresponds to a similar sentence in § 1910.269(e) specifying that employers are not required to comply with § 1910.146(d) through (k) for the same type of routine entries into enclosed spaces. OSHA has used slightly different wording from the language in § 1910.269 to emphasize that ''in lieu of'' language is only applicable where the entry is routine and the space does not contain hazards that could cause death or impede exit. As with the general industry standard, the new sentence in § 1926.1953(a) only exempts employers from compliance with some, but not all, of subpart AA's requirements. In the ''in lieu of'' sentence in § 1910.269, OSHA only excuses employers from compliance with § 1910.146(d) through (k) for these routine entries, but employers must still comply with the requirements in § 1910.146(c) and (l), including the requirements to assess the space, prevent unauthorized entry, communicate with and coordinate with the host employer when applicable, and to involve entrants and their representatives in the process. Likewise, in § 1926.953(a), the enclosed spaces requirements apply in lieu of the permit requirements in § 1926.1204 through § 1211, but employers still need to comply with subpart AA's corresponding requirements in § 1926.1203 to assess the space, prevent unauthorized entry, and coordinate with and communicate with the controlling contractor, in addition to the requirements in § 1211 to involve entrants and their representatives in the process.

Finally, in addition to some minor, non-substantive grammatical changes to improve the paragraph, OSHA is also revising the note to paragraph § 1926.953, which appears at the end of the section, by replacing its reference to § 1910.146 with a reference to new subpart AA. The note clarifies that OSHA considers employers who comply with new subpart AA when entering an enclosed space as in compliance with § 1926.353(a). Some employers may prefer to comply with new subpart AA rather than § 1926.353(a), and subpart AA protects employees entering enclosed spaces at least as effectively as the provisions in § 1926.353.

Section 1926.1201—Scope

The scope of new 29 CFR part 1926, subpart AA—Confined Spaces in Construction is set forth in 29 CFR 1926.1201. This subpart provides minimum safety and health requirements and procedures to protect employees who work in confined spaces. It addresses how to protect employees from confined-space hazards. The final rule includes requirements for training, identification and assessment of confined spaces, hazard analysis, entering, working, exiting, and rescue for confined spaces containing a variety of different hazards.

The proposed rule contained an ''Introduction'' section that provided a general overview of the standard and stated that the proposed standard would cover ''working within or near a confined space that is subject to a hazard'' (see proposed § 1926.1201(a)). OSHA removed the ''Introduction'' section to make this final rule similar to § 1910.146, and to avoid confusion caused by potential overlap with the ''Scope'' provisions. Section 1926.1201 in the final rule is the scope section.

Paragraph (a). Although many commenters urged OSHA to conform this final rule to the general industry standard as much as possible, the scope section for confined spaces in general industry at § 1910.146(a) expressly excludes construction work. Therefore, it is impractical for OSHA to change the language in final rule § 1926.1201 to mirror § 1910.146(a). Instead, OSHA structured the scope section in final rule § 1926.1201 in a manner that draws from the language in the scope sections of the general industry standard and the proposed rule. As with the scope of the general industry standard, which states that it protects employees from the hazards of entry in permit-required confined spaces (§ 1910.146(a)), OSHA phrased final § 1926.1201(a) in terms of the employees protected by the final standard. In contrast, the scope of the proposed rule focused on employers (see proposed § 1926.1202(a)). While the final standard necessarily imposes the duties exclusively on employers, OSHA concluded that phrasing the scope in terms of employers ''who have confined spaces at their job site'' was potentially more problematic than the general industry approach because the regulated community could misinterpret the proposed language as requiring some analysis of the extent to which the employer exercised control over a particular part of a construction site.

A number of commenters expressed confusion about the description of the standard included in the proposed introduction, which appeared to function as an additional statement about the scope of the rule (see, *e.g.,* ID–032.0; –100.1; –105.1; –114.1; –119.1; –120.1; –125.1; –135.0.) In particular, many commenters asserted that the reference to work ''within or near a confined space,'' as used in the proposed description of the standard, was too vague, and requested that OSHA clarify its meaning. (See, *e.g.,* ID–031, p. 4; –061, p. 7; –095, p. 1; –101, p. 2; p. 1; –106, p. 1; –117, p. 7; –120, p. 2; –121, p. 8; –124, p. 4; p.–125, p. 5.) In response, OSHA did not include the phrase ''within or near a confined space'' in the scope section in this final rule. Instead, in final § 1926.1201(a), OSHA describes the scope in more definite terms by stating that the new standard protects employees engaged in construction activities at a worksite with one or more confined spaces, which is similar to the language of the proposed rule except that it avoids the reference to ''their job site.'' The language in final § 1926.1201(a) incorporates a bright-line test (whether or not the worksite has a confined space) to underscore two important points in the final rule that also are true for the general industry standard and the proposed rule: First, all employers engaged in construction have a duty under the final standard to ensure that their employees do not enter a confined space except in accordance with the requirements of the standard, and the presence of a confined space on the worksite triggers this duty rather than the type of work the employer is performing. Second, there are critical components of this standard, such as information sharing and coordination of work, that apply to certain employers that, regardless of whether their employees are authorized to enter a confined space, have information necessary for the protection of employees working inside confined spaces, or are engaged in activities that could, either alone or in conjunction with activities inside the confined space, endanger the employees working inside a confined space. Final § 1926.1201(a) makes it clear that the focus of the final standard is on the type of work performed, and whether that work could produce, and expose employees to, confined space hazards. Although final § 1926.1201(a) differs slightly from proposed § 1926.1202(a), this difference does not affect the scope of the final rule; it merely makes the scope more precise than the scope of the proposed rule. This change also is consistent with the proposed ''Introduction'' section in proposed § 1926.1201(a).

Final § 1926.1201(a) includes a note with a non-exhaustive list of potential confined spaces that commonly occur on a construction worksite. This list provides examples for employers who may be unfamiliar with confined spaces in construction. The note to final § 1926.1201(a) is identical to the note to proposed § 1926.1202(a).

One commenter asserted that OSHA should exclude steel tanks, which OSHA included in the list of examples of confined spaces in construction in the proposed rule, from the new standard when the tanks are under construction because this activity does not produce an atmospheric hazard (ID–138, p. 2; –214.1, p. 4; –210, Tr. p. 217). In particular, the commenter asserted that contractors typically do not close entirely steel tanks under construction until the final phase of construction and that, prior to the final phase, the tanks typically have sufficient natural ventilation to prevent a hazardous atmosphere from forming. The final phase is typically conducted without any employees inside the tank (ID–210, Tr. p. 5).

Whether a confined space exists is a separate analysis from whether a hazard exists, unless the hazard prevents unrestricted egress from the space. A steel tank is a confined space at any stage of construction when it has limited or restricted means for entry and exit (see the definition of a confined space in § 1926.1202, which is discussed later in this preamble). However, OSHA recognizes that a significant portion of steel-tank construction activity may not result in work inside a confined space if contractors generally do not assemble the tank sections in a manner that would place an employee inside a space with limited egress. Even when construction of the tank results in such a space, the space may not contain a hazard that would render it a permit-required confined space. If the space is not a permit-required confined space, then the employer's duties are very limited. In such spaces, the employer's responsibility under this standard would be limited to verifying what the commenter asserts is true: There is no atmospheric hazard or other hazard. Nevertheless, the commenter acknowledged that welding activities in some steel tank construction, particularly for relatively small tanks, could produce the types of hazardous atmospheres this standard is intended to address (ID–210, Tr. pp. 228–229). Thus, OSHA is not categorically excluding steel tanks from coverage under this standard and continues to include steel tanks in the list of potential confined spaces to alert employers that the process of steel-tank construction could place employees in a space that meets the definition of a permit-required confined space.

Another commenter asserted that the note did not include wind turbines (ID–210, Tr. p. 154). This commenter misunderstood the reference to ''turbines'' in the note in the proposed and final rules. The reference to ''turbines'' is general, and applies to all turbines that meet the definition of a confined space.

It is important to note that only the presence of a hazard inside a confined space will trigger the majority of procedures required by this final rule. One commenter asserted that limited egress is a continual hazard to every employee in a confined space, regardless of whether any other hazards exist (ID–060, p. 3). Therefore, the commenter argued that the permit requirements of this final rule, including the requirement to have a rescue service available, should apply to all confined spaces, even those spaces in which another hazard does not exist. This approach would apparently treat all confined spaces as permit spaces, which would be a radical departure from OSHA's longstanding treatment of confined spaces in the general industry. OSHA does not agree that such a departure, or the additional costs that employers would incur because of such departure, are warranted in the absence of employee exposure to some hazard inside the confined space. Limited egress in a confined space is a safety concern only when an employee cannot readily exit a confined space to avoid being exposed to a hazard within the space. Limited egress, by itself, is unlikely to injure or kill an employee. If limited egress is the only safety concern, then OSHA concludes that it is not reasonable to require employers to comply with the provisions of this final rule that pertain to permit spaces. In such a circumstance, employers already must follow existing construction standards that apply to work in an enclosed space (for example, § 1926.353—Ventilation and protection in welding, cutting, and heating at, and § 1926.55—Gases, vapors, fumes, dusts, and mists).

Another commenter noted that the shipyard employment standard at 29 CFR part 1915 includes confined spaces requirements and was unsure whether this new construction standard will apply to confined space construction work performed in a shipyard (ID–028, p. 1). It will. OSHA focuses on the type of work activity, not necessarily the location of the work activity, in determining whether this confined spaces in construction standard or the shipyard employment standard, part 1915, applies. See, *e.g.,* Feb. 9, 2004, letter to Jack Swarthout.[2] The shipyard employment standards apply to ship repairing, shipbuilding, ship breaking, and related employment. This confined spaces in construction standard covers confined space work in shipyards to the extent that it is construction work and is not ship repairing, shipbuilding, ship breaking, or related employment. An example in which this confined spaces in construction standard applies is the construction of a building on the grounds of a shipyard. Non-construction work performed in a shipyard is not subject to this final rule; either § 1910.146 or the shipyard employment standard at 29 CFR part 1915, subpart B—Confined and Enclosed Spaces and Other Dangerous Atmospheres in Shipyard Employment would cover such work.

Paragraph (b) Exceptions. This paragraph explicitly excludes construction work regulated by 29 CFR part 1926, subpart Y—Diving, construction work regulated by 29 CFR part 1926, subpart P—Excavation, and construction work regulated by 29 CFR part 1926, subpart S—Underground Construction, Caissons, Cofferdams and Compressed Air from the scope of this final rule. Accordingly, this provision exempts employers operating under one of the three listed exemptions from complying with this final rule for work within a confined space, so long as that work falls within the scope of one of the listed subparts.

The Agency exempted each type of work covered by the listed subparts from the requirements of this standard because OSHA specifically tailored the existing requirements in these subparts to protect employees from the hazards associated with confined spaces. In addition, OSHA believes that overlapping standards covering these activities could be unnecessarily burdensome to employers, or cause some confusion about the appropriate procedures to use.

Under § 1926.1201(b)(3), this confined spaces standard does not apply to construction activities covered by 29 CFR part 1926, subpart Y, which encompasses diving and related support operations conducted in connection with all types of work and employments, including construction (29 CFR 1926.701, referencing 29 CFR 1910.401). As defined in subpart Y, a ''diver'' is an employee working in water using underwater apparatus which supplies compressed breathing gas at the ambient pressure (§ 1926.701, referencing § 1910.402). The Agency notes that, if a diver engages in construction activity in an area that meets the definition of a confined space under this final rule, and is not working in water or removes his/her underwater breathing apparatus, then, in most cases, the activity is outside the scope of subpart Y because the employee is no longer a ''diver''; in such a case, the requirements of this confined spaces standard apply instead.

The other exemptions set forth in final § 1926.1201(b) are identical to the proposed exemptions except that OSHA removed the ''non-sewer'' limitation for the exemption that applies to 29 CFR part 1926, subpart P—Excavations and 29 CFR part 1926, subpart S—Underground Construction. Under § 1926.1201(b)(1) and (b)(2), OSHA exempted construction activities covered by subparts P and S. In its explanation in the proposed rule, the Agency noted that subparts P and S generally provide adequate protections against hazards in excavations and underground work (72 FR 67356 (Nov. 28, 2007)). In light of the additional hazards associated with sewers as continuous systems that often have hazardous atmospheres and engulfment hazards, the Agency proposed limiting the Excavations, and Underground Construction exemptions to ''non-sewer'' work, which would have the effect of applying this final standard, in addition to subpart P or subpart S, whenever an employer performed excavation or trenching construction work related to a sewer system. One commenter urged OSHA to limit the exemption further, characterizing subpart P as ''insufficient for addressing potential worker exposures to hazardous atmospheres,'' and asserting that this final rule should apply to excavations where a hazardous atmosphere exists because the confined spaces standard would provide more comprehensive protection for employees than the excavation standard (ID–105, p. 5). The commenter did not, however, provide any basis for this assessment. Two commenters emphasized the significance of the hazards posed by excavation, and urged OSHA to protect employees from those hazards; however, they did not discuss subpart P—Excavations and did not provide a clear rationale for why those standards do not provide adequate protection for employees working in excavations (ID–032, p. 4; –034, p. 1).

A different commenter asserted that OSHA should apply the confined spaces standard to hazards in excavation work not covered by the excavation requirements (ID–025, p. 2). In other words, OSHA should exempt excavation work unless there is a hazard present not addressed by subpart P—Excavations, but addressed by this confined spaces standard, in which case the confined-space requirements applicable to addressing that specific hazard would apply. The commenter did not provide an example of a hazard that could be present in excavations but not addressed by subpart P. Also, OSHA believes that the approach advocated by the commenter would lead to confusion, and may not promote safety. OSHA designed the confined spaces standard to work as a comprehensive system, not through piecemeal application. Therefore, OSHA concludes that it is

[2] All of the letters and memoranda included in this preamble are available at *www.osha.gov.*

not appropriate to limit the exemption as requested by the commenter.

Another commenter asserted that the excavation standards in subpart P do not provide protection against hazards associated with applying waterproofing products on building foundations below grade level (ID–106). OSHA disagrees with this commenter. Even assuming that the particular waterproofing product used would constitute an atmospheric hazard, 29 CFR 1926.651(g) requires an employer to test for atmospheric hazards and to take adequate precautions to protect employees accordingly.

Most of the commenters who addressed the issue of the potential overlap between this final standard and the excavation and underground construction requirements in subparts P and S, respectively, requested that OSHA expand the exemption to exclude all work subject to those standards from the scope of the final rule, regardless of whether the excavation or underground work connects to a sewer, because other OSHA standards, primarily subpart P, adequately cover such work (ID–060, p. 1; –108, p. 2; –117, p. 6; –124, p. 3; –140, p. 6; –143, p. 1). One of these commenters noted that subpart P's requirements ''include testing the trench/excavation(s) before workers enter them when a hazardous atmosphere exists or could reasonably be expected to exist (*e.g.* excavations near landfills or in areas where hazardous substances may be stored) and providing proper respiratory protection or ventilation to prevent exposure to harmful levels of atmospheric contaminants and to assure acceptable atmospheric conditions,'' and also include appropriate rescue provisions (ID–117, pp. 6 and 7). Furthermore, several of the commenters asserted that applying both this final rule and the excavation standards to work inside all excavations would result in a confusing and disjointed regulatory scheme that could reduce employee safety (ID–060, p. 1; –108, p. 2; –117, p. 6; –140, p. 6). OSHA agrees with these comments and, therefore, the Agency excluded all excavation work from the scope of the final rule (see § 1926.1201(b)(1)).

Although the exemption in the final rule may be broader than the proposed exemption because the final rule does not cover underground sewer work and sewer excavation work, the expanded exemption is still consistent with OSHA's intent in the proposed rule. In proposing to apply the confined spaces standard to all sewer work, the Agency emphasized the extraordinary dangers associated with sewer systems, including the difficulties in isolating hazards in a contiguous system, and the extremely hazardous atmospheres that can develop in sewers and quickly cause fatalities. These dangers, however, primarily involve *existing* sewer structures, rather than construction of new sewer systems; new systems would not necessarily present such hazards until connected to an existing sewer system. Under this final rule, the limitations on the scope of subparts P and S will ensure that the confined-space requirements apply to most construction work *within existing* sewer structures, as explained in the following discussion of the interaction between this confined spaces standard and subparts P and S. In the context of sewer work, the principal hazards associated with the *excavation* work around the sewer lines are likely to be atmospheric hazards that arise from the soil surrounding an existing sewer pipe (from leaching or other sources), as well as potential hazards associated with the release of hazardous substances from the sewer pipe. These hazards are similar to the hazards encountered during excavation and underground work near landfills and water mains that OSHA exempted from coverage in the proposed rule because OSHA regarded the protections of subparts P and S as sufficient (see 72 FR 67356).

OSHA considered the common scenario in which an employer digs down to an existing sewer line, then excavates a new trench in which it lays new sewer pipe and connects it to an existing sewer line. During the ''tie in'' process of connecting the new sewer pipe to the existing sewer line, employees could potentially be exposed to atmospheric hazards and physical hazards emanating from the existing sewer line. While any entry into the existing sewer line, including placing any part of the body inside existing line (see definition of ''entry'' in § 1926.1202), would be governed by the confined spaces standard, OSHA does not believe that hazards from the existing sewer line should subject the entire excavation project to the confined spaces standard. Employers already have a duty under subpart P to address the atmospheric and physical hazards in the excavation, and employers must anticipate and address the hazards that might come from the existing sewer line. Employers must use extreme caution in unsealing the existing sewer line. Before opening the existing line, employers must, whenever possible, isolate the existing line to be opened from the rest of the sewer and ensure that employees are removed from the excavation.

Based on the record, OSHA concludes that subparts P and S are also sufficient to address the hazards associated with excavation work around sewers and the construction of new sewers, while the confined spaces standard will address the work inside the sewer pipes where the atmospheric and physical hazards are greatest.

Clarification of the Scope of Subparts P and S

OSHA does not intend for this final standard to overlap with 29 CFR part 1926, subpart P or 29 CFR part 1926, subpart S. Each of these standards contains specific provisions addressing many of the same hazards that could arise in the same space. The Agency is, therefore, taking this opportunity to clarify the scope of subparts P and S relative to the scope of this final confined spaces standard, thereby simplifying the regulatory scheme for employers working in these spaces.

Subpart P applies to ''all open excavations made in the earth's surface,'' including trenches (§ 1926.650(a)). For example, the work of digging trenches, shoring up the trenches, and placing a sewer pipe or other materials into the trenches are subject to subpart P. When an employer is excavating a trench to install a new storm drain, subpart P applies to all excavation and trenching activities. The final confined spaces standard applies, however, to non-excavation work within a confined space located in an excavation, as this work would expose employees to additional hazards besides excavation-related hazards. For example, this final standard covers entry into a prefabricated storm drain, other pipe, or manhole even if located at the bottom of an open excavation.

Subpart S applies to the construction of underground tunnels, shafts, chambers, and passageways and cut-and-cover excavations which are both physically connected to ongoing underground construction operations within the scope of the subpart, and covered in such a manner as to create conditions characteristic of underground construction (§ 1926.800(a)(1)). For subpart S to apply, ''the tunnel or other underground structure must be under 'construction.' '' See October 1, 2010, letter #20061017–7300. For example, the construction of an underground structure by boring a tunnel through soil and providing the concrete or metal supports necessary to preserve the opening is subject to subpart S, as are structural modifications such as upgrading a tunnel wall to construct a new structure following a collapse.[3] OSHA developed subpart S to protect employees from the hazards associated with the construction of underground structures, and OSHA concludes that the subpart S standard provides more appropriate protections in these situations than this final confined spaces standard.

In the context of underground work, this final standard applies mainly to construction activities inside an existing underground confined space, as opposed to the initial construction of that underground space.[4] Examples of activities covered by this confined spaces standard include: installing a structure within an existing tunnel, working inside a large pipe or vault located within an existing sewer tunnel, laying a new cable inside an existing sewer tunnel, upgrading a grate in an existing sewer system, installing a new lining in a sewer pipe, adding tile or grout or other sealant to an existing concrete tunnel, or attaching equipment to the walls of an existing tunnel.[5] OSHA recognizes that, in large underground construction projects, the distinction between an existing portion of a tunnel and the construction of a new tunnel might not be clear when the same employees are working to construct a tunnel, or employees add equipment or structures to tunnel walls at the same time they are digging the tunnel. To avoid requirements that could potentially cause confusion and extra burdens by forcing employers to switch back and forth between different standards during the same general tunnel-construction project, OSHA will treat non-structural work performed in conjunction with initial construction of an underground space as covered by subpart S. For example, if employees install a cable as part of the initial sewer tunnel-construction project, subpart S would cover both the employees engaged in tunnel construction and those engaged in cable installation. Otherwise, the result would be different employees working on the same construction project in the same space, but under different standards with significantly different requirements.

One commenter representing homebuilders asserted that house foundations and basement excavations become ''trenches'' when contractors construct formwork, foundations, or walls, and, therefore, subpart P, rather than the final confined spaces standard, should cover these work areas (ID–117, pp. 6 and 7). According to the commenter, OSHA should not consider this type of work area a confined space because it is subject to natural ventilation. Whether a work area is subject to natural ventilation is not dispositive in determining whether the area meets the definition of a confined space in final § 1926.1202. However, if the work is ''excavation'' work or ''trench'' work under subpart P, then this final rule would not apply. OSHA agrees that subpart P, and not this confined spaces standard, would apply to the construction of most house foundations in an excavated area until the contractor backfills the area adjacent to the foundation or otherwise covers the foundation or the other areas. However, depending on the particular circumstances at the worksite, once the backfill or other covering occurs, the area inside the foundation space could be a confined space subject to this final rule if it meets all of the criteria in the definition of a confined space in § 1926.1201.

Other Requests for Exemptions

1. Home Construction

One commenter requested that OSHA exempt the following areas from coverage under this standard: attics, crawl spaces, basements, cabinets, and ''similar areas in home building'' (ID–117, pp. 6 and 7). The commenter's rationale for these exemptions was that these spaces ''do not contain hazardous atmospheres or engulfment hazards'' (*id*). The commenter did not provide any basis for the assertion that these areas are inherently free of the identified hazards, and OSHA does not agree that these spaces are always inherently free from such hazards. Hazardous gases or other substances may occur in almost any confined space. For example, one employee may store or apply an epoxy or other chemical in a crawl space, which could expose that employee or a subsequent entrant to a hazardous atmosphere. A different commenter noted that surface coatings such as paints and epoxies are seemingly stable, and, while generally undetectable through air monitoring once applied and dried, could result in significant safety and health hazards to employees who are welding or involved in other hot work in a confined space (ID–213.1, pp. 6 and 7).

Moreover, hazardous atmospheres and engulfment hazards are only two types of hazards that could cause death or serious injury to employees in a confined space. The commenter requesting the exemption did not provide any indication that the spaces would be free of physical hazards that could trap, kill, or seriously injure the employees. In fact, the final economic analysis for this rule cites several fatalities that resulted from exposure to physical hazards (generally electrical) in crawlspaces under homes. Therefore, a categorical exemption for these types of spaces is inappropriate, and would be inconsistent with the purpose of the standard.

However, while a categorical exemption is not appropriate, OSHA anticipates that, in new construction, employers may be able to organize work practices to avoid placing workers in areas that meet the definition of a confined space (for example, complete work in what will eventually become a crawl space before constructing the overhead portion of the crawl space, apply insulation to an attic floor before the underlying ceiling below it is installed, complete basement work before the overhead structure is installed or after stairways are in place). Furthermore, if the commenter is correct that the majority of the spaces it identified do not contain a hazardous atmosphere or other hazards, then the employer would have only a limited duty under this standard because a permit program would not be necessary if the spaces do not contain such hazards. Accordingly, employers would only need to identify the spaces and ensure that the confined spaces remain free of hazards.

2. 29 CFR Part 1926, Subpart V Work

Commenters representing the electric utilities asserted that OSHA should not

[3] OSHA previously determined that the underground construction requirements in subpart S also apply to tunnels placed underwater. See August 8, 2002, memorandum to K. Frank Gravitt. This new confined spaces standard does not affect that previous determination. However, this confined spaces standard does cover construction work that occurs inside an underwater tunnel following the initial construction of that tunnel.

[4] Note that the distinctions discussed here are solely for the purposes of determining which construction standard applies. This discussion does not impact OSHA's analysis of whether an activity constitutes construction work as opposed to maintenance work.

[5] OSHA notes that in a 1991 memorandum the Agency applied subpart S to the ''rehabilitation'' of a sewer tunnel originally completed in 1932. January 21, 1991, memorandum to Michael Connors. OSHA issued the memorandum before it issued either this standard or the general industry standard for confined spaces, and, thus, before it had reason to consider potential overlap between a confined spaces standard and other construction standards, or could point to any other employee protections. Depending on the extent of the ''rehabilitation'' and the activities involved, the new confined spaces standard may apply instead to such projects in the future. For example, subpart S would cover the ''rehabilitation'' of an existing tunnel that involves expansion of the existing sewer or an improvement of a collapsed wall. However, this final confined spaces standard would cover ''rehabilitation'' that consists of adding sealant to the existing tunnel structure, or attaching equipment or new materials to the tunnel walls. To the extent that the 1991 memorandum requires a different result, this final standard supersedes it.

require employers engaged in 29 CFR part 1926, subpart V work to follow two different confined spaces standards (ID–112, pp. 3 and 4; –134, p. 2; –210, Tr. pp. 106–108, 142). These commenters stated that general industry electric-utility work practices are similar to construction electric-utility work practices. OSHA addresses the commenters' preference to have identical confined-space provisions applicable to both general industry and construction earlier in this preamble where the Agency explains why it chose to adopt a modified version of the general industry standard as the confined spaces in construction final rule. As discussed there, OSHA will also treat compliance with this new rule as compliance with the general industry confined spaces rule when one or more employers are engaged in both general industry work and construction work at the same time in the same space.

To the extent that the commenters were requesting that OSHA exempt all subpart V work from all of the new confined-space requirements in final subpart AA, OSHA declines to do so. First, the general industry standard includes no such broad exemption, and the record does not indicate why electric-utility industry work in confined spaces is less hazardous or otherwise less suitable for coverage by a confined spaces standard than the work of any other industry. The general industry electric power generation, transmission, and distribution rule, § 1910.269, does not exempt that industry from the general industry confined-space requirements at § 1910.146: to the contrary, the ''enclosed spaces'' provision in § 1910.269(e) expressly requires employers to comply with the requirements in § 1910.146 when the enclosed-space entry will not be routine in nature or the space contains a hazardous atmosphere that cannot be controlled through the steps specified in § 1910.269(e).

As explained earlier in this preamble, OSHA anticipated in its recent amendments to the corresponding construction rule, 29 CFR part 1926, subpart V—Electric Power Generation, Transmission, and Distribution; Electrical Protective Equipment, that the confined spaces in construction standard would provide the parallel integral protections to employers engaged in construction work that involves conducting non-routine entries into enclosed spaces, or where the enclosed spaces contain hazards that are not controlled by the enclosed spaces requirement (see § 1926.953(a) and its explanation at 79 FR 20375–20376).). OSHA explained that the enclosed spaces provisions in § 1926.953(a) are only intended to address routine entries with a limited type of hazard, while the general industry confined spaces standard (which the Agency noted it intended replace with the construction version in this final rule) applies to all other entries into enclosed spaces. The confined space standard ''ensures that employees working in enclosed spaces will be afforded protection in circumstances in which the Subpart V provisions are insufficiently protective'' (79 FR 20376). If OSHA exempts employers engaged in subpart V work from the confined spaces standard, it would be creating a regulatory gap that is not present in the general industry context.

The commenter asserted that electric utility work in ''power generation facilities and other electric utility installations'' is sufficiently similar that OSHA has previously acknowledged it should be regulated in the same manner, regardless of whether the employer is engaged in construction or general industry activity (ID–112.1, p. 4–5). To the extent that this commenter is requesting greater consistency between the construction rule and the general industry rule, OSHA has provided that in this final rule. To the extent that this commenter is requesting an exemption from the construction standard so that it could comply instead with the general industry standard, OSHA disagrees because such an approach would result in a regulatory gap. Section 1910.146 is a general industry standard that, by its own terms, could not apply to construction activities beyond the scope of the previous § 1926.953 incorporation, but that incorporation of § 1910.146 was limited: it only applied to routine entries into enclosed spaces. Not all enclosed spaces are permit-required confined spaces and not all entries are routine. Further, while in general industry, ''routine'' entries for maintenance work covers a relatively broad range of activities, in the context of construction work a ''routine'' entry would be much narrower. In practice, a complete exemption from the new construction rule for confined spaces would leave many subpart V workers completely unprotected from the hazards in many confined spaces.

Paragraph (c)—Other Standards. This final rule replaces the confined spaces training requirement previously specified in § 1926.21(b), but does not replace any other construction standards. Rather, OSHA developed this final rule to work in conjunction with other construction standards to provide additional protections needed to address hazards that may arise when employees are working in or near a confined space. No requirement in this confined spaces final rule supplants or diminishes employer duties imposed by any other OSHA standard, and the Agency included § 1926.1201(c) in this final standard to emphasize that point. When both the scope of final § 1926.1201 and the provisions in another OSHA construction standard related to confined-space hazards cover an activity, OSHA requires employers to comply with both provisions (§ 1926.1201(c)). For example, while 29 CFR part 1926, subpart D—Occupational Health and Environmental Controls contains requirements for ventilation when working in potentially hazardous atmospheric conditions, it does not address other equipment or workplace conditions covered by this final rule. Therefore, where a potential hazardous atmosphere exists and this final confined spaces rule requires ventilation to control that hazard, the employer must ventilate in accordance with § 1926.57. However, the remaining provisions of this confined spaces rule will still apply: for example, if the situation requires rescue, the employer must provide rescue in accordance with this final rule.

In the preamble to the proposal, OSHA also discussed the overlap of the confined-spaces standard with its construction welding standard in subpart J of 29 CFR part 1926. The Agency explained that both standards would apply, noting for example that subpart J sets criteria for the use of a lifeline system in the confined space, but does not set criteria for the use of rescue services or provide the same level of procedures and controls for permit-required confined spaces (72 FR 67356 (Nov. 28, 2007)). OSHA designed the welding standard to protect employees solely from the hazards of welding, which include metal fume, gases, and smoke hazards associated with the welding process, physical hazards from the welding device or contact with the hot welding surface, potential explosion of the gas tanks, and hazards from working with specific materials. The confined-spaces standard, however, addresses a wider range of hazards than the welding standard, and OSHA considers the confined-spaces standard more detailed and comprehensive than the welding standard in its protection of employees from those other hazards for purposes of 29 CFR 1910.5(c).[6] Although the

[6] The OSHA regulation addressing the overlap of different standards is in 29 CFR 1910.5. Paragraph

Continued

welding standard has a section designed to address the hazards of welding in a confined space, the Agency is applying the provisions of the confined-spaces standard to all other hazards associated with confined-spaces work to the extent these provisions of the confined-spaces standard do not conflict with employee protections in subpart J. Therefore, as OSHA explained in the proposal, the rescue service and entry procedures must meet the requirements of this confined-spaces standard, while the employer must use a lifeline system as required to meet the criteria in subpart J. Specifically, employers must comply with the requirements of § 1926.1203(c) to prevent unauthorized entry, and the subpart AA requirements to implement a permit program (including posting a permit) to provide for entry in accordance with §§ 1926.1203(d), 1926.1204, 1926.1205, and 1926.1206. Employers must comply with the ventilation requirements in § 1926.353(a) of subpart J to address atmospheric hazards produced by welding fumes, but employers also must comply with § 1926.1204(c), which requires ventilation as necessary to control any atmospheric hazards beyond those generated by welding because the welding standard does not address those hazards. Employers also must comply with the identification, assessment, and information-exchange and coordination requirements in § 1926.1203(a), (b), and (h), and the relevant training required by § 1926.1207. Employers must develop a rescue plan in accordance with § 1926.353(b)(3) of subpart J, but also must assess and select a rescue service in accordance with §§ 1926.1204(i) and 1926.1211(a) and (c), and equip and train its in-house rescue services pursuant to § 1926.1211(a) and (b). Finally, employers must comply with additional confined-spaces requirements not addressed in the welding standard, such as the requirement to make Safety Data Sheets available to the medical facility treating any entrant exposed to hazardous substance (§ 1926.1211(d)), and the employee-participation requirements in § 1926.1212.

Subpart D—Occupational Health and Environmental Controls, at § 1926.64(f)(4) and (j), discussed above, and in subpart V—Power Distribution and Transmission, at § 1926.950(a), provide other examples of potential overlap with existing standards. In general, the final confined-spaces standard applies to hazards not addressed by subpart V. Subpart V generally protects employees from electrical hazards but does not necessarily address a hazardous atmosphere or other physical hazards in the confined space; the requirements of the confined-spaces standard address those hazards, and employers must comply with these requirements during confined-spaces operations. For example, in § 1926.953 of subpart V OSHA specifically addresses the overlap between the ''enclosed spaces'' requirements of subpart V and the confined spaces standard, mandating compliance with the confined-spaces requirements when hazards remain even after an employer has complied with all of the measures described in subpart V.

Language in proposed § 1926.1202(d) not included—Statement on other duties of controlling contractors. Proposed § 1926.1202(d) contained a statement that the information-sharing requirements in the rule do not limit a controlling contractor's responsibilities under any other provisions of the rule or the OSH Act, including those responsibilities described in OSHA Directive CPL 02–00–124: Multi-Employer Citation Policy (Dec. 10, 1999). The proposed rule text listed several specific examples of controlling contractor duties.

OSHA is not including that statement or any equivalent statement in the final rule for several reasons. First, such a statement is unnecessary because it is only a reminder that OSHA has a wide variety of health and safety standards that could apply to various activities of controlling contractors and host employers, depending on their activities and responsibilities. OSHA does not typically include such a reminder in the regulatory text of its standards. For example, OSHA does not include a similar statement in the general industry confined spaces standard even though that standard includes specific duties for host employers, and the host employers could also have additional duties under other standards or if they qualify as controlling employers or exposing employers under OSHA's multi-employer citation policy.

Second, OSHA is concerned that the regulated community will view the inclusion of such a statement in this standard as implying that standards without the same statement preempt other potentially applicable standards or policies. OSHA did not intend such an implication, and it does not have the time or resources to revise all of its standards to include this statement.

Third, several commenters found fault with the statement in the proposed rule. One commenter noted the statement was incomplete because it addressed controlling contractors, not host employers (ID–117, p. 19). Another commenter implied that the statement would not be helpful unless it listed all of the other potential duties to which controlling contractors could be subject (ID–211, Tr. p. 76).

1926.1202—Definitions

Final rule § 1926.1202 provides definitions for key words used to describe the requirements of this final rule. OSHA adopted most of the definitions from its general industry confined spaces standard (29 CFR 1910.146); most definitions also are generally consistent with the voluntary consensus standard on confined spaces, ANSI Z117.1–2003. Unless otherwise noted, these definitions are applicable only to this confined spaces in construction standard; OSHA added an introductory statement to that effect in § 1926.1202 of the final rule. OSHA took many of the definitions of the terms used in final rule § 1926.1202 from other OSHA construction standards; the Agency included these definitions in this final rule to minimize the need to reference those other standards.

Several commenters objected that some of the definitions of terms used in the proposed confined spaces in construction standard were different than the definitions for identical terms in the general industry confined spaces standard at § 1910.146(b) (ID–086, p. 3; –112, p. 7; –147, pp. 2–3). For the reasons set forth in section II.B (History) of this preamble, in the final rule OSHA revised many of these definitions so that the terms are consistent with the general industry terms defined at § 1910.146(b): *entry, entry supervisor, hazardous atmosphere, immediately dangerous to life and health, permit-required confined space, rescue service, retrieval system,* and *testing.*

In addition, OSHA included some terms in the Definitions section of this final rule not defined in the proposed rule, but defined in the general industry confined spaces standard at

(c)(1) of that regulation states that if a particular standard is specifically applicable to a condition, practice, means, method, operation, or process, it shall prevail over any different general standard which might otherwise be applicable to the same condition, practice, means, method, operation, or process. Paragraph (c)(2), however, provides that any standard shall apply according to its terms even though particular standards are also prescribed for the industry to the extent that none of such particular standards applies. The Agency interprets this regulation in this context to mean that the welding standard is the more specific standard addressing welding hazards and, therefore, applies to welding activities even when conducted in confined spaces; however, several provisions of the confined-spaces standard apply to confined-space hazards not addressed by the welding standard (see examples later in this paragraph), and employers must comply with these provisions when their employees are exposed to these hazards during confined-space operations.

§ 1910.146(b), including: *acceptable entry conditions, hot work, inerting, line-breaking, non-permit confined space,* and *prohibited condition.* Again, for the reasons explained in preamble section II.B (History), OSHA made definitions of these terms in this final rule consistent with § 1910.146(b). In general, OSHA defined the terms identically to the general industry standard or revised the definition slightly to make grammatical improvements or to clarify the meaning of the term. When OSHA deviated substantively in the final definition from the term as defined in § 1910.146(b), the Agency explains its reasons for doing so in the individual preamble paragraph addressing that definition.

One commenter urged OSHA to define certain terms exactly as ANSI Z–117.1–.2003 defines the terms (ID–086, p. 3). The Agency does not agree that such an approach is appropriate. The commenter did not explain why the definitions as proposed were inappropriate, how the change would improve safety, or why the consensus standard was preferable to the longstanding definitions in the general industry standard that most commenters supported. OSHA selected the definitions in this final rule specifically for the activities and equipment covered by this final rule and, to the extent possible, to be consistent with the definitions in § 1910.146(b) so as to reduce confusion among the regulated community and facilitate compliance. In many cases, the ANSI standards were not as clear or comprehensive as the final language, and therefore less preferable for a mandatory and legally enforceable standard.

Some commenters also noted that OSHA proposed definitions for many terms not defined in § 1910.146(b) (ID–112, p. 9; –147, pp. 2–3). These commenters did not, however, specifically object to these definitions, identify errors, suggest improvements, or otherwise give a reason why OSHA should not include these definitions in the final rule. In this regard, the final standard uses some terms, such as *early warning system* and *controlling contractor,* not used in the general industry confined spaces standard. The general industry confined spaces standard uses other terms not defined in § 1910.146(b). In general, for definitions in either of these categories, OSHA made the definition in this final rule identical to the definition in the proposed rule. When the Agency includes in the final rule a definition that does not have a parallel definition in the general industry standard, and when the Agency revises a definition from the proposed definition, it explains the reasons for its decision below in the discussion accompanying that definition.

OSHA also decided not to include several of the proposed definitions, such as definitions of *contractor, controlled atmosphere confined space,* and *isolated hazard confined space* in this final rule because OSHA did not use these terms in this final rule. In addition, the final rule does not include a definition of ''protect'' or ''protection'' because the Agency believes these terms, as used in this final rule, are sufficiently clear from their ordinary use. The general industry standard uses these terms without definition. In addition, the general industry standard does not include a definition of ''control,'' but OSHA is including a definition of this term in this final rule to clarify that ventilation and other atmospheric controls provide some level of worker protection, even if such measure are not fully protective.

OSHA believes that the construction industry readily understands most of the defined terms in the final rule because these terms are self-explanatory or are consistent with the definitions used in § 1910.146 and ANSI 117.1–2003. Nevertheless, OSHA includes an expanded discussion for several of the defined terms, and, when necessary, explains differences between the definition in the final rule and the definitions contained in either the proposed rule or § 1910.146(b). The Agency also addresses comments on terminology received during the SBREFA process and the public comment period, including comments made through testimony during the public hearing.

1. Defined Terms

Acceptable entry conditions means the conditions that must exist in a permit space, before an employee may enter that space, to ensure that employees can safely enter into, and safely work within, the space. The definition differs slightly from the definition of the term in § 1910.146(b). OSHA added ''before an employee may enter that space'' to clarify that employers are to measure and determine ''acceptable entry conditions'' before entry. Once entry occurs, the employer must continue to monitor the permit space and terminate the entry if a prohibited condition (*i.e.,* a condition that is not an ''acceptable entry condition'') arises. (See the discussion of final § 1926.1204(c)(1) for an explanation of how an employer must consider the work it will perform inside a confined space when identifying ''acceptable entry conditions.'') In the NPRM, OSHA defined ''planned condition'' in a similar manner. In the final rule, OSHA uses and defines the term in the same manner as the general industry standard to provide consistency between the two standards.

Attendant means an individual stationed outside one or more permit spaces who assesses the status of authorized entrants and who must perform the duties specified in § 1926.1209—Duties of Attendants. The general industry definition of ''attendant'' refers to an attendant who performs ''all attendant duties assigned. . ..'' In the final construction rule, the attendant's duties are specified in § 1926.1209—Duties of Attendants. OSHA refers to an attendant's responsibility to ''assess,'' rather than ''monitor'' as in the general industry standard, because ''monitor'' is a term of art in the new standard (but not under the general industry standard). However, there is no substantive difference from the definition in the general industry standard.

Authorized entrant means an employee who is authorized by the entry supervisor to enter a permit space. The general industry rule defines ''authorized entrant'' based on who the *employer* authorizes to enter the permit space. OSHA shifted the focus to who the *entry supervisor* authorizes to enter the space to avoid confusion about who the authorizing employer is on a multi-employer worksite. This revision clarifies that an entry supervisor has the duty to identify the authorized entrants on the entry permit, regardless of whether or not they are employees of another employer.

Barrier means a physical obstruction that blocks or limits access. One commenter suggested that OSHA place a note under the definition of ''barrier'' explaining that a barrier does not block or limit egress (ID–025, p. 2). This revision is unnecessary because there are provisions in the final rule that require employers to provide unobstructed egress when employees are inside a confined space. For example, final rule § 1926.1204(d)(7) requires an employer to provide equipment needed for safe egress from a Permit-Required Confined Space (''PRCS'' or ''permit space''), and final rule § 1926.1208(e) requires the authorized entrant to exit a PRCS as quickly as possible under certain circumstances. Therefore, an employer would be in violation of this final rule when a barrier that prohibits or limits persons from entering a PRCS from outside the space also prohibits or limits egress for authorized entrants seeking to exit the permit space, even though the definition of ''barrier'' does not address egress explicitly. Locking a bolt on a door that is the only means of egress from a permit space, for example, could constitute a prohibited barrier that would interfere with egress from the permit space.

Blanking or blinding means the absolute closure of a pipe, line, or duct by fastening a solid plate (such as a spectacle blind or a skillet blind) that completely covers the bore, and that is capable of withstanding the maximum pressure of the pipe, line, or duct with no leakage beyond the plate. OSHA took this definition directly from § 1910.146, and uses this term the same way in this final rule as in the general industry standard.

Competent person means a person capable of identifying existing and predictable hazardous conditions, and who has the authority to address them promptly. Section 1926.1203 of the proposed rule did not use or define ''competent person,'' but required the employer to identify and assess confined spaces. Several commenters suggested that OSHA clarify that a competent person make these determinations, and to include in the final rule the same definition for ''competent person'' as the one contained in other OSHA construction standards (ID–025, p. 2; –028, p. 4; –095, p. 2; –124, p. 7; –150, p. 3). OSHA agrees with these commenters and, therefore, added its customary definition to the final rule. OSHA uses this well-known definition in several of its construction standards. See, *e.g.,* §§ 1926.32(f), 1926.450(b), 1926.650(b), 1926.751, and 1926.1401; see also the discussion of final § 1926.1203(a) for a further explanation of why OSHA included a competent person requirement in this final rule.

Confined space means a space that: (1) Is large enough and so configured that an employee can bodily enter it; (2) has limited or restricted means for entry and exit; and (3) is not designed for continuous employee occupancy. OSHA based the definition of ''confined space'' on the definition of ''confined space'' in the general industry confined spaces standard at § 1910.146(b). It describes a space where three elements exist. First, the configuration of the space is such that a person can enter into it with his/her entire body (although the ''entry'' occurs as soon as any part of the body crosses into the confined space).[7] Second, there is limited or restricted entry or exit from the space. Third, the space is not designed for continuous employee occupancy.

OSHA is not including in the definition of ''confined space'' in the final rule the requirement that employees be able to ''perform assigned work,'' which it included in the general industry definition in § 1910.146(b). OSHA did not include this phrase in this final standard because it was superfluous, and to avoid arguments that it added ambiguity. Some in the regulated community might attempt to interpret the phrase incorrectly to suggest that this final standard, and the majority of the protections provided by the standard, would not apply if the entrant did not have an assignment to perform on entering the space, or if the employee was unable to perform work inside the space. Therefore, this final rule addresses confined spaces in terms of the hazards present, rather than the purpose for entering the space. By removing the unnecessary language from the proposed definition of ''confined space,'' OSHA makes it clear that this final standard covers any entry into a confined space. This does not imply that ''performed assigned work'' has a substantive meaning in the general industry standard; OSHA is simply taking the opportunity to improve the language of the definition as it proposed. OSHA did not include the ''perform assigned work'' language in the proposed definition of ''confined space'' adopted in this final rule, and received no comment on the absence of that language.

The final definition also includes an additional change from the general industry standard. The definition of ''confined space'' in § 1910.146(b) contains examples of different types of confined spaces in a parenthetical to the second part of the definition. OSHA did not include this parenthetical in this final rule to avoid confusing these examples with a note to § 1926.1201(a) that provides a more comprehensive, but not exclusive, list of examples of confined spaces.

One commenter asserted that the proposed definition of a confined space is too broad because it includes attics, crawlspaces, cabinets, unfinished basements, swimming pools, window wells or utility closets that contain water heaters in single-family residential homes, but those spaces ''do not present the kind of risk the standard is intended to address.'' (ID–117, p. 5). Although some of these spaces could meet the definition of a confined space, the Agency does not agree that this definition is too broad. As noted earlier when OSHA rejected the same commenter's request for a complete exemption from the standard, the commenter provides no support for the assertion that these spaces do not present the kind of risks this standard is addressed and the crawl-space fatalities included in the final economic analysis clearly demonstrate that these spaces are not inherently safe. OSHA defined the term broadly to ensure that employers perform the requisite evaluation to determine whether a known or potential hazard exists in those spaces. The majority of the requirements of this final rule would apply only if a known or potential hazard is found to exist in the confined space, but the initial assessment required by this standard is crucial to discovering whether such hazards are present. Therefore, an employer performing construction work inside attics or any of the other spaces noted by this commenter must comply with only the reevaluation provisions in this final rule when no atmospheric or physical hazard exists in a confined space. If an employer does not wish to conduct an evaluation, then the employer can either prevent its employees from entering the space or design the construction process to avoid the need for entry into a confined space.

One commenter expressed confusion as to the meaning of the third element of the confined space definition: ''not designed for continuous employee occupancy'' (ID–119, p. 5). The third element captures all spaces where conditions are such that employees would normally exit the space relatively soon after entering, absent the construction activity. When determining whether a space is designed for continuous occupancy, it is appropriate to focus on the design of the space and whether that space is still configured as designed. See October 22, 1993, letter to Robert Bee; December 20, 1994, letter to Edward Donoghue; June 22, 1995, letter to Dan Freeman (noting difference between the ''primary function'' and ''design'' of a confined space). For example, if a space that meets the definition of a confined space has a powered ventilation system that allows for continuous occupancy, but that system is not functional or the construction activity would interfere with the proper function of that system, then the space would be a confined space subject to this final standard. See

[7] See March 5, 2008, letter to Andrew Lewis (no confined space where it is impossible for employee to fit his entire body into the space); October 18, 1995, letter to Charles M. Bessey (entry occurs when any part of the body breaks the plane of the opening of a space large enough to allow full entry, regardless of intent to fully enter).

October 27, 1995, letter to William Taylor.

The same commenter also asked for additional examples of confined spaces (ID–119, p. 5). The note in final rule § 1926.1201(a) provides examples of locations where confined spaces may occur. In addition, OSHA notes that numerous letters of interpretation are available providing additional guidance as to the meaning of a ''confined space'' in the context of the general industry standard. OSHA is adopting into its construction rule the guidance regarding the definition of a confined space provided by the letters of interpretation referenced in the previous paragraph. In addition, the following letters apply with respect to the definition of a confined space in this final standard as they did to the general industry standard: September 19, 1994, letter to Edward Donoghue Associates, Inc. (elevator pit can be a confined space); June 15, 1992, letter to George Kennedy (storm sewer manhole entrance can be a confined space); July 11, 1995, letter to Alan Sefton (entry by a robot does not trigger the standard); October 23, 1995, letter to Mark Arriens (roll off container, dump truck bed, and truck trailer can be confined spaces); October 27, 1995, letter to James Sharpe (entry limited if employee must bend down to avoid striking the top of an opening or step over a raised threshold); February 8, 1996, letter to Remi Morrissette (personnel airlock can be a confined space when both sets of doors cannot open at the same time); April 24, 1998, letter to Gregory Faeth (30-inch deep chest-type freezer not a confined space when person can simply stand up to get out); December 2, 2002, letter to Art Varga (dock leveler pit can be a confined space); March 8, 2005, letter to Ron Sands (box van of truck is not a confined space as normally used and configured). The Agency notes, however, that any guidance previously provided with respect to its previous confined spaces in construction standard, 29 CFR 1926.21, is no longer applicable or in effect. See, *e.g.,* July 10, 2006, letter to John Williams II.

One commenter requested that OSHA clarify the distinction between an ''enclosed space'' and a ''confined space,'' and another commenter suggested that OSHA provide additional discussion of the hazards of an ''enclosed space'' in this final rule (ID–119, p. 6; –140, p. 4). As OSHA stated in the preamble to the proposed rule, the Small Business Advocacy Review Panel recommended that OSHA examine the benefits and costs associated with provisions addressing hazardous-enclosed spaces (72 FR 67398 (Nov. 28, 2007)). Consequently, the Agency decided not to include any new or additional requirements for hazardous-enclosed spaces in the final rule. Instead, OSHA relies on existing standards, such as § 1926.55—Gases, vapors, fumes, dusts, and mists, to address the hazards of working inside enclosed spaces. OSHA Technical Information Bulletin 02–05–30 is available to employers who are looking for guidance on the particular hazards of working in enclosed spaces. For example, this bulletin states that the OSHA respirator standard may apply when employees are working in enclosures that do not meet the definition of ''confined space.''

Another commenter questioned the inclusion of spaces equipped with ladders or stairways for employee entry or exit in the proposed definition of ''confined space'' (ID–013, p. 5). Both the proposed and final definitions of ''confined space'' include ''limited or restricted'' entry or exit. A space where an employee can enter or exit only with the use of a stairway or a ladder, like an attic, generally meets this definition of a confined space. See*, e.g.,* October 27, 1995, letter to James Sharpe. The following guidance provided earlier by OSHA with respect to the general industry standard definition of this term also is applicable to this construction standard:

> Ladders, and temporary, movable, spiral, or articulated stairs will usually be considered a limited or restricted means of egress. Fixed industrial stairs that meet OSHA standards will be considered a limited or restricted means of egress when the conditions or physical characteristics of the space, in light of the hazards present in it, would interfere with the entrant's ability to exit or be rescued in a hazardous situation.

OSHA Directive CPL 02–00–100: Application of the Permit-Required Confined Spaces (PRCS) Standards, 29 CFR 1910.146 (May 5, 1995), Appendix E.

OSHA also clarified in the context of the general industry confined spaces standard that, although the Agency does not generally consider doorways and other portals through which a person can walk to be limited means of entry or exit, it may deem a space containing such a door or portal to be a confined space if the door or portal hinders an entrant's ability to escape from the confined space in an emergency (see 59 FR 55208 (Nov. 4, 1994)). The same interpretation applies in the construction context. OSHA provided the following explanation in its compliance directive on the general industry rule, which also applies in the construction context:

> A space has limited or restricted means of entry or exit if an entrant's ability to escape in an emergency would be hindered. The dimensions of a door and its location are factors in determining whether an entrant can easily escape; however, the presence of a door does not in and of itself mean that the space is not a confined space. For example, a space such as a bag house or crawl space that has a door leading into it, but also has pipes, conduits, ducts, or equipment or materials that an employee would be required to crawl over or under or squeeze around in order to escape, has limited or restricted means of exit. A piece of equipment with an access door, such as a conveyor feed, a drying oven, or a paint spray enclosure, will also be considered to have restricted means of entry or exit if an employee has to crawl to gain access to his or her intended work location. Similarly, an access door or portal which is too small to allow an employee to walk upright and unimpeded through it will be considered to restrict an employee's ability to escape.

OSHA Directive CPL 02–00–100: Application of the Permit-Required Confined Spaces (PRCS) Standards, 29 CFR 1910.146 (May 5, 1995), Appendix E.

Another commenter asked OSHA to clarify whether a space that is temporary can still meet the definition of a confined space in the final rule (ID–136, p. 2). For example, the commenter asserted that a space constructed for the sole purpose of allowing employees to temporarily work over the end of a large open gas pipe could qualify as a confined space. In this particular example, the commenter emphasized the need for an employer to address the hazard of establishing an oxygen-deficient atmosphere as a result of purging the pipe with nitrogen.

OSHA agrees that a temporary space, including the temporary space provided in the commenter's example, can be a ''confined space.'' The fact that the space described by the commenter is temporary does not prevent the space from meeting the definition of a confined space in this final rule. The temporary character of the space may be the most readily apparent factor in determining whether a temporary space would permit continuous employee occupancy.

OHSA did not define the term ''contractor'' in the final rule, as it did in the proposed rule. One commenter recognized that OSHA's proposed definition of ''contractor'' excluded controlling contractors (ID–099, p. 1). To simplify the terminology used throughout the standard, to address the inconsistency identified by the commenter, and to avoid other confusion with the term ''controlling contractor,'' OSHA is using terms more precisely in the final rule. OSHA uses the term ''employer'' to refer generically to employers, including employers that meet the final rule's definitions of ''controlling contractor'' or ''host employers.'' OSHA also added the term ''entry employer'' to refer to employers performing confined-space entry. As discussed elsewhere in this preamble the Agency also is using ''controlling contractor'' and ''host employer'' to refer to other specific types of employers when necessary.

Control, as defined in this final standard, is an action taken, through engineering methods, to reduce the hazard level inside a confined space, including the maintenance of this reduced hazard level. This definition is consistent with the use of the term in the general industry confined spaces standard, although OSHA did not define the term in § 1910.146(b). The proposed rule's definition of ''control'' provided isolation as an example of a control action. However, controlling a hazard provides less protection to an employee than isolating the hazard because it does not result in the elimination or removal of the hazard. For example, ventilation is a control method that merely reduces the hazard level below its Permissible Exposure Limit (PEL) or Lower Explosive Limit (LEL) for the duration needed to protect employees in or near a confined space. Therefore, OSHA deleted the reference to isolation from the final standard to clarify the distinction between control and isolation. Otherwise, the final standard defines the term as proposed.

Controlling contractor is the employer that has overall responsibility for construction at the worksite. In addition, the note to this definition explains that, if a host employer has overall responsibility for construction at the worksite, then the host employer also is the controlling contractor under this final rule. The final rule's definition of ''controlling contractor'' is identical to the proposed rule's definition. The general industry confined spaces standard does not use the term ''controlling contractor'' and, therefore, § 1910.146(b) does not define the term.

OSHA included a definition of ''controlling contractor'' in this final rule because it is a common practice in construction work for a number of employers to be working at a construction site at the same time. Also, there often is one employer that has overall authority over the construction site, including the authority to change worksite conditions, set schedules, and alter work practices with regard to safety. This definition is nearly identical to the definition of the term as used in the OSHA's Steel Erection standard at 29 CFR part 1926, subpart R. The definition reflects the core principle of general supervisory control over the construction site. Under this final rule, OSHA clarified the responsibilities of different employers on the site and assigned specific duties to the controlling contractor, as distinguished from the host employer and the other employers (see final § 1926.1203(h)). Consequently, there is a need to define the term ''controlling contractor.''

Some commenters were unsure whether an employer with no contractual authority for the overall safety of a project could qualify as a ''controlling contractor'' (ID–106, p. 2; –129, p. 2). Another commenter asserted that an employer will have extreme difficulty exercising the control required by the standard without explicit contractual authority to do so (ID–120, p. 2). The facts and circumstances present at the job site determine whether an employer is a controlling contractor under this final rule: explicit contractual authority is sufficient to indicate a controlling contractor, but the absence of contractual authority is not definitive. In this regard, OSHA intends the controlling contractor's authority to be established in the same manner that a controlling employer's authority is established under OSHA's Multi-Employer Citation Policy. For more information about the role of the controlling employer, see OSHA Directive CPL 02–00–124: Multi-Employer Citation Policy.

Double block and bleed means the closure of a line, duct, or pipe by closing and locking or tagging two in-line valves and by opening and locking or tagging a drain or vent valve in the line between the two closed valves. This can be done to eliminate the potential for substances in the sections of the pipes to enter the space. OSHA took this term directly from § 1910.146. The proposed definition was different grammatically, and also specified the exact position in which the closures were to be locked or tagged, but there is no substantive difference between the final language and the language in the proposed rule.

Early-warning system is the method used to alert attendants, as well as authorized entrants in a permit space, that an engulfment hazard may be developing. Examples of early-warning systems include: alarms activated by remote sensors and lookouts with equipment for immediately communicating with the authorized entrants and attendants. OSHA did not revise the definition from the proposed rule, other than to use ''assess'' rather than ''monitor'' because the latter is now a defined term under the standard. Although § 1910.146 does not explicitly include the ''early warning system'', the Agency included the term in the final rule to ensure that the regulated community understands that these systems must provide an effective means of warning attendants and authorized entrants that a non-isolated engulfment hazard may be developing in an area where it could flow into the work area. A clear understanding of this term will help employers ensure that authorized entrants have sufficient time to safely exit the space (see explanation of § 1926.1204(e)(1) below in this preamble). As illustrated by the non-exhaustive list of examples of early-warning systems in this definition, employers have flexibility regarding the type of early-warning system to use for continuously monitoring engulfment hazards. However, as stated in final rule § 1926.1204(e)(1)(iii), whatever warning system an employer selects, it must alert authorized entrants and attendants in sufficient time for the authorized entrants to safely exit the space.

Emergency means any occurrence inside or outside a space that could endanger an entrant. The definition is similar to the definition in the general industry standard, and is not substantively different from the definition provided in the proposed rule. The only distinction between the general industry standard and the final rule is that the final rule includes a loss of power in the non-exhaustive list of examples of emergencies. OSHA is specifying power loss to make it clear that unexpected loss of power can endanger entrants, particularly if the permit plan relied on the use of ventilation, monitoring, controls, communication with the attendant, or egress that would be affected by the loss of power. The definition is important because 1204(d)(5) requires employers to provide adequate lighting for egress in an emergency.

One commenter urged OSHA to clarify that an occurrence constituting the emergency must involve the work performed in the confined space (ID–099, p. 1). For example, in this commenter's view a heart attack that does not involve the working conditions in a confined space, but occurs while an employee is working in or near a confined space, would not qualify as an ''emergency'' under § 1926.1202. OSHA disagrees with this comment, and is not making this revision because the final standard uses the term ''emergency'' with respect to the provision of rescue services. (See, *e.g.,* final § 1926.1204(i), which requires the employer to develop and implement procedures for responding to emergencies.) The Agency believes that an emergency occurs regardless of whether or not it is foreseeable based on the work the employee is performing within or near the confined space. Under the rescue provisions of this final standard, emergencies, regardless of their cause, require employers to initiate rescue of the affected employees working inside the confined space because of restricted access to, and egress from, the confined space.

Engulfment refers to the surrounding and effective capture of a person by a liquid or finely divided (flowable) solid substance, such as water, dirt, sand, sawdust, or rocks. Any solid or liquid that can flow into a confined space and that can drown, suffocate, or crush an employee can be an engulfing medium. This definition is nearly identical to the definition of the same term in § 1910.146, except that it also includes ''or suffocation'' at the end of the definition, paraphrasing the following additional language from the proposed rule: ''or the substance suffocates the individual.'' This additional language clarifies that the definition includes suffocation that does not result from strangulation, constriction, or the blockage of any respiratory mechanism. For example, the definition includes surrounding an employee with a flowable material even if personal protective equipment or some other barrier (for example. a person trapped in sand while wearing respirator mask with an enclosed air source) delays immediate drowning or suffocation. The final definition does not differ substantively from the definition in the proposed rule, and OSHA received no comments on the proposed definition.

Entry means the action by which any part of a person passes through an opening into a permit-required confined space. Entry includes ensuing work activities in that space, and occurs as soon as any part of the entrant's body breaks the plane of an opening into the space, whether or not such action is intentional or the person performs any work activities in the space. This definition is similar to the definition of ''entry'' in § 1910.146(b), except OSHA added the last clause to clarify that this is a bright-line definition: entry occurs under all circumstances in which the entrant's body breaks the physical threshold of the opening, regardless of the events or actions that caused entry. For example, when an employer assigns an employee a task that would not ordinarily involve entry into a confined space, and the employee inadvertently falls into the confined space and does not perform any work in that space, the employee entered the space at the instant the first part of the employee's body crosses the plane of the confined space. This clarification is consistent with OSHA's longstanding interpretation of the general industry standard. See October 18, 1995, letter to Charles Bessey. As a result, an entry employer's duty to prevent unauthorized entry under § 1926.1204(a) means that the employer must take the necessary steps, such as installing barriers when appropriate, to prevent both intentional and unintentional entries.

As noted in the explanation for the definition of ''confined space,'' a space must be large enough to fit the entering employee's entire body to constitute a confined space. However, if the space is large enough to qualify as a confined space, any entry into that space constitutes an entry, even if the employee's entire body does not enter the space. This application is consistent with OSHA's design of this final standard: to ensure that this construction rule is enforceable. Therefore, OSHA declines to incorporate into this final rule its previous guidance offered with respect to the general industry rule to the extent that the guidance indicated that entry would not take place if only part of the body, and not the whole body, crossed the plane of the confined space. See July 13, 1993, letter to Dean Davenport (no entry into water pipe when employee stuck in an arm, but not the whole body). Absent some safeguard to ensure that the rest of the employee's body could not cross the threshold into the confined space, the likelihood of inadvertent entry into a space in the context of construction warrants a strict approach that differs from the more routine entries often associated with maintenance under the general industry standard. For example, an employee who sticks his/her head into a new space established during construction may be overcome by fumes and fall into the space or be rendered unable to remove his or her head from the space and avoid further exposure to the hazards.

The definition of ''entry'' in this final rule is slightly different than the proposed definition, but the differences do not change the substantive meaning of the term as proposed. OSHA made these changes to the proposed definition to make the final definition of ''entry'' similar to the definition of the term in § 1910.146(b).

Entry employer means an employer who decides that an employee it directs will enter a permit space. Paragraph (b) of § 1910.146 does not use the term ''entry employer''; instead, the general industry standard refers generally to ''employer.'' In general the term ''entry employer'' in this final rule and the term ''employer'' in § 1910.146(b) are synonymous because both terms identify the employer who must follow the accompanying confined-space procedures for employers that plan to enter a permit space. However, OSHA uses this term in this final rule to clarify that not all employers on a multi-employer worksite have duties associated with entering a permit space.

On a multi-employer worksite, each employer has a duty under this new standard to ensure that a competent person identifies all confined spaces in which any employee it directs may work (§ 1926.1203(a)). Each employer must then prevent the employees it directs from entering permit spaces or limit access to those spaces in accordance with the permit procedure (or alternatives) specified in this standard (see § 1926.1203(a) and (c)–(e)). Under the standard, an entry employer has a number of important duties that must be performed prior to anyone physically entering a permit space, such as the requirements for pre-entry information exchanges in § 1926.1203(h) and the duty to develop and implement a permit program to restrict access under § 1926.1204. Therefore, under the definition, an employer becomes an entry employer when it ''decides that'' an employee it directs will enter, rather than at the later point when the employee actually enters. An employer can be an entry employer regardless of whether that employer has completed any of the steps of instituting a permit program or an employee has actually entered the space.

However, OSHA does not intend for the ''decides that'' language in the definition to narrow the meaning of ''employer'' in any way or to focus on any deliberative or procedural process. OSHA has added a note to the definition of ''entry employer'' to emphasize that an employer cannot avoid the duties of the standard merely by refusing to decide whether its employees will enter a permit space, and OSHA will consider the failure to so decide to be an implicit decision to allow employees to enter those spaces if they are working in the proximity of the space.

The ''an employee it directs'' language encompasses temporary workers, permanent employees, and all other workers who are under the direction of the employer at the worksite, whether they are contracted directly or through a third party such as a staffing agency. For example, when a general contractor contracts with a third party to bring on a temporary worker and assigns the worker to work in a permit space, the general contractor is an entry employer. However, if the temporary employee is assigned to a welding subcontractor, and the welding contractor makes the determination of where the temporary employee will work without direction from the general contractor, then the welding subcontractor would be the entry employer. The general contractor would not be an entry employer in the latter example.

Entry permit means the document, provided by the entry employer, which allows and controls entry into a permit space. Section 1926.1206—Entry Permit of this final standard specifies the contents of the permit. As part of its effort to specify the duties and responsibilities of different employers on a multi-employer worksite, OSHA specifies that the employer ''who designated the space a permit space,'' must prepare the permit, rather than just ''the employer'' as in § 1910.146. This definition is otherwise identical to the definition in § 1910.146(b). In a typical multi-employer worksite, all employers would have the duty to identify confined spaces that their employees might enter, but only some employers must establish a permit program and complete permits.

Entry rescue means rescue that occurs when a rescue service enters a PRCS to rescue one or more employees. This definition is identical to the proposed definition of ''entry rescue,'' except that the Agency clarifies that the term includes a rescue of a single employee. Section 1910.146(b) does not define ''entry rescue'' because the general industry standard does not use the term. The term is included in this final rule to make the requirements for each type of rescue more clear.

Entry supervisor means the qualified person (such as the employer, foreman, or crew chief) assigned by the employer to determine if acceptable entry conditions are present at a permit space where entry is planned, to authorize entry and oversee entry operations, and to terminate entry as required by the final standard. This definition is identical to the definition provided in § 1910.146(b), except that OSHA replaced ''person'' with ''qualified person'' as in the proposed rule (the proposed rule used ''qualified individual''), to clarify that the individual must meet the requirements for ''qualified person'' as defined later in this section. The note to this definition, which clarifies that the entry supervisor may enter the permit space or serve as an attendant if the applicable requirements are met, is identical to the note in the general industry definition.

Hazard means a ''physical hazard'' or ''hazardous atmosphere'' as defined by this standard. The proposed rule defined this term, and OSHA is including it here to clarify that references to a ''hazard'' or ''hazards'' can mean either physical or atmospheric hazards, or both.

Hazardous atmosphere refers to the five enumerated atmospheres, any one of which may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue (that is, unaided escape from a permit space), injury, or acute illness. The proposed definition of ''hazardous atmosphere'' varied slightly from the definition in § 1910.146(b), and several commenters requested that OSHA make the definition in this final rule more similar to the definition in § 1910.146(b) (ID–017, p. 1; –132, p. 2; –138, p. 3; –153, p. 12). OSHA did so, as explained below, and the final definition is substantively identical to the definition in the general industry standard.

One commenter noted that the proposed definition included ''existing or potential'' atmospheres, and argued that this language, combined with OSHA's failure to include a note that is part of the general industry definition of ''hazardous atmosphere,'' constituted an inappropriate expansion of the scope of this final standard compared to the general industry standard (ID–219.2, p. 72). OSHA addressed this commenter's concerns by adopting the general industry language, which does not refer to ''existing or potential'' atmospheres, and also included the note favored by the commenter. See the note after the fourth enumerated paragraph in the definition, which is substantively identical to the note in the general industry standard.

The five enumerated paragraphs or conditions in the definition address four specific types of hazardous atmospheres and a broad condition that encompasses any other atmosphere that is immediately dangerous to life or health. The first enumerated condition addresses an atmospheric condition that consists of a flammable gas, vapor, or mist in excess of 10 percent of its lower flammable limit (LFL). OSHA set this level to account for the difficulty employers have in detecting each and every flammable gas vapor, or mist. The LFL, as it is defined by the confined spaces in construction standard, refers to the minimum concentration of a substance in air needed for an ignition source to cause a flame or explosion. The LFL of the atmosphere is a cumulative measure that represents the mixture of different flammable elements, not just the presence of a single element that could lead to an explosion. Therefore, for the reasons explained below, OSHA has defined hazardous atmosphere as any atmosphere at or above 10 percent of a detected substance's LFL (10 percent LFL) to provide an adequate safety margin, and to ensure that an atmosphere does not exceed the LFL if one of a combination of substances goes undetected.

OSHA specifically asked for public comment on the propriety of defining a hazardous atmosphere for purposes of the confined spaces in construction standard at 10 LFL when § 1926.651(g)(1)(iii) prohibits exposure to atmospheres in excavations exceeding 20 percent of the LFL (20 percent LFL). Some commenters urged OSHA to permit 20 percent LFL in this final rule for the sake of uniformity, while another commenter favored this change only if credible data justifies this uniform LFL (ID–090, p. 1 and ID–108, p. 6; ID–060, p. 1, respectively). Other commenters, however, indicated that 10 percent LFL was more appropriate, and recommended that OSHA revise the subpart P LFL to 10 percent LFL to provide adequate safety to employees working in excavations (ID–132, p. 3; –140, p. 6). This last group of commenters noted that using 10 percent LFL would align the definition of ''hazardous atmosphere'' in this final rule with the general industry confined spaces rule at § 1910.146(b) and ANSI Z–117.1. One commenter also noted that because the LFL of many common petroleum based materials is approximately 1 percent of the total volume of the atmosphere, which would convert to 10,000 parts per million (ppm), 10 percent of that LFL is 1,000 ppm, which approaches the immediately dangerous to life or health (IDLH) (see below) level for many materials (ID–132, p. 3).

OSHA selected the 10 percent LFL in the final rule to match the general industry standard. As the Agency explained when selecting the 10 percent LFL in § 1910.146(b), the 10 percent level is ''widely recognized as being the threshold value for a hazardous atmosphere'' (58 FR 4473). The record indicates that this lower level continues to be more widely used and more appropriate than the 20 percent LFL suggested by the commenter, particularly now that the general industry standard is nearly 20 years old. (See also ANSI Z–117.1 (setting the maximum level at 10 percent LFL); ANSI 6.3.1.12 (setting the maximum level at *less than* 10 percent LFL.))

Moreover, the record does not include credible data to justify why the 20 percent LFL would be more appropriate for a confined space. OSHA may consider amending subpart P to a similar level in the future, but that decision is outside the scope of this rulemaking.

The second enumerated condition in the final definition addresses ''hazardous atmosphere'' consisting of an airborne combustible dust at a concentration that meets or exceeds its lower flammable limit (LFL). One commenter asked why OSHA did not propose a 10 percent LFL for combustible dust, similar to OSHA's approach for flammable gas, vapor, or mist in the first condition under this definition (ID–112, p. 6). OSHA did not propose a percentage of the LFL in defining a hazardous airborne combustible-dust concentration level for several reasons. Employers usually can visually judge the flammability hazard posed by airborne dust. Moreover, as OSHA noted in the preamble to the general industry standard, it is difficult at present to measure airborne concentrations of combustible dust reliably at a site, so there likely would be significant delays in determining whether the level of combustible dust meets the LFL at a particular site. Therefore, LFL determinations would appear to be unnecessarily burdensome with regard to combustible dust. OSHA concludes that the final rule will protect employees adequately so long as employers train their employees in the recognition of combustible dust, and ensure that the concentration of combustible dust remains below its LFL.

For this reason, OSHA has incorporated the note for this condition from § 1910.146(b), except that it has added the word ''combustible'' before ''dust'' to clarify the meaning of the note, and made a minor additional change from the proposed rule to make the final definition identical to § 1910.146(b). OSHA used LFL in this final rule definition, rather than ''lower explosive limit (LEL),'' which OSHA used in the proposed definition. OSHA notes, however, that the Agency uses these terms interchangeably. (See, *e.g.,* proposed definition of ''lower flammable limit or lower explosive limit'' at 72 FR 67406.)

The third condition of a hazardous atmosphere in this definition addresses the conditions of an atmospheric oxygen concentration below 19.5 percent (''oxygen deficient'') or above 23.5 percent (''oxygen enriched'') in a confined space. Four commenters suggested that OSHA change the oxygen-enriched level from 23.5 percent to 22 percent, which they noted is the level set by the National Fire Protection Association (NFPA)[8] (ID–25, p. 2; –27, p. 6; –28, p. 4; 95, p. 1). Two commenters suggested that increases in oxygen levels due to leaks of compressed oxygen used in ''hot work'' would more easily be detected if the maximum acceptable oxygen level was 22 percent instead of 23.5 percent (ID–95, p.1), as it is in the rules for maritime work. The commenters did not, however, provide any data or other information supporting the suggestion that the proposed level, which is identical to the level in the general industry standard, is not sufficiently protective. The absence of such information, the lack of incidents caused by oxygen levels between 22 and 23.5 percent lead OSHA to conclude that the difference is not significant. In addition, this consistency benefits employers that engage in both general industry and construction work. OSHA finalized the level at 23.5 percent so that it is consistent with the general industry confined spaces standard at § 1910.146(b), as well as the definition of ''enriched oxygen'' in OSHA's Respiratory Protection standard. This oxygen-enriched level also is the same as the level in the proposed definition of ''hazardous atmosphere.'' OSHA continues to believe that the 23.5 percent level provides a sufficient amount of time for employers to detect a hazardous oxygen-enriched atmosphere, and to exit the space safely, before the oxygen level gets so high that it begins to have adverse effects on the exposed employees. Other standards, such as Subpart J—Welding and Subpart V—Electronic Transmission and Distribution, set forth protective requirements for employees engaged in ''hot work'' that address the commenters' concerns.

Additionally, OSHA recognizes that safe levels of oxygen vary with altitude, and that concentrations of oxygen at or above the oxygen deficient limit of 19.5 percent in this final rule may still pose atmospheric hazards at very high altitudes. For example, ANSI/ASSE Z88.2–1992 recognizes an IDLH circumstance at altitudes of 5,000 ft. above sea level or higher, if the oxygen concentration is at 19.5 percent.[9] The Agency believes that most confined-space work takes place at altitudes lower than 5,000 ft. above sea level, and retains the 19.5 percent oxygen deficient limit in this final rule. However, the Agency notes that to the extent a high altitude causes an otherwise permissible oxygen concentration to become IDLH, such circumstances may also result in a ''hazardous atmosphere'' as set forth in the fifth condition in OSHA's definition, which defines a ''hazardous atmosphere'' to include any other atmospheric condition that is IDLH.

The fourth condition in the definition of ''hazardous atmosphere'' addresses an airborne concentration of a substance that exceeds the permissible dose or exposure limit specified by OSHA. The final definition includes cross-references to the applicable PELs in subparts D—Occupational Health and Environmental Controls and Z—Toxic and Hazardous Substances of 29 CFR part 1926, rather than the general reference to PELs specified in ''any OSHA requirement'' contained in the proposed rule. The form of the definition now duplicates the form found in the general industry standard. In addition, removing the reference to ''any OSHA requirement'' avoids the implication that PELs in general industry standards would apply to construction work.

One commenter requested that OSHA insert a note under this fourth condition explaining that the PELs in § 1910.1000 also would apply under this condition (ID–028, p. 5). OSHA did not include a reference to § 1910.1000 because those general industry PELs do not apply to construction work. Section 1926.55 establishes the relevant PELs for construction.

OSHA did, however, include a note to the fourth condition of the definition that is substantively identical to the note to the fourth subheading of the § 1910.146(b) definition of ''hazardous atmosphere,'' except that OSHA changed the word ''provision'' to ''definition'' to make it clear that the note applies to the types of hazards covered by the definition of ''hazardous atmosphere.'' OSHA sets its construction PELs at different levels for different reasons; some of these PELs prevent harm from substances that manifest quickly in the human body, such as [hydrogen sulfide and carbon monoxide, among others], while OSHA sets other PELs prevent harm from substances that produce long-term health effects but do not produce any acute effect on employees. The note

[8] NFPA 53 defines ''oxygen-enriched atmosphere'' as one in which the concentration of oxygen exceeds 21 percent by volume or its partial pressure exceeds 21.3 kPa. (See NFPA 53, Recommended Practice on Materials, Equipment, and Systems Used in Oxygen-Enriched Atmospheres, 2011 Edition at 3.3.25).

[9] The Agency also notes that an updated revision of ANSI/ASSE Z88.2–1992 was forthcoming at the time of its development of this final rule. The draft of the updated standard appeared to be consistent with the 1992 version on this issue.

makes clear that, for the purposes of determining whether a hazardous atmosphere exists under this final rule as the result of a concentration of a substance in excess of its PEL, employers need to address only the substances with PELs that could result in immediate harm or impairment of the employee's ability to perform self-rescue. See also the discussion in the general industry preamble at 58 FR 4474. For example, a short-term exposure to silica is unlikely to cause immediate injury. Likewise, nitrogen and carbon dioxide will not impair self-rescue unless their levels are so high that they replace significant oxygen, so that they act as an asphyxiant. The same is true for any inert gases, for example argon, neon and helium. Most of the substances with an OSHA PEL (in subparts D and Z of the construction standards) are based on long-term, chronic risks to health. Presumably, most of these substances do not pose a risk of an acute health effect or of self-rescue at exposure levels near the PEL. However, if extremely high levels of exposure far above a PEL occurred, one of these substances could potentially pose a risk to self-rescue, which would in turn trigger the fourth condition of hazardous atmosphere.

The note also addresses a comment that PELs regulating substances with long-term effects, such as iron oxide emitted during welding or xylene emitted when painting, should not automatically trigger the PRCS requirements (ID–028). While OSHA agrees that iron oxide by itself would not trigger permit restrictions because the symptoms of iron oxide exposure would generally not prevent an entrant from exiting a confined space, xylene is highly flammable and would therefore present a hazard if the potential exists for the concentration of xylene to exceed the LFL.

A different commenter suggested that OSHA avoid potential confusion by rearranging the order in which the subparagraphs in the definition of ''hazardous atmosphere'' are presented to reflect the order in which OSHA requires atmospheric testing and monitoring (oxygen content, flammability, then toxicity—see § 1926.1204(e)(3) of the final rule) (ID–132, p. 2). OSHA does not agree that the order of presentation in this definition is likely to cause confusion, particularly when the actual order of testing is spelled out in § 1926.1203(e). OSHA did not make this change in the final rule so that it could to keep the definition of ''hazardous atmosphere'' in this final rule similar to the definition of that term in § 1910.146(b), including the order of the listed conditions.

Host employer means the employer that owns or manages the property where the construction work is taking place. As explained in the definition of ''controlling contractor,'' OSHA added this definition to clarify the distinction between a host employer, a controlling contractor, and an employer performing confined space entry because each of these entities has specific obligations under this final rule. (See the discussion under ''controlling contractor'' above.) OSHA used the term ''host employer'' in the general industry standard without defining it, but the definition in this final rule is consistent with the use of the term in that general industry standard. It is also substantively the same as the proposed definition.

One commenter asserted that an employer should never meet the definition of ''host employer'' if the employer ''had no employees at all (a home owner, for example, might fit this category) or had no employees 'engaged in construction work' (an owner of an office building might fit this category)'' (ID–117, p. 5). OSHA notes that it has already addressed the commenter's first concern because an entity only meets the definition of a ''host employer'' under the final rule if it is ''an employer.'' OSHA disagrees with the commenter's second assertion, and has addressed the propriety of placing duties on the host employer, and OSHA's authority for doing so, in the discussion of § 1926.1203(h) later in this preamble.

OSHA also added a note to the definition of ''host employer'' to address situations in which the owner of the property contracts with a management company to manage the property. OSHA understands that this type of arrangement is somewhat common with commercial properties, and that in many cases the management company will be the principal custodian of blueprints and other information about the property that identifies confined spaces on the property or is otherwise relevant to confined spaces work on that property. Because the host-employer requirements in final § 1926.1203(h)(1) are designed to ensure that relevant information about the property and known hazards therein is conveyed to employers who will be performing work in confined spaces, OSHA clarifies in the note that the entity that possesses that information, either the owner or the management company, will serve as the host employer for the purposes of this standard for as long as the company manages the property (if there is a change in management companies, the initial management company would return the information to the owner, and the host employer duties would revert to the property owner until discharged to the new management company). The note also clarifies that only one of these entities will serve as a host employer. If a property owner contracts with a third party to manage the property, turns over all relevant information about the property that it has (the locations of permit space the hazards they contain, and the previous precautions used to address them) to the management company, then OSHA will treat the management company (not the property owner) as the ''host employer'' under this standard. That management company, rather than the owner, must then maintain the relevant information about the property and fulfill the duties of the host employer under this standard (*e.g.,* share that information with the controlling contractor). For example, if the owner transfers its records to the management company, including a map of the property showing a confined space marked for storage of containers of flammable liquids, then the management company must relay to the controlling contractor hired to oversee welding operations the location of that space, its contents, and any previous measures used to address them (*e.g.,* ''when the painters came, they tried to move the containers but the containers began to leak and soaked into the floors so the painters had to continuously ventilate the whole area during their entry.'') The property owners would not have a separate duty to relay that information to the controlling contractor. In another example, the owner of a commercial property hires a professional property management company to manage a property. The property owner turns over all relevant information to the management company. The management company contracts with a general contractor to oversee renovations in a furnace room and boilers on the property, and the general contractor hires a subcontractor to perform the construction work inside the boilers, which are activated through an electrical system. Under this standard, the management company has a duty to notify the controlling contractor that the boiler tanks are connected to the electrical system, the way in which that electrical hazard is normally addressed (*e.g.,* isolating the electrical hazards by disconnecting, and locking out, the power source).

Hot work means operations capable of providing a source of ignition, such as riveting, welding, cutting, burning, and heating. In § 1910.146(b), OSHA defined ''hot work permit'' to describe the same activity, but focused on the permit rather than the work. OSHA did not include the word ''permit'' in the definition in this final rule because the final regulatory text uses only the term ''hot work,'' and does not use the term ''hot work permit.''

Immediately dangerous to life or health (IDLH) means any condition that could cause a threat to life, cause irreversible health effects, or otherwise inhibit an employee's ability to escape from a permit space. The proposed definition of ''IDLH'' also included separately any condition that exposes an employee to ''serious physical harm,'' which some commenters opposed. (ID–0013, p. 2; ID–219.2, p. 74; ID–0147, p. 3.) In particular, one commenter noted that the definition of ''IDLH'' in § 1910.146(b) does not include every condition that could cause ''serious physical harm,'' and asserted that the use of this term makes it less clear that an IDLH condition is one associated with urgent danger. (ID–0013, p. 2) For example, the commenter asserted that, under the proposed definition, an IDLH condition would be present when an employee breaks his/her nose.

Another commenter asserted that ''irreversible adverse health effects'' should not be an element of the IDLH definition unless OSHA adds language tying those effects to an impairment of the ability for self-rescue (ID–0219.2, p. 74.). OSHA notes that the revised definition of IDLH is applied in this standard through the definition of hazardous atmosphere, and excludes ''an atmospheric concentration of any substance that is not capable of causing death, incapacitation, impairment of ability to self-rescue, injury, or acute illness'' (see Note to the definition of ''hazardous atmosphere''). Thus, the standard follows the general industry standard and is as appropriately focused on conditions that would impair the ability to self-rescue as is the definition in the general industry standard. In a comment submitted after the hearing for this rulemaking, the same commenter did not object to the inclusion of ''irreversible adverse health effects'' in the general industry standard, asserting that the general industry standard ''does not regulate non-acute hazards'' (ID–219.2, p. and 71.) However, OSHA finds no evidence in the record, even after 20 years of experience with the general industry standard, that this ''irreversible adverse health effects'' component of the IDLH definition would be less appropriate for the construction industry. OSHA has thus modified the definition of IDLH to focus on conditions which would impair an entrant's ability to self-rescue and either pose a threat to life or have the capacity to cause irreversible adverse health effects, and notes that all other OSHA standards regarding exposure to hazardous substances continue to apply.

Inerting means displacing the atmosphere in a permit space by adding a noncombustible gas (such as nitrogen) to such an extent that the resulting atmosphere is noncombustible. The definition is identical to the general industry definition, except for a minor grammatical change. OSHA also included a note from the general industry standard to remind employers that the inerting process results in an atmosphere that is oxygen deficient; oxygen deficiency is a separate atmospheric hazard identified in the third subparagraph of ''hazardous atmosphere.'' Accordingly, the final rule prohibits employees from working in that space without a permit program which includes use of necessary PPE.

Isolate or Isolation means the process—such as misaligning or removing sections of lines, pipes or ducts; a double block and bleed system; lockout or tagout of all sources of energy; or blocking or disconnecting all mechanical linkages—that an employer uses to completely protect entrants from the release of energy or other hazard into a confined space. This definition is based on the definition in § 1910.146(b) and the proposed rule, but OSHA made two minor adjustments to the definition in this final rule and added a clarification regarding isolation of a portion of a contiguous space such as a sewer system. First, OSHA clarified that the purpose of isolation is to protect employees, rather than the space itself, from the release of hazards into the space. In most cases this involves isolating the entire space from a hazard, such as isolating a room from a potential source of flooding. However, in some cases employers may be able to isolate a hazard inside a confined space, and the final rule's emphasis on protecting employees, rather than the space, allows for that type of isolation. To that end, the second difference from the general industry definition is that in the final rule OSHA defines ''isolate'' to include employers' use of physical barriers to eliminate the opportunity for contact between an employee and a physical hazard inside a confined space, as requested by a commenter (ID–061, p. 6). This addresses commenter concerns that a single physical hazard such as low-hanging pipe or a sharp object would unnecessarily foreclose alternative entries under § 1926.1203(e) (discussed below) and require an employer to treat the entire space as a permit space even after the employer has taken steps to ensure that employees could not come in contact with the physical hazard. OSHA has reached a similar result in most circumstances by interpreting the general industry standard to allow employers to ''eliminate'' hazards in a similar manner without necessarily deeming it isolation. See, *e.g.,* October 27, 1995, letter to William Taylor (temporary floor could be used to eliminate fall hazard from inwardly converging walls). But in the construction context the addition to the definition of isolation addresses the issue directly and provides more flexibility for employers to address physical hazards for the purpose of alternative entries under § 1926.1203(e) (see the discussion of § 1926.1203(e) for additional explanation on the difference between the general industry standard and this final rule regarding alternative procedures for addressing permit spaces with hazardous atmospheres and physical hazards).

A different commenter suggested that using the term ''isolation'' to refer to the elimination of a physical or atmospheric hazard will be confusing since industry generally uses the term ''isolation'' to refer to the control of a hazard and not to the elimination of the hazard (ID–098.1). OSHA agrees that the terms are not interchangeable, and has tailored the definition of isolation accordingly. While eliminating a hazard or removing it altogether from a confined space would constitute means of isolating a hazard, isolating the hazard in the context of this rule does not necessarily eliminate it from the space altogether in the sense that the physical item may remain in the space and that it might still pose a hazard absent the isolation measures. For example, if exposed rebar is sticking out of a wall in a confined space, the employer may eliminate the hazard by pounding the rebar into the wall so that it does not protrude in any way; it may remove the hazard by cutting out the rebar and carrying it out of the space; or it may isolate the rebar by erecting a barrier in a manner that effectively prevents the possibility of anyone coming into contact with the rebar.

Both of the definitions in the general industry rule and this final rule permit ''tagout'' in addition to ''lockout'' as a means of isolating a hazard, but in both cases the tagout process involves more than the placement of a tag on equipment because tagging equipment does not prevent the release of a hazard into the space. As discussed below, OSHA has added definitions of ''lockout'' and ''tagout'' to ensure that the regulatory text of this final rule reflects these critical elements of the general industry standard.

Several commenters asserted that the definition of ''isolation'' should not include misaligning or removing sections of lines, pipes, or ducts, but did not provide a reason for this assertion (ID–025, p.2; –027, p. 4; –095, p. 2). The general industry confined spaces standard at § 1910.146(b) includes misaligning or removing sections of lines, pipes, or ducts in its definition of ''isolation.'' Without a clear reason to depart from this established understanding of the term ''isolation,'' OSHA continues to include the misalignment or removal of sections of lines, pipes, or ducts as a form of ''isolation'' to match the definition of the term in § 1910.146(b). To the extent that the commenters were concerned that removing a section of pipe within a space would not isolate employees from a hazard entering the space, such an action would not meet the definition of ''isolation'' if it does not effectively and completely prevent employee exposure to the hazard. The removal of a section of a water pipe that would effectively divert water away from a confined space could be a form of isolating the employees in that space from the water hazard; disconnecting a sewer pipe in a location where fumes or physical hazards could still enter a confined space and affect employers (such as disconnecting the pipe at a location inside the confined space or immediately adjacent to the space where the remainder of the pipe entering the confined space is not sealed) does not meet the definition of ''isolation.''

Another commenter asserted that defining ''isolation'' differently from ''control'' could cause confusion (ID–025, p. 2). This comment highlights the need to have a separate definition: ''Isolate or isolation'' is distinct from ''control'' in this final rule because the former term requires the elimination or removal of the hazard. Control, on the other hand, merely entails a reduction in the degree of a hazard or a reduction in the risk that the hazard will cause an injury or death. For example, an employer can control an atmosphere through ventilation, but it cannot use ventilation to isolate a space from a hazard.

Limited or restricted means for entry or exit means a condition that may obstruct an employee's ability to exit or enter a confined space, including trip hazards, poor illumination, slippery floors, inclining surfaces and ladders (see the earlier discussion of the definition of ''confined space'' for a discussion of ladders). The proposed construction rule, but not the general industry standard, defined this term. The proposed definition referred to ''hazards'' rather than ''trip hazards.'' OSHA did not include in this final standard the reference to all ''hazards'' because the Agency believes that term was potentially too broad, and that its inclusion in this final standard would render all the other examples redundant. Instead, the final definition refers to ''trip hazards,'' which is a condition that is similar to the other examples, and provides a greater degree of guidance than the term ''hazards.''

One commenter objected to the inclusion of ''poor illumination and slippery floors'' in the definition, arguing that the regulated community does not generally understand these conditions as ''limited or restricted means for entry and exit'' as used in the general industry confined spaces standard at § 1910.146(b) (ID–153, p. 14). The commenter did not explain why poor illumination and slippery floors would not limit or restrict means for entry or exit. The same commenter acknowledged that § 1910.146 does not define this term, but nevertheless accused OSHA of ''changing the meaning of the term.'' OSHA disagrees, and is retaining the list of examples in the final rule. The Agency previously explained in its compliance directive on general industry confined spaces, OSHA Directive CPL 02–00–100: Application of the Permit-Required Confined Spaces (PRCS) Standards, 29 CFR 1910.146 (May 5, 1995), that a ''space has limited or restricted means of entry or exit if an entrant's ability to escape in an emergency would be hindered.'' Therefore, OSHA concludes that the meaning of ''limited or restricted means for entry and exit'' as used in the general industry standard already encompasses these conditions, and that the Agency is simply providing the same guidance more explicitly in this final standard.

Line breaking refers to the process of opening a pipe or duct when the substance inside could injure an employee because of the characteristics of the substance or the manner in which it is released from the conductor. This definition is identical to the corresponding definition in the general industry standard. Although the term is not otherwise used in the text of this final standard (or in the text of the general industry standard), OSHA included it for parallelism with the general industry standard and to inform construction employers of the hazards that may be associated with opening an existing pipe or duct.

Lockout refers to a means of isolating a physical hazard (typically an electric-powered device) by placing a lockout device on an energy isolating device in accordance with established procedures to ensure that the equipment which poses a hazard and the energy isolating device cannot be operated or inadvertently energized until the lockout device is removed. This definition is identical to the definition in the general industry standard (see § 1910.147(b)). OSHA has included it to maintain consistency with the general industry approach to lockout in confined spaces. As discussed in the explanation for ''Isolate or isolation'', above, lockout is one method of isolating a physical hazard in a confined space.

Lower flammable limit (LFL) or lower explosive limit (LEL) means the minimum concentration of a substance in air needed for an ignition source to cause a flame or explosion. The measurement is usually expressed in terms of percentage by volume of gas or vapor in air. When more than one type of flammable substance is present in the air, the LFL is derived from the combined sum of all flammable substances as a percentage of the total atmosphere. The definition is identical to the proposed definition and is consistent with the use of the term in the general industry standard. The Agency did not receive any comments on this definition.

Monitor or monitoring means the process used to identify and evaluate the hazards after an authorized entrant enters the space. This is a process of checking for changes that the employer must perform in a periodic or continuous manner after the completion of the initial testing or evaluation of that space.[10] The proposed rule included a definition this term. OSHA included the definition in this final rule, but revised it slightly to make it clear that monitoring does not apply solely to atmospheric hazards.

Non-entry rescue means a rescue, usually by the attendant, that retrieves employees in a permit space without the rescuer entering the permit space. While the general industry standard does not include a definition of this term, the proposed rule did include such a definition. OSHA included the definition in this final rule, but clarified the distinction between entry rescue, as defined above, and rescue that does not involve entering the permit space.

Non-permit confined space means a confined space that meets the definition

[10] OSHA uses ''periodic testing'' and ''periodic monitoring'' interchangeably in this standard.

of a confined space, but does not meet the requirements for a permit-required confined space, as defined in this subpart. This term, as defined in the general industry standard at § 1910.146(b), requires a separate analysis of hazards or potential hazards. OSHA revised the general industry definition in the final rule to make it clear that a non-permit confined space is simply the inverse of a permit-required space: It meets all of the requirements to be a confined space, but does not meet the criteria to be a permit-required confined space (see the discussion of the definition of ''permit-required confined space'' below in this preamble). A confined space in which all physical hazards are isolated or eliminated and in which there are no actual or potential hazardous atmospheres is a non-permit confined space.

Oxygen deficient atmosphere means an atmosphere containing less than 19.5 percent oxygen by volume. This final standard defines the term exactly as it is in § 1910.146(b).

Oxygen enriched atmosphere means an atmosphere containing more than 23.5 percent oxygen by volume. The final standard also defines this term exactly as it is in § 1910.146(b).

OSHA based the general industry definitions for ''oxygen deficient atmosphere'' and ''oxygen enriched atmosphere'' on levels set by the National Institute for Safety and Health (NIOSH) (see 58 FR 4474 and 4476). The proposed rule did not include separate definitions of these terms, but did incorporate the same levels into the definition of ''hazardous atmosphere.'' As discussed in the explanation above of ''hazardous atmosphere,'' OSHA does not agree with several commenters' suggestions for an alternative oxygen level. OSHA did not receive any other comments disputing that the construction industry generally accepts these definitions of the terms.

Permit-required confined space (permit space) means a confined space that has at least one of the following characteristics: (1) Contains or has the potential to contain a hazardous atmosphere; (2) contains an engulfment hazard; (3) is configured so that it poses a risk of entrapment or asphyxiation; or (4) any other recognized serious hazards. OSHA revised this definition in final rule § 1926.1202 to make it identical to the definition in the general industry confined spaces standard at § 1910.146(b). Consequently, the final rule diverges from the proposed rule in that OSHA revised the order of the characteristics from the proposed rule, clarified that a potential hazardous atmosphere can trigger a permit space, and separated the third and fourth characteristics from the proposed definition (''an engulfment hazard or other physical hazard'') so that engulfment hazards addressed in the second characteristic in the final definition while some physical hazards are encompassed by ''other recognized serious safety or health hazard'' in the fourth characteristic; there was not a fourth characteristic in the proposed definition. Otherwise, this definition is the same as the definition in the proposed rule.

Several commenters noted that the proposed definition of ''permit-required confined space'' included any ''physical hazard,'' and asserted that the definition of ''permit space'' would, therefore, include non-serious hazards in a confined space (ID–013, p. 3; –147, pp. 2–4). In the proposed rule, OSHA addressed this concern in the definition of ''physical hazard,'' which limited the definition to hazards that were capable of causing ''death or serious physical harm.'' In this final rule, OSHA defined the term to match the definition in § 1910.146(b), which specifies that the phrase ''contains any other recognized serious safety or health hazard'' applies only to serious hazards, and the definition of serious physical harm (now ''serious physical damage'' in the final rule) excludes injuries that could not impair the ability of an entrant to escape the space without assistance. As noted in the explanation of the definition of hazardous atmosphere, this standard is focused on hazards that could impair the ability of an entrant to self-rescue.

The proposed definition of permit-required confined space referred to a ''hazardous atmosphere,'' which OSHA defined to include an existing or ''potential'' atmosphere. One commenter urged OSHA to clarify that a ''potential hazardous atmosphere'' is a hazardous atmosphere that an employer could anticipate, as opposed to a hazardous atmosphere that is ''remotely possible under unforeseen conditions,'' such as a train carrying chlorine crashing and causing a toxic cloud of chlorine that engulfs an entire worksite. (ID–0138, p. 4.) The phrase ''potential to contain a hazardous atmosphere'' in the context of this final rule refers to the existing conditions affecting the confined space at the time of entry and any changes to those conditions over the duration of the entry, and limits hazards to those hazards that a qualified person should anticipate would affect that space. If an employer becomes aware (or should be aware) of the release of a toxic gas that could enter the confined space, or detects such a gas near a ventilation source for that space, then the space would have the potential to contain a hazardous atmosphere when the PEL or LEL are below the ''hazardous atmosphere'' levels. The potential for a hazardous atmosphere remains until the employer confirms that the space is completely free of the toxic gas or the gas level rises to a hazardous level.

As OSHA stated in a December 2, 2005, letter to Ms. Laura Johnson, a potential hazard exists if the employer does not entirely remove the source of the hazard. For example, a space will have the potential to contain a flammable atmosphere if any piping, containers, materials brought into the space, or residual contamination of the space brings combustible dust or flammable gas, vapor, or mist into the space. Employers can refer to a substance's Safety Data Sheet (SDS) as one indicator of the hazards the employer should reasonably anticipate as a result of using a particular substance. Testing and monitoring are some other methods of identifying potentially flammable atmospheres. OSHA also previously clarified that an appropriate lockout procedure that blocks a potentially hazardous atmosphere does *not* eliminate the potential for a hazardous atmosphere, so the space cannot be classified as a non-permit-required space. See August 28, 1995 letter to William K. Principe. Under this final rule, however, employers who can effectively isolate a potential hazardous atmosphere by using one of the other techniques described in the definition of the term ''isolation'' in § 1926.1202 (excluding lockout/tagout) may be able to re-classify the space.

Permit-required confined space program (permit space program) means the employer's overall program for regulating employee entry into permit spaces and protecting employees from permit space hazards. This definition of this term in the final standard duplicates the term's definition in § 1910.146(b). An employer need not tailor a confined space program specifically to each space entered. If the permit contains most of the relevant information required by this final rule, the program may be general and designate the particular permit that the employer developed earlier for such work, along with any other testing procedures, PPE, or other information normally required in response to the types of hazard present in the space. Accordingly, the employer is still responsible for developing the appropriate plans and other information required by this standard to address the unique conditions of each space.

In the general industry standard, OSHA uses the term ''permit system'' as the heading for § 1910.146(e), and defines it in § 1910.146(b). In the final rule, OSHA uses the term ''permitting process'' as the heading of the parallel requirement at § 1926.1205, but does not employ the term anywhere else in the text of the final rule. OSHA, therefore, chooses not to provide a separate definition of ''permitting system'' in § 1926.1205 because such a definition is unnecessary; the ''permitting system'' is comprised of the requirements of § 1926.1205.

Physical hazard means an existing or potential hazard that can cause death or serious physical damage. Examples include: Explosives (see paragraph (n) of § 1926.914 for the definition of ''explosive''); mechanical, electrical, hydraulic, and pneumatic energy; radiation; temperature extremes; engulfment; noise; and inwardly converging surfaces. The term ''physical hazard'' also includes chemicals that can cause death or serious physical damage through skin or eye contact (rather than through inhalation). The general industry confined space standard does not define the term ''physical hazard.'' OSHA uses the term ''physical hazard'' throughout this final rule, however, and defined this term in the proposed rule to clarify its meaning.

The proposed definition of ''physical hazard'' referred to a hazard that can cause harm ''in or near a confined space,'' or a hazard that might ''occur'' in or near the confined space. OSHA deleted the language tying the location of where the harm could occur to the meaning of ''physical hazard'' because a condition establishing a physical hazard can exist wherever it is regardless of proximity to a confined space (*e.g.,* exploding dynamite is a physical hazard whether or not it is in or near a confined space, and an engulfment hazard may originate in a sewer far upstream from where employees are located). OSHA provides appropriate guidance in the implementing requirements of the final standard to ensure that the standard focuses on physical hazards related to confined spaces. See discussion of final §§ 1926.1203 and 1926.1204 in this preamble.

The proposed definition of ''physical hazard'' also referred to a hazard that has a ''reasonable probability'' of occurring, and referred to the same list of examples now incorporated into the text of the final rule. OSHA has replaced that phrase with ''potential hazard'' to keep the terminology consistent with the general industry standard. Both § 1910.146 and this final rule use the term ''potential hazard'' throughout the standard, so OSHA is using the term with which the industry is already familiar.

One commenter noted that, in the proposed rule, OSHA defined ''physical hazard'' to encompass not only hazards that could cause death or serious physical harm, but also ''a hazard that has a reasonable probability of occurring in or near a confined space'' (ID–219.2, p. 75). The latter part of the definition did not require the hazard to result in death or serious physical harm, so the commenter objected on the grounds that the definition of ''hazard'' would be unnecessarily broad because it would cover minor hazards (*i.e.,* ''a stubbed pinky finger or toe'') that would, in turn, trigger the permit restriction in the proposed standard (*id*). This final definition does not encompass stubbed fingers or toes or other minor injuries; therefore, the Agency did not include the extra component of the proposed definition in the final rule. The definition duplicates the general industry standard in this regard, and it also limits coverage to hazards that can cause death or ''serious physical damage,'' which OSHA has defined to clarify the differences between ''serious physical damage'' in this standard and ''serious physical harm'' as it is used in other OSHA standards. For additional information, see the explanation for the definition of ''serious physical damage'' below in this preamble.

Another commenter asserted that the definition of ''physical hazard'' should not encompass equipment or material inside a confined space that could cause an ''impact hazard'' (*e.g.,* ''a low hanging pipe or angle iron strut'') simply because it is present inside a confined space and could injure an employee who comes into contact with it (ID–061, p. 7). The commenter expressed concern that if OSHA included these types of equipment or materials, the alternate procedures set forth in § 1926.1203(e) of the final rule would almost never be available because such spaces must be free of physical hazards. In response, OSHA modified the definition of ''isolation'' and the ventilation alternative procedure in § 1926.1203(e) to make it clear that this alternative procedure remains an option for employers if the employer protects entrants sufficiently from the impact hazards by eliminating them or isolating them through the use of engineering controls. For example, if a low-hanging pipe does not obstruct the entrance or egress of the space and is adequately padded to prevent potential employee exposure to the hazard, or there is enough room in the confined space to barricade the hazardous condition and prevent employee exposure to the hazard posed by the pipe, OSHA would consider the physical hazard isolated within the meaning of that term in this final standard. If there are no other physical hazards in the space, and the employer can demonstrate that it satisfied the other conditions of § 1926.1203(e), then the employer may use the ventilation alternative procedure in that space.

If, however, there is a piece of equipment or other physical object inside a confined space that could cause serious physical damage to an employee upon impact, and the employer does not eliminate or isolate that hazard, then the employer must follow all of the PRCS procedures set forth in § 1926.1204. The commenter did not provide any evidence of why an ''impact hazard'' is different than any other type of physical hazard, nor did the commenter indicate any inherent restrictions on physical movement that would necessarily limit the force of the impact to a level not capable of causing serious physical damage. In the absence of such evidence, OSHA believes that an object such as a low hanging pipe or angle-iron strut has the same potential to impair the ability of an entrant to exit the confined space unaided as other physical hazards. For example, an entrant could walk into a low-hanging pipe and receive a head injury that could render the entrant unconscious, or the entrant could receive some other form of serious injury to another part of the body that could render the entrant immobile.

Two commenters suggested that the examples in the definition should include both fire and crush hazards (ID–025, p. 2; –095, p. 2). Another commenter suggested that the final rule definition should include falls as an example (ID–211, Tr. p. 42.) OSHA agrees that each of these is an example of a physical hazard, but notes that the list of examples provided in the definition is not an exhaustive list. Therefore, OSHA concludes that it is not necessary to add to this non-exhaustive list.

The Agency included ''noise'' in the proposed definition of ''physical hazard'' as one example of such a hazard because sound waves constitute a physical disturbance of the air that results in a physical impact on the human ear. Several commenters asserted that excessive noise should not trigger the application of PRCS procedures when no other hazard exists (ID–112, p. 17; –114, p. 2; –138, p. 4). These commenters indicated that the final standard should not treat noise as a physical hazard if the noise did not rise to the level of impairing the ability of an entrant to exit the space without aid; however, these commenters did not assert, or provide any evidence supporting the view, that noise alone is incapable of such impairment or otherwise causing serious physical damage, as OSHA defines it in this final rule. Therefore, OSHA is retaining the term ''noise'' as an example of a physical hazard in this final definition.

One of the commenters questioned whether noise levels exceeding the decibel levels specified in § 1926.52, OSHA's construction noise standard, would trigger the permit-space requirements. The final construction confined spaces standard does not specify this threshold, and OSHA notes that noise will only trigger PRCS procedures if it reaches a level at which it can cause death or serious physical damage. For example, noise would constitute a physical hazard if it is loud enough to substantially reduce the efficiency of the entrant's ears to process communications from the attendant or entry supervisor regarding exit instructions or other emergency information, thereby impairing the ability of the employee in the permit space to exit the space safely (see the definition of ''serious physical damage,'' which includes ''an impairment . . . in which a body part is made functionally useless or is substantially reduced in efficiency'' and specifically mentions disorientation). OSHA has previously recognized the capacity of noise to create a hazardous situation by masking warning shouts or signals (see, *e.g.,* OSHA's preamble to § 1910.95, the general industry noise exposure standard, at 46 FR 4080 (Jan. 16, 1981). Employers generally can address these types of noise hazards by implementing a permit program that uses non-auditory cues, such as flashing lights, to resolve communication issues.

In some cases, the sound waves from an explosion or other air disturbance may be so intense that it might cause physical pain or disorient an entrant to the extent that it could impair the ability of the entrant to exit the space unaided. See, *e.g.,* Stephen A. Fausti, Ph.D., et al., *Auditory and vestibular dysfunction associated with blast-related traumatic brain injury, Journal of Rehabilitation Research and Development,* Vol. 46, No. 6 (2009) pp. 797–810 (discussing the impacts of excessive noise exposure, such as the noise caused by a blast or explosion, including immediate temporary hearing loss and sensory damage).

Two of these commenters asserted that the use of personal protective equipment can protect employees effectively from noise hazards, but expressed concern that OSHA would prohibit employers from working in a confined space with excessive noise because the definition of ''control'' provides explicitly that ''personal protective equipment is not a control'' (ID–114, p. 2.) As another commenter noted, OSHA would treat earplugs as protection from a hazard, but not control of the hazard, and, therefore, would prohibit work in an area with an uncontrolled noise hazard (ID–112, p. 17).

The final rule will not prevent work in a noisy confined space if employees are properly protected. In the final rule, OSHA requires employers to protect their employees adequately from confined-space hazards; in protecting employees, other construction standards also would apply. Therefore, if the noise is above the decibel levels specified in 29 CFR 1926.52, employers must protect their employers in accordance with that section, regardless of whether the noise conditions trigger the permit-space requirements of this final standard. OSHA's Field Operations Manual provides that employers may ''rely on personal protective equipment and a hearing conservation program, rather than engineering and/or administrative controls, when hearing protectors will effectively attenuate the noise to which employees are exposed to acceptable levels.'' (CPL 02–00–150 at Ch. 4, XI.B). However, feasible administrative and/or engineering controls must be used when personal protective equipment may not reliably reduce noise levels received to the levels specified in the standard or when those controls are less expensive than an effective hearing conservation program. Employers choosing to rely on personal protective equipment instead of administrative or engineering controls must ensure that employees will be aware of continuous monitoring alarms and other hazard alerts in a timely manner regardless of PPE use. Therefore, to promote consistency with OSHA's treatment of noise hazards under § 1926.52, OSHA permits employers to use these same methods to address the noise hazards in a permit space so long as the administrative and engineering controls, or the personal protective equipment, do not interfere with the ability of the entrant to maintain effective communication with the attendant and other workers. Notwithstanding the general statement in the definition of ''control'' that personal protective equipment does not constitute a control, OSHA is permitting employers to use appropriate hearing-protection equipment as a means of addressing a noise hazard in a permit space when the PPE attenuates the noise to acceptable levels. However, if the employer is unable to reduce an employee's exposure to noise to a level where it does not constitute a threat of death or serious physical damage, then the employer must not permit employees to enter any portion of the permit space that would expose the employee to such a noise level.

Prohibited condition means any condition in a permit space not allowed by the permit during the period of authorized entry. This portion of the definition is identical to the definition in § 1910.146(b), and is similar to the definition of ''unplanned condition'' in the proposal. In addition, the Agency added a sentence to the definition in the final standard to clarify that a hazardous atmosphere is always a prohibited condition, unless the employer can demonstrate that use of appropriate PPE will effectively protect entrants; this added condition means that employees cannot work in a hazardous atmosphere without the appropriate PPE. The definition of hazardous atmosphere in the general industry standard implies this condition, which the Agency made explicit in this final rule for construction.

Qualified person means one who successfully demonstrates his/her ability to solve or resolve problems relating to the subject matter, the work, or the project. While the general industry does not include this term in the definition of ''entry supervisor,'' the proposed rule did, and OSHA retained this term in the final standard. While the proposal did not define ''qualified person,'' the final rule's definition is similar to definitions of the term found in § 1926.32(m) and other subparts of OSHA's construction safety standards (see, *e.g.,* § 1926.1401—Cranes and derricks in construction). In this way the final rule clarifies that an ''entry supervisor'' clarifies that the employer must ensure that the entry supervisor has sufficient experience to properly conduct identification, testing, and planning for the type of confined space involved.

Representative permit space means a confined space, or mock-up of a confined space, that has entrance openings that are similar to, and is of similar size, configuration, and accessibility to, the permit space that authorized entrants enter. OSHA simplified this definition from the definition included in the proposed rule, but the simplification is a non-substantive change that clarifies the criteria for a representative permit space. OSHA changed the term from ''simulated permit-required confined space'' to ''representative permit space'' because the Agency used the latter term in the general industry confined spaces standard at § 1910.146; however, changing the terminology has no effect on the meaning of the term and the requirements relating to it. OSHA changed this terminology to make this final rule more consistent with § 1910.146, for the reasons set forth above in the section, ''Decision to abandon the proposed new classification system.''

Rescue means retrieving, and providing medical assistance to, one or more employees who are in a permit space. OSHA defined this term in the proposed rule, and included the term in the final rule unchanged except for addition of the phrase ''one or more'' to clarify that a rescue can involve the retrieval of a single employee.

Rescue service means the personnel designated to rescue employees from permit spaces. This definition duplicates the definition of the term in the general industry standard at § 1910.146. In the proposed rule, OSHA included specific statements that the term applied to both onsite and offsite personnel, and to personnel designated by the employer for either non-entry or entry rescue (or both). In the final standard, OSHA elected to use the broader language of the general industry standard for consistency; however, the Agency believes that there is no substantive difference between the proposed and final standards in the meaning of these statements.

Retrieval system means the equipment used for non-entry rescue of persons from permit spaces. The purpose of the retrieval system is to provide a means of removing an entrant from a space quickly without exposing any additional employees to the hazards of permit-space entry. This equipment typically includes a retrieval line attached around the chest of the entrant or to a full-body harness worn by the entrant, with the other end of the line attached to a lifting device or anchor. Alternatively, the retrieval system may consist of a retrieval line attached to wristlets or anklets when this method of pulling the entrant from the confined space would be safer than using a body harness.

The definition of this term in the final standard duplicates the definition found in § 1910.146 except that it allows for the use of anklets. In proposed § 1926.1213(a)(4), OSHA permitted the use of ''ankle straps'' for retrieval in certain cases, and at least one commenter supported this option in limited circumstances such as some horizontal entries (ID–94, p. 1) (see also the discussion of the requirements retrieval lines in § 1926.1211(c)(1)).

Serious physical damage refers to an impairment or illness in which a body part becomes functionally useless or substantially reduced in efficiency.

One commenter noted that the proposed definition (''serious physical harm'' in the proposed rule) included impairments that are ''chronic,'' in addition to impairments that are ''acute,'' and asserted that this definition is, therefore, too broad because it would apply on exposing an employee to a minor hazard that would not interfere with the ability to self-rescue (ID–219.2, p. 76).

The term ''serious physical harm'' has a longstanding meaning within the OSH Act that developed over many years through litigation and many rulemakings. When developing the definition used in the final rule, OSHA used the Agency's common understanding of ''serious physical harm,'' as provided in the Agency's Field Operations Manual (FOM), which provides guidance to OSHA personnel conducting inspections and other activities in the field.[11] The Agency acknowledges that the FOM, compared to the final rule, has a broader purpose of providing guidance for the enforcement of the OSH Act as a whole, and that the inclusion of the phrase ''acute or chronic'' from the FOM in the definition may not provide meaningful guidance in the context of this final rule. Therefore, OSHA changed the term to ''serious physical damage'' to distinguish it from the broader term used in the FOM and other contexts, and also did not include the phrase ''or acute or chronic'' in this definition. By doing so, OSHA addressed the commenter's concern that the reference to ''chronic'' impairments would ''cause the standard to apply to conditions that cannot pose a significant risk of harm from the entry'' and thereby ''increase the cost of the standard so drastically as to render it infeasible for all construction industry sectors'' (ID–219.2, p. 72). In addition, OSHA recognizes that a similar issue exists with the reference to illness. The proposed definition included ''illnesses that could shorten life or substantially reduce physical or mental efficiency by impairing a normal functioning body part.'' This language could be read as including chronic illnesses that do not limit the ability to self-rescue. For the purposes of this standard only, OSHA intends the reference to illness to encompass only those illnesses that could interfere with the entrant's ability to exit the confined space. Therefore, the final rule deleted this language, and inserted ''illness'' after ''impairment'' to make clear that only illnesses that could impede self-rescue are covered in the meaning of serious physical damage.

Nevertheless, the Agency does not believe that these distinctions make a meaningful difference in employer duties because the majority of hazards in a confined space that could cause a serious physical injury are also likely to have the potential to impair the entrant's ability to exit the space without aid. As OSHA stated in the FOM in a note explaining the term ''serious physical harm'': ''The key determination is the likelihood that death or serious harm will result *IF* an accident or exposure occurs'' (Emphasis in the original).

Although one commenter belittled the proposed definition of ''serious physical harm'' as encompaasing a ''stubbed pinky finger or toe'' criticized the potentially broad scope of ''serious physical harm'' by suggesting that it would include ''a stubbed pinky finger or toe'' (ID–219.2, p. 75), such an argument improperly shifts the focus of the standard away from the hazard requiring protection and to the potential outcome of employee exposure to that hazard. If, for example, there is a physical obstruction in a confined space that is only capable of inflicting, as a maximum injury, a stubbed toe or finger, then OSHA agrees with the commenter that such an obstruction would not trigger any permit space requirements under this final standard. However, if it is reasonably foreseeable that an obstruction could cause the entrant to trip and either strike his/her head and lose consciousness, or fall and break his/her arm or leg thereby impairing the entrant's ability to exit the space, then the presence of this hazard would trigger the permit-space requirements of this standard, and the entry employer would need to address the hazard to protect employees it directs.

[11] OSHA based the definition in the proposed rule on the Field Inspection Reference Manual, chapter III, section C.2.b(2)(c). See 72 FR 67358. OSHA subsequently published the Field Operations Manual and updated it in April, 2011, but the definition of ''serious physical harm'' remains unchanged from the previous version: ''Impairment of the body in which part of the body is made functionally useless or is substantially reduced in efficiency on or off the job. Such impairment may be permanent or temporary, chronic or acute. Injuries involving such impairment would usually require treatment by a medical doctor or other licensed health care professional.'' See CPL 02–00–150 II.C.3. at p. 4–11.

Tagout, as used in this confined spaces standard, is a two-step process that follows the general industry approach: First, a tagout device must be placed on a circuit or equipment that has been deenergized, in accordance with an established procedure, to indicate that circuit or equipment being controlled may not be operated until the tagout device is removed. Second, the employer must ensure that the tagout provides equivalent protection to lockout, or that lockout is infeasible. If lockout is infeasible, the employer must tag the equipment and also provide protection from stored (residual) energy. This ensures that the final rule is more closely aligned with the full protections required for general industry work.

Both the general industry rule and this final rule permit ''tagout,'' in addition to ''lockout,'' as a means of isolating some hazards. The Agency added a definition of ''tagout'' to the construction standard because OSHA intends the tagout process under this construction rule to parallel the process under the general industry rule, which requires compliance with § 1910.147—The control of hazardous energy (lockout/tagout) (see § 1910.146(b); § 1910.147(a)(3)(ii)).[12] That tagout process involves more than the placement of a tag on equipment, and the final rule's definition of ''tagout'' ensures that the regulatory text of this final rule reflects the critical additional elements of the general industry standard.

First, tagging equipment does not, by itself, prevent the release of a hazard into the space. Therefore, under § 1910.147(c)(2), an employer may use tagout alone (*i.e.,* not in conjunction with lockout) only if an energy isolating device is not capable of being locked out or the employer can demonstrate that the utilization of a tagout system will provide full employee protection. The standard specifies that ''full employee protection'' means that the employer shall demonstrate that the tagout program will provide a level of safety equivalent to that obtained by using a lockout program (§ 1910.147(c)(3)). Paragraph (2) of the final rule's definition of tagout requires employers to ensure the same level of safety if they use tagout when lockout is feasible.

Second, the general industry standard provides examples safety measures employers may use as a part of the tagout process to reduce the likelihood of inadvertent energization: Removal of an isolating circuit element, blocking of a controlling switch, opening of an extra disconnecting device, or the removal of a valve handle (§ 1910.147(c)(3)(ii)). Under the final rule, employers may also use these methods, when applicable to their work, as part of their process for fulfilling their obligation to ensure that tagout provides equivalent protection to lockout. Finally, even when tagout is used alone, the general industry standard requires the employer to relieve, disconnect, restrain and otherwise render safe stored (residual) energy (see § 1910.147(d)(5)).

This same requirement applies in this final rule to the use of tagout alone.

Test or testing means the process by which employers identify and evaluate the hazards that may confront entrants of a permit space. Testing includes specifying the identification and evaluation processes the employer will perform in the permit space. This definition is similar to the definition found in § 1910.146, except that OSHA added the word ''test'' to clarify that the definition applies to both words. OSHA is also including a note identical to the note to this definition on the general industry standard. The note emphasizes the importance of testing as the basis for developing and implementing adequate control measures.

Ventilate or ventilation means controlling a hazardous atmosphere using continuous forced-air mechanical systems that meet the requirements of 29 CFR 1926.57—Ventilation. This definition is identical to the definition of these terms in the proposed rule. Some commenters asserted that the final definition should allow for the use of suction as a form of ventilation (ID–061.1, p. 1; –210, Tr. p. 289). Although the final rule does not prohibit the use of suction, suction is not an adequate means of providing the general ventilation required by this final rule. The general industry standard does not include a definition of ''ventilation,'' but OSHA interpreted that standard as precluding the use of ''negative'' suction ventilation to meet the requirements of the standard. See April 24, 1996, letter to Verne Brown. Suction may be appropriate to remove contaminants from a specific operation close to the source of the contaminant, but not for general ventilation of the entire confined space. OSHA is, therefore, including the proposed definition of ''ventilate'' in the final rule.

Another commenter requested clarification regarding how an employer can use forced air to ''ventilate'' while also complying with OSHA's welding requirements at § 1926.353(a) through (e) (ID–061.1, p. 2). Section 1926.353(a)(3) requires local exhaust ventilation (LEV) when general mechanical ventilation does not provide sufficient protection. In addition, § 1926.351(a)(1) authorizes the use of general mechanical ventilation. The overlap of the welding standard and this confined spaces standard is addressed earlier in the explanation of § 1926.1201(c). Both of these practices are consistent with the requirement in this final rule that employers use ventilation that consists of continuous forced-air. Accordingly, this confined spaces standard requires that employers use continuous forced-air ventilation to ventilate confined spaces. When an employee is welding inside a confined space, § 1926.353(a)(3) may require the employer to also implement LEV. In conclusion, OSHA believes that LEV alone is not sufficient for the purposes of providing general ventilation of a confined space because LEV might not eliminate all of the toxic material from the area, and any residual fumes would be more likely to build up and create a potential or actual hazardous atmosphere in a confined space.

Section 1926.1203—General Requirements

Final § 1926.1203 sets forth general requirements for employers that have operations within the scope of this standard. This section establishes a comprehensive regulatory framework under which employers must identify any permit spaces at their workplaces and take appropriate measures for the protection of affected employees. It is similar to the general industry rule at § 1910.146(c). The corresponding requirements in the proposed rule also were similar to the requirements in this final rule, but this final rule organizes the requirements differently.

Paragraph (a). Final § 1926.1203(a) is similar to the corresponding provision for general industry confined spaces at § 1910.146(c)(1), with some minor modifications. Final § 1926.1203(a) requires an employer to have a competent person evaluate the spaces in which employees it directs may work, and requires a two-step process for the evaluation: (1) The competent person must evaluate whether a space meets the definition of a confined space, and if so, (2) the competent person must identify, in accordance with other

[12] OSHA did not include a definition of ''tagout'' in the NPRM, though the preamble noted the Agency's intent that ''appropriate lockout/tagout procedures'' were required for isolation of physical hazards (72 FR 67386). As explained earlier in this preamble, OSHA is tailoring the final rule to follow the general industry rule more closely in response to numerous requests by commenters. If OSHA had allowed the use of tags without more, it would have been a key distinction from the general industry standard and would have allowed employers to circumvent most of the permit-space requirements involving physical hazards.

provisions of this final rule, any confined spaces that are PRCSs through consideration and evaluation of the space, including testing of the space as necessary. The final construction rule specifies both the two-step approach and the competent-person requirement more explicitly than in the general industry standard.

OSHA added the competent-person requirement in response to several comments noting that the analysis required for these evaluations necessitated some level of expertise. (See ID–025, p. 2; –028, p. 4; –095, p. 2; –097, p. 3; –140, p. 3; –150, p. 2.) A ''competent person,'' which § 1926.1202 defines under this standard, must be capable of identifying the hazards of permit spaces and have the authority to eliminate them promptly. Because final § 1926.1203(a) requires the competent person to conduct initial testing as necessary, the competent person also must be knowledgeable about appropriate testing. The correct initial identification of permit spaces is an important part of preventing unauthorized entry into those spaces and ensuring that authorized entrants have adequate protection.

As discussed in the explanation of the definition of ''entry employer,'' each employer has a responsibility to protect all the employees that it directs, including employees hired directly by that employer as well as other employees, such as temporary workers, who are under its the control at the worksite. Thus, each employer who directs a temporary worker to a work area must ensure that a competent person evaluates that area for confined spaces and permit spaces.

Final § 1926.1203(a) also differs from the general industry rule in that it explicitly specifies that the competent person must identify confined and permit spaces through consideration and evaluation of other elements of the confined space, and testing as necessary. The atmospheric-testing requirement in this final rule is less specific than the atmospheric-testing requirement in proposed § 1926.1204(b), which would have required employers to test for atmospheric hazards using the procedures in proposed § 1926.1204(b)(3). However, final § 1926.1203(a) is more specific than the corresponding provision in the general industry rule, which states that employers must ''evaluate the workplace'' to determine if any spaces are permit-required spaces. Accordingly, this final provision explicitly requires testing if necessary to assess whether a confined space is a permit-required confined space.

The testing required by final § 1926.1203(a) is only initial testing; final § 1926.1204(b) addresses the detailed evaluation and identification of hazards found within the space (see discussion later in this preamble). The primary purpose of the assessment required by § 1926.1203(a) is to determine whether the space is a permit space so that this information can be conveyed to employees, the controlling contractor, and other employers at the site in order to prohibit unauthorized entry. In some cases employers may discover that the space is a permit space after only limited testing and decide not to allow their employees to enter the space at that point rather than fully assessing the space. Employers who intend to enter, however, may choose to conduct more thorough testing that satisfies the requirements of both § 1926.1203(a) and § 1926.1204(b) at the same time, so long as it does not delay their notification of their employees and the controlling contractor of the existence of the permit space.

Final § 1926.1203(a) also requires the competent person to consider and evaluate other elements of the confined space to determine if it is a permit-required confined space. Such elements include the configuration of the space and any physical hazards or obstacles to egress from the space. Both the testing and consideration of the space are essential in making an initial determination whether a confined space is a permit-required space; the Agency believes that requiring these basic steps will ensure that employers correctly identify PRCSs.

OSHA determined that employers must identify confined spaces that meet the definition of a permit space at the time their work begins on a worksite rather than when an employer decides that employees will enter a confined space. The Agency believes that the initial workplace survey is essential because it alerts employers to the need to take measures to prevent unauthorized entry into these spaces. OSHA further notes that while it may not always be feasible for employers to create and follow a full permit program before assessing an previously unexplored confined space, when it is feasible employers must treat any entry into a confined space as if the space was a permit space and eliminate or isolate the hazards before entry (see § 1926.1203(d) and (g)(2); § 1926.1204(b)(2)). This applies to entries performed to determine whether or not that space is a permit space.

Final § 1926.1203(a) states that there are two steps to be followed. The first step in the evaluation process is to determine whether a space meets the definition of a confined space. If the employer determines that there is a confined space on the worksite, the second step requires the employer to evaluate, in accordance with other provisions of this final rule, whether there are any actual or potential hazards in the confined space. Actual or potential hazards the employer must consider include atmospheric, engulfment, physical, or any other type of hazard. Both stages of the initial evaluation are crucial, as correctly identifying both confined spaces and the conditions or potential conditions that would make a confined space a permit-required confined space determines how the employer and employees will perform in and around the space thereafter. Though the general industry rule at § 1910.146(c)(1) does not explicitly identify the two steps, they are implicit in § 1910.146(c)(1) because an employer cannot evaluate the hazards of a confined space without first evaluating whether there are confined spaces on the worksite, as well as the location of these confined spaces. This clarification that an employer must first consider whether there are confined spaces at a worksite also was in proposed § 1926.1204(b). The Agency believes that making this requirement explicit is necessary to ensure that employers correctly assess the spaces so that they can adequately protect employees from the hazards present in the confined spaces.

One commenter requested that OSHA clarify which employer has the responsibility to evaluate hazards in confined spaces (ID–086, p. 4). Final § 1926.1203(a) clarifies the requirement by specifying that each employer that directs employees who *may* work in a confined space must perform the requisite evaluation. As in both the general industry standard and the proposed rule, this evaluation provision applies to a group of employers larger than just entry employers. The general industry standard requires each employer to evaluate the workspace and determine if any confined spaces are permit spaces (§ 1910.146(c)(1)). On a construction worksite, there typically are many more employers than at general industry worksites. Therefore, under final § 1926.1203(a), each employer that directs employees who may work in a confined space must identify all such spaces, and also identify each space that is a permit space. The term ''may work'' means that this requirement applies to any employer (not just entry employers) at a construction worksite who should reasonably anticipate employee exposure to confined spaces; the focus is on whether the employee might enter the space, with the assumption that entry would constitute ''work.'' Accordingly, these employers must determine whether employees they direct could foreseeably work in areas at a worksite having confined spaces and whether any of these confined spaces are permit spaces.

Employers may cooperate in identifying the confined spaces and permit-required confined spaces on a worksite, but each employer remains responsible for identifying spaces that could affect employees it directs, including temporary workers. For example, several different employers could work with a single competent person designated by one of them, or by the controlling contractor, to identify the confined and permit spaces on a site, but each employer must still ensure compliance with the requirements of this standard.

The commenter who requested clarification about evaluating hazards also asked why the controlling contractor or host employer did not have the responsibility to evaluate the confined spaces, and asserted that entry employers did not have the information necessary to classify a space (ID–086, p. 4). The final rule follows the general industry standard, which assigns employers the responsibility to evaluate the spaces, and it is appropriate that the employers who direct employees who may be exposed to the hazards of permit spaces are responsible for classifying the space. Further, prior to entry into a permit space, controlling contractors and entry employers have duties under final §§ 1926.1203(h) and (i) to exchange information about the permit space.

Some commenters also suggested requiring a competent person to perform additional duties specified by this standard, such as monitoring or calibration of equipment (ID–025, p. 3; –028, pp. 3–4; –150, p. 2). However, final § 1926.1204(h) requires employers to properly train employees who perform these duties during entry operations. This final standard also includes training and knowledge requirements for entry supervisors, attendants, and other specific positions set forth in this standard to ensure that the employees filling those positions have the knowledge and capabilities to perform the specified duties once a permit space is identified (see final §§ 1926.1207–1210). The initial evaluation of spaces under final § 1926.1203(a) includes a competent-person requirement because of the critical need to identify confined and permit spaces early in the work at the site, and because the requirement to evaluate spaces also applies to employers who are not entry employers and who are, thus, not covered under the permit-space requirements of this final rule.

One commenter suggested that OSHA add a note in the standard to inform the regulated community that Material Safety Data sheets (now called Safety Data sheets) may be helpful in evaluating confined space hazards (ID–140, p. 4). OSHA agrees that this is useful information, but observes that a note under the definition of ''hazardous atmosphere'' in final § 1926.1202 provides similar information and achieves the commenter's stated result.

The same commenter also expressed concern that an employer, when identifying confined space hazards, does not have to consider the work it plans on performing inside the confined space, which may create a hazard (*e.g.,* welding or painting) (ID–140, p. 5). The commenter based this assertion on proposed § 1926.1204(b)(1), which provided that an employer must identify confined space hazards without entering the space and, thus, without first performing the work that could potentially create a hazard. OSHA drafted final § 1926.1203(a) broadly, so it is not as specific as proposed § 1926.1204(b)(1). An employer who is planning to conduct entry operations must develop and implement a written permit-space program under final rule § 1926.1203(d). Furthermore, under final § 1926.1205(c)(1), these employers must specify acceptable entry conditions. Taken together, these provisions require an employer that will conduct entry operations to consider the work it is planning to perform and the hazards that may result from this work when conducting the initial evaluation under final § 1926.1203(a).

One commenter asserted that the proposed prohibition on the use of mechanical ventilation or changing the space's natural ventilation during atmospheric testing would make some confined space work dangerous (ID–077, p. 1). This commenter asserted that when an employer is performing abrasive blasting on a tank interior, it is unsafe to perform the abrasive blasting with the dust collector turned off just to get a baseline reading. This commenter misunderstands the purpose of this requirement. Under final § 1926.1203(a), an employer's evaluation is the first step for any confined space work. This evaluation must occur before the employer performs either ventilation or construction in the confined space (see § 1203(a) and § 1204(e)(1) (allows an exception for spaces where it is infeasible to isolate the space). Only after the employer completes this initial evaluation, and the other required steps of its permit-space program, may it perform the construction work permitted under the rest of this final rule (*e.g.,* abrasive blasting with the dust collector turned on); however, the employer must consider this work and the types of hazards it might create when conducting the initial evaluation and when developing its permit-space program.

Paragraph (b). Final § 1926.1203(b) requires an employer that identifies one or more permit spaces on a worksite to inform exposed employees, employees' authorized representatives, and controlling contractors of the existence and location of those permit spaces and the known dangers inside. This duty applies to the employer that identifies a permit space under final § 1926.1203(a), as opposed to the general industry language, which refers to ''the employer.'' One of the keys to protecting employees from PRCS hazards is for both employers and employees to know the location of the PRCSs at the job site, the characteristics of the hazards, and their associated dangers. The provisions in this paragraph will achieve this goal.

The introductory language in paragraph (b) follows the general industry standard except that the new rule specifies that the employer's duty is triggered when the workplace has ''one or more'' permit spaces, whereas the general industry standard just refers to ''spaces'' in the plural. A single permit space triggers the employer's duty under both the general industry standard and this final rule, and OSHA is making this point explicit in the new rule.

Paragraph (b)(1). Final § 1926.1203(b)(1) requires the employer to inform exposed employees of the existence and location of, and the danger posed by, the permit spaces by posting danger signs or by any other equally effective means. Final § 1926.1203(b)(1) is similar to both the general industry rule at § 1910.146(c)(2) and proposed § 1926.1209(a)(2). As OSHA noted in the preamble to the general industry standard, many confined space accidents occur when an employee fails to recognize the hazards present when entering a permit-required confined space that the employer failed to mark as such. (58 FR 4462, 4483 (Dec. 17, 1993)). Therefore, OSHA determined that it is important to identify permit spaces and to inform exposed employees of their presence and the hazards involved. The Agency believes that employees need this information to understand the seriousness of potential hazards in PRCSs. To recognize all methods of informing employees and to clarify the purpose of the rule, OSHA is adopting a performance-oriented requirement in the final rule. Accordingly, the employer must post a danger sign at or near PRCS entrances, which the Agency believes is an effective way to ensure that employees receive proper warning of the hazards in a PRCS, or adequately inform exposed employees through another equally effective means. Compliance with this requirement will ensure that exposed employees who are not authorized entrants receive the information necessary to prevent them from entering the spaces. Whatever method the employer uses, the standard requires the employer to inform employees exposed to the hazards posed by permit-required confined spaces of the existence, location, and danger of those spaces. Everyone at the construction site benefits from this information even if they do not engage in construction activity (*e.g.,* designers or architects).

However, OSHA notes that only employees who work in PRCSs need to know the details about the potential hazards. Final § 1926.1205(c) provides that employers post the entry permit, which contains information about the hazards of the PRCS and the measures used to address those hazards, at the entry portal or make this information available by any other equally effective means at the time of entry. Final § 1926.1212 provides that employers must make available to each affected employee and his/her authorized representatives all information required by this standard. Therefore, final § 1926.1203(b) does not require employers to list specific PRCS hazards on each sign.

In enforcing this provision, OSHA will make determinations about whether methods other than warning signs used by employers to notify employees about the spaces are truly as effective in imparting the required information to employees. Such methods must go beyond just the generic training required by this standard, for example, since generic training would not identify the location of permit spaces at a specific worksite. Therefore, an equally effective means would identify the PRCS locations so that employees at the job site who may work near the PRCSs would be aware of these locations and would understand the importance of not entering them. The final rule places on employers, not employees, the burden of using an effective means of identifying the spaces and controlling the associated hazards.

If an employer uses a warning sign, the sign must convey that entering the space is dangerous and that only authorized employees may enter the space. In this final provision, OSHA included the note from § 1910.146(c)(2) that a sign reading ''DANGER—PERMIT-REQUIRED CONFINED SPACE, DO NOT ENTER'' or similar language would satisfy the requirement for a sign.[13] This language is familiar to employers and employees under the general industry standard, and is a clear warning not to enter the space. The Agency believes that, when properly warned, employees who are not authorized to enter the space would avoid entering the PRCS, thereby preventing harm that could result from the PRCS hazards.

Proposed § 1926.1209(a) specified a two-step process that involved notifying employees who would be in or near the permit space, and then posting a sign. One commenter asserted that limiting notification to employees who the entry employer anticipates will be in or near the PRCS, as provided in proposed § 1926.1209(a)(1), would allow entry employers to avoid this requirement by claiming they did not anticipate a particular employee was going to be in or near the PRCS (ID–086, p. 5). Final § 1926.1203(b)(1) requires notification to exposed employees, which addresses this commenter's concern.

Other commenters argued that notifying employees near a PRCS, or employees on the jobsite, was burdensome, and that posting a warning sign would be sufficient to notify employees of the PRCSs and their hazards (ID–124, pp. 6–7; ID–133, p. 2). At least one other commenter argued that the barriers required by proposed § 1926.1209(b) would not always be feasible, and that posting warning signs would be sufficient (ID–104, p. 3). OSHA agrees with these commenters, and drafted final § 1926.1203(b)(1) to specify that notification by posting a warning sign would provide adequate notice to employees of the existence, location, and hazards of the PRCSs.

Another commenter was unsure whether the posting requirement applies when employers physically barricade the space (ID–099, p. 3). It does. Final § 1926.1203(b)(1) requires posting a warning sign or using another equally effective means of informing exposed employer about the hazards of the permit space, and final § 1926.1203(c) requires an employer to comply with final § 1926.1203(b)(1) when the employer prohibits entry into a confined space. Barricading the confined space in a manner that prevents easy entry by unauthorized employees (for example, by using a barricade that requires a key to gain entry) would be an equally effective means of informing employees under § 1926.1203(b)(1), provided the employer ensures that all affected employees receive information about such spaces and know that they must not enter the spaces without authorization and without taking proper precautions This means of compliance is consistent with the general industry standard. See OSHA Directive CPL 02–00–100: Application of the Permit-Required Confined Spaces (PRCS) Standard, Appendix E, Section (c)(4), and July 22, 1998, letter to Mr. Black.

This commenter, as well as another, asked which employer has the responsibility to post the warning sign if the space is a pre-existing one or there are multiple entry employers (ID–099, p. 3; –133, p. 2). Each employer that identifies that space, or receives notice of it, has a duty to inform exposed employees about a permit space (see § 1926.1203(b) and (c)). Each employer also has a responsibility to identify permit spaces in which one or more of employees it directs may work (see § 1926.1203(a)). However, if there already is a warning sign posted at the permit space, then the employer does not need to post an additional sign. Rather, an employer that relies on a preexisting sign to identify a space must ensure that the sign remains posted for the duration of the potential exposure to the permit space of employees it directs.

One of those commenters also asserted that the controlling contractor or host employer should post the warning sign because of their responsibility to ensure safe confined space entry operations. Final § 1926.1203(b)(1) requires the ''employer who identifies a permit space'' to post the warning sign. For the purposes of this standard, such employers include the controlling contractor, the host employer, and the entry employer if these employers have employees who could be exposed to permit-space hazards. The standard merely requires that an employer post the sign, thereby retaining flexibility among these entities to determine which employer is in the best position to post the sign. When multiple employers will be working in the same space, each employer has a separate duty to post the warning sign. If an employer decides to enter the space, then this subject must be resolved between the controlling contractor and the entry employers as part of the coordination discussion required by final § 1926.1203(h)(4).

[13] OSHA's requirements for accident prevention signs in § 1926.200 also apply.

Paragraph (b)(2). Final § 1926.1203(b)(2) requires each employer to notify its employees' representatives and the controlling contractor, in a manner other than posting, of the hazards of permit spaces and the location of those spaces. This requirement follows proposed § 1926.1209(a)(1). The primary purpose of this provision is to ensure that the employer who identifies a permit space conveys the location and general characteristics of the space to the designated recipients as soon as possible. Later, in accordance with § 1926.1203(h)(3), the entry employer must provide to the controlling contractor a more thorough assessment of the space, the hazards it expects to encounter, and the permit program measures it intends to use to address those hazards. It is important for employers to provide the controlling contractor with this information because the controlling contractor is in the best position to convey the employer's information to other employers at the site, and later share this information with entry employers under final § 1926.1203(h). Final § 1926.1203(b)(2) is also important because it applies to employers who identify a permit space, even if they choose not to allow their employees to enter it, thereby ensuring that the location of all permit spaces will be conveyed to the controlling contractor. Otherwise, the information exchange in § 1926.1203(h)(3) would only apply if the employer chooses to enter the space and become an ''entry employer.''

One commenter questioned the necessity of notifying authorized representatives, particularly if no such representatives are on the project site (ID–099, p. 2). Both the general industry standard and this final standard typically require information sharing between employers and employees and the employees' authorized representatives (see, *e.g.,* § 1910.146(l) and the discussion of § 1926.1212 later in this document). OSHA believes that notifying employees and their authorized representatives of the presence of confined spaces on a worksite will contribute to the successful implementation of safe entry operations, and the prevention of unauthorized entry, by ensuring that they have knowledge of the hazards present in the confined space. Sharing this information with employees' authorized representatives provides an additional way to ensure that this information reaches the employer's employees, and alerts the authorized representatives that there is the potential for permit entry operations. Final § 1926.1203(b)(2) also will facilitate the effective sharing of this important information among other employers at the site whose activities may impact the PRCS, as well as the employees of those other employers.

In some cases, an authorized representative of employees may have more extensive knowledge than the employee about particular hazards, or may be in a better position than the employee to assess the safety of the project site based on past experience at similar sites; therefore, OSHA sees no reason to deviate from the accepted general industry practice of information sharing with the employee's authorized representatives. Final § 1926.1203(b)(2) limits this notification requirement to only the representatives of the employer's employees. Also, while employers must notify these representatives in a timely manner to ensure that the information is available to the employee representatives and controlling contractor in sufficient time for it to be useful, this notification may be by any means normally used for communication with the employee representative or agreed upon in advance, including telephonic or electronic communication. If there are no authorized representatives of employees, the employer must still notify employees under final § 1926.1203(b)(1), and the controlling contractor under final § 1926.1203(b)(2).

Another commenter asserted that notifying the controlling contractor of the existence of every PRCS was unnecessary because posting would provide adequate notification (ID–090, p. 2). With respect to employees exposed to confined space hazards, OSHA agrees with this commenter that posting will provide these employees with adequate notification because of the proximity of the danger sign to the PRCS. Therefore, final § 1926.1203(b)(1) requires only posting to notify employees of confined space hazards, similar to the general industry standard at § 1910.146(c)(2). However, with respect to the controlling contractor and the employees' authorized representatives, a separate notification requirement is necessary to ensure a timely and efficient information exchange, rather than relying on the controlling contractor and employees' authorized representatives to explore the worksite and discover each danger sign.

Paragraph (c). Final § 1926.1203(c), which is similar to § 1910.146(c)(3), requires an employer that identifies, or has notification of, a permit space to take measures that are effective in prohibiting entry when that employer decides employees it directs will not enter permit spaces, and to comply with the rest of the standard as applicable. This provision applies to all employers that: Identify permit spaces under final § 1926.1203(a); receive notification from the controlling contractor of the presence of a permit space under final § 1926.1203(h)(2); receive notification of the permit space from a danger sign posted at a permit space; or receive notification of the permit space from any other means. While proposed § 1926.1209(b) required employers not conducting confined space operations to take specific steps to prohibit entry by employees, final § 1926.1203(c) follows the performance-oriented language of the general industry rule.

The effective measures to prohibit entry could include permanently closing the space and providing barriers, supplemented by training employees and the posted danger signs required under § 1926.1203(b). In any event, the steps taken by the employer must be effective in preventing employee entry into permit spaces. In OSHA's experience, posting signs without barriers is generally less effective than with barriers, so employers who choose the former method must take special care to ensure that employees they direct recognize and understand permit-space warning signs, that they are knowledgeable regarding the hazards associated with these spaces, and that they understand that entry into the spaces is not authorized. This reinforces the employer's existing obligation under § 1926.21(b)(2) to instruct each employee in the recognition and avoidance of unsafe conditions. OSHA believes that these provisions in the final rule will protect employees from unauthorized entry into permit spaces.

Final § 1926.1203(c) also requires employers covered by this provision to comply with the rest of the confined spaces in construction standard, as applicable. The parallel provision in the general industry standard requires employers to comply with specific provisions of that standard, which correspond to the following provisions in this final rule: § 1926.1203(a), relating to identification of permit spaces in the workplace; § 1926.1203(b)(1), relating to informing employees of the presence of permit spaces; § 1926.1203(f), relating to changes in confined spaces; and § 1926.1203(h), relating to the controlling contractor's information exchange with employers. Employers must comply with those provisions that are applicable. For example, under final § 1926.1203(h)(2) and (h)(4), controlling contractors must inform and coordinate with employers that direct employees (including employees not involved directly in the confined space operations) whose activities could, either alone or in conjunction with the activities performed in the confined space, foreseeably result in a hazard to employees in the confined space. Additional provisions of this standard may apply as well, depending on the activities of the employer in question. For these reasons, in final § 1926.1203(c), OSHA used the general language ''all other applicable requirements'' rather than specifying different sections of the final standard that may be applicable.

Paragraph (d). Final § 1926.1203(d) requires any employer that has employees who will enter a confined space to have and implement a written permit-space program that meets the requirements of this final standard, and to make the program available for inspection by employees and their representatives. Final § 1926.1203(d) is similar to the corresponding provision for general industry confined spaces at § 1910.146(c)(4), with slight modifications. OSHA modified the language of this final provision slightly to clarify that entry employers do not necessarily have to develop a separate written program for each individual entry. Rather, an entry employer may reuse a program it developed previously, or a program developed by another employer, an industry association, or other entity, so long as the program is appropriate for the specific entry operations and the type of work involved, and that the program meets the requirements set forth in final § 1926.1204. OSHA anticipates that in most cases employers will be able to use or modify an existing program and will not need to develop an entirely new program.

Although the final rule requires the permit program to meet the requirements of final § 1926.1204, OSHA will allow employers to fulfill this obligation through a combination of the permit program and the entry permit itself. In a 2006 interpretation of the general industry standard, the Agency noted that employers could use the same permit program to cover multiple spaces:

> If employees will enter a permit space, an employer must develop and implement the means, procedures and practices necessary for safe permit space entry operations in accordance with § 1910.146(d)(3). Before a specific permit space is entered, the employer must document the completion of the measures required by § 1910.146(d)(3) by preparing an entry permit. A specific permit must be completed prior to each entry. However, if there are several similar tanks, with the same conditions and hazards, the same means, procedures and practices could be used for this similar group of tanks.

September 21, 2006, letter to Fred Rubel. OSHA anticipates that, in practice, some employers in construction may operate with a general permit-space program that covers numerous types of permit spaces and hazards, along with a specific permit that includes the unique hazards and practices applicable to each of those spaces. The Agency has no objection to this approach, provided the permit conveys all of the applicable information to employees at the required times, this information is readily available to the employees for reference during entry operations, and employees receive the training necessary for them to refer to the appropriate document for the required information. Therefore, for this purpose, OSHA allows employers to treat the permit as part of the written permit space program required by this section.

The proposed rule did not require an employer to have a written confined space program. Instead, in proposed § 1926.1219(a), the proposed rule provided that the employer could keep either a copy of the standard on the worksite or a copy of a program that incorporated the requirements of the standard. At least one commenter recommended that OSHA revise proposed § 1926.1219(a) so that the provision required employers to have a written copy of the final rule on site, regardless of whether the employer had a written copy of its confined spaces program (ID–108, p. 4). Several other commenters disagreed with OSHA's approach in the proposal, and urged OSHA to require a written confined space program as the general industry standard does. One commenter stated, ''For a confined space program to be effective, it must be easy to understand and implement. . . . Providing employees with the generic terms of the standard—even if they read it—would not provide that kind of clarity. Instead, they need information specific to working at the particular worksite [which a program provides]'' (ID–220, p. 28–29). Another commenter asserted, ''Having a written program gives everyone a clear idea of what is required and their roles and responsibilities. It also is an important reference document. Construction contractors commonly have written safety programs, and many already have written confined space programs as well, so compliance should not be difficult'' (ID–150, p. 3). Another commenter asserted that the written program in the general industry standard contributed to employee safety, and that the lack of a written program in the proposal diminished employee safety and also weakened training because ''the vision of what is expected can not be focused'' (ID–129, p. 3). A different commenter stated that requiring a written plan was the most important provision of the standard because it ensures that employers plan the permit space entry carefully and are familiar with the hazard analysis; it also provides an important reference document (ID–130, p. 1). The latter two commenters also noted that the lack of a written program in the proposal was a step backwards from the general industry rule.

OSHA wrote this final standard in performance-based language to be consistent with the general industry rule; consequently, this final standard does not provide the specific classification system and detailed step-by-step procedures for employers to follow found in the proposed rule. Therefore, this final rule is less suitable as a replacement for a written permit program than was the proposed rule. Accordingly, OSHA does not believe that maintaining a copy of this final rule on site, in lieu of having a written permit-space program, will ensure that an employer's confined space procedures will provide adequate employee protection. OSHA agrees with the commenters who supported a written program.

The Agency believes that final § 1926.1203(d) will effectively prevent unauthorized entry into PRCSs, and so protect employees from encountering PRCS hazards. The Agency also believes that it is necessary for employers to have a written confined space program at the worksite as a reference for employees involved in implementing safe entry procedures. A written program provides the basis for any permit-space entry operation, as well as a reference for guiding and directing supervisors and employees alike. A written program also will serve to assign accountability for all functions related to permit-space entry, and will aid in avoiding mistakes and misunderstandings. Additionally, because of the compliance flexibility and discretion that the standard provides to the employer, a written plan is essential to demonstrate that the employer took all aspects of permit-space entry into consideration. For these reasons, OSHA decided to specify in the final rule that the permit-space program be in writing. The written plan must, in combination with the permit itself, address the employer's particular facts and circumstances to ensure that the procedures will protect employees' safety. For all of the reasons above, requiring an employer to have and implement a written permit-space program, rather than simply relying on a copy this final rule, will enhance the protection afforded to employees from confined space hazards.

Final § 1926.1203(d) explicitly requires employers to implement their written permit-space program at the jobsite. A program that is drafted but not implemented at the jobsite will not protect employees from the hazards of permit-space entry. This requirement is implicit in the general industry standard, but OSHA has made it explicit in this final rule. Additionally, this final provision requires employers to make the written program available for inspection by employees and their authorized representatives. The Agency believes that such access is essential for the successful implementation of a permit-space entry program. Finally, final § 1926.1203(d) clarifies that the employer must make the program available to employees prior to, and during, entry operations, which are the periods that the written program is most important. During these periods, employees must understand the program to ensure their safety. The general industry rule requires that the program be available, and this final rule simply clarifies that it must be available during these critical periods.

Paragraph (e). Final § 1926.1203(e) authorizes an employer to use alternate procedures for permit-space operations under limited circumstances. The standard permits these alternative procedures when an employer can demonstrate that it eliminated or isolated all physical hazards through engineering controls and controls atmospheric hazards through continuous forced-air ventilation. OSHA notes that continuous ventilation is a control method, and not a method suitable for eliminating or isolating an atmospheric hazard, so final § 1926.1203(e) spaces remain permit-required spaces, but can be entered without a permit program under the alternate procedures specified in this final section. OSHA believes that in the context of construction work, these alternative procedures provide adequate safety measures while being more efficient, and less costly to implement, than complying with the full permit-program requirements specified by final rule § 1926.1204. The requirements for the alternate procedures allowed under the final construction rule are similar to the corresponding provisions of the general industry confined spaces standard at § 1910.146(c)(5), but contain some substantive modifications explained in the following paragraphs. OSHA also added the word ''only'' to the introductory provision to clarify that an employer cannot use these alternate procedures under any other circumstances. In addition, final § 1926.1203(e) is similar to proposed § 1926.1216.

Paragraph (e)(1). Final § 1926.1203(e)(1), which is substantively identical to § 1910.146(c)(5)(i), sets forth the six conditions that an employer must meet before employees can enter a permit space under the alternative procedures specified in paragraph (e)(2). OSHA modified final § 1926.1203(e)(1) slightly from the general industry rule to state explicitly that employers must meet *all* of the conditions listed in final § 1926.1203(e)(1) before using the alternate procedures specified by final § 1926.1203(e). If employers meet all of these conditions, the employer need not comply with final §§ 1926.1204–1206 (addressing permits and permit programs) or final §§ 1926.1208–1211 (setting forth specific duties for permit-required confined spaces). Employers in permit spaces qualified to use the alternate procedures, however, still must comply with final § 1926.1207 (training requirements), final §§ 1926.1212–1213 (Employee participation and provision of documents to the Secretary), and the other provisions of final § 1926.1203, including the information exchange requirements in final § 1926.1203(h).

One commenter asserted that any space that requires ventilation to protect employees should have an attendant to monitor conditions in the space (ID–060, p. 3). The general industry standard does not require an attendant for entry under its parallel alternative entry procedures, and OSHA disagrees with this commenter, who offered no explanation for this assertion. Employers are only eligible to use the alternate procedures in final § 1926.1203(e) when the employer can demonstrate that the only hazard posed by the permit space is an actual or potential hazardous atmosphere, can demonstrate that continuous forced-air ventilation alone provides adequate safety, and the employer continuously monitors the space during entry. These requirements make the eligible spaces safe for employee entry. The more extensive requirements of final § 1926.1204 apply to those permit spaces with hazards that employers cannot isolate by engineering controls, or that the employer cannot control by ventilation. The Agency notes that the alternative entry procedures are only available for as long as the physical hazards remain isolated and the atmospheric hazards controlled. Employers must take care to ensure that physical hazards remain isolated and must exit the space and implement a full permit program if there is any indication that workers might be exposed.

Another commenter requested that the final rule clarify that employers need not provide attendants and rescue services for final § 1926.1203(e) spaces (ID–099, p. 3). Final § 1926.1203(e)(1) clarifies that spaces qualifying for the alternate procedures under § 1926.1203(e) do not need to comply with final §§ 1926.1204–1206 (addressing permits and permit programs) and §§ 1926.1208–1211 (setting forth specific duties for permit-required confined spaces).

Paragraph (e)(1)(i). Final § 1926.1203(e)(1)(i), which is similar to the general industry standard at § 1910.146(c)(5)(i)(A), sets out the first condition that employers must meet before using the alternative procedures. It provides that an employer may use these alternate procedures only when the employer can demonstrate that it eliminated or isolated all physical hazards using engineering controls, and that the only hazard posed by the space is an actual or potential hazardous atmosphere. OSHA modified this provision from the general industry rule by adding language that an employer can use the alternative procedures when it can demonstrate that all physical hazards are ''eliminated or isolated'' by engineering controls within a confined space, rather than just ''eliminated.'' OSHA adopted this change from proposed § 1926.1216(a), which provided that employers could use the equivalent provisions when they could demonstrate the isolation of physical hazards.

One commenter supported the proposed rule's provisions for entry into ''controlled-atmosphere confined spaces'' in proposed § 1926.1216, which the commenter described as requiring the elimination of all physical hazards (ID–220, p. 6). Proposed § 1926.1216 did not, however, specify that physical hazards must be eliminated before an employer could use the alternative ventilation-only procedures in that section; it required the employer to ''determine and implement an isolation method'' for each of the physical hazards identified (see proposed § 1926.1216(a)(1); see also proposed § 1926.1216(a)(3), which required the documentation of the method for ''isolating'' each physical hazard). The final rule, which defines ''isolate or isolation'' in final § 1926.1202 to allow employers to isolate physical hazards within a confined space like the proposed rule, and provides for isolation using the same methods specified in the proposed definition, which include the elimination or removal of hazards. (See the discussion of this definition earlier in this preamble.)

Another commenter expressed concern that, in construction work, employers would almost never be able to use these alternate procedures because the complete elimination of all physical hazards, such as an iron angle at head level, from such a space would, in many cases, not be feasible or necessary (ID–061, p. 6). OSHA believes that isolating physical hazards using methods such as wrapping a low-hanging pipe with foam or locking out pieces of equipment (see the definition of ''isolate or isolation'' in final § 1926.1202) can be sufficient to prevent injury from those hazards. Thus, the Agency decided that isolating or eliminating physical hazards is the most appropriate approach in the construction context where potentially isolated physical hazards are likely to be more prevalent because of the nature of construction, and adopted the proposed requirement accordingly.[14]

Paragraph (e)(1)(ii). Final § 1926.1203(e)(1)(ii), which corresponds to the general industry standard at § 1910.146(c)(5)(i)(B), sets out the second condition required for employees to use the alternative procedures: An employer must be able to demonstrate that continuous forced-air ventilation alone provides adequate safety from hazardous atmospheres and that entrants can safely exit the space in the event the ventilation system stops working. For the space to be safe under this final provision, the mechanical ventilation must control the hazardous atmosphere at levels that are below the levels at which they are harmful to entrants so that, if the ventilation shuts down for any reason (such as loss of power), the employees will have sufficient time to recognize the hazard and exit the space. Employers have a responsibility to specify a hazard level that is adequate for employees to escape the confined space before the hazard reaches unsafe levels. As with the general industry standard, employers must account for the introduction of additional hazards from the work conducted in the permit space, such as additional gases generated by painting or application of coating, and ensure that the ventilation is adequate to account for the introduced hazards (see 58 FR 4462, 4488 (Jan. 14, 1993)). In addition, certain types of work are inherently unsuitable for entries under § 1926.1203(e). In the preamble to § 1910.146(c)(5) of the general industry standard, OSHA explained that ''work with hazardous quantities of flammable or toxic substances and hot work are not permitted'' because they would ''introduce hazards beyond those accounted for by the determination that the permit space can be maintained safe for entry'' through mechanical ventilation alone (*id*). For the same reasons, OSHA does not permit this work for entries under § 1926.1203(e).

Final § 1926.1203(e)(1)(ii) also requires that the employer be able to demonstrate that in the event the ventilation system stops working, entrants can exit the space safely. OSHA based this requirement on proposed § 1926.1216(a)(2)(ii) which would have required employers to document their determination that monitoring procedures would give sufficient warning to allow entrants to exit. In the final rule, OSHA moved the monitoring requirement to 1926.1203(e)(2)(vi). However, the Agency retained the determination requirement in (e)(1)(ii) to make clear that safe exit time must be factored into the selection of monitoring procedures, intervals, and detection levels, including the levels at which monitoring alarms are triggered. Safe exit time is a precondition for reliance on alternative procedures.

One commenter asserted that determining what is a sufficient time to exit, as required by the proposed rule, would require an industrial hygienist (ID–114, p. 2). OSHA does not believe an industrial hygienist is the only person capable of making this determination because the final rule bases the time required for a safe exit on the physical attributes of the space. Any person trained in confined-space operations under final § 1926.1207 should be able to use these attributes to determine the time needed by entrants to safely exit the confined space as required by § 1926.1203(e)(1)(ii). For example, if the employer is unsure how quickly the atmosphere would return to a hazardous atmosphere following a ventilation failure, the employer can run a test by shutting off the ventilation when no one is in the space to determine the amount of time before the continuous monitor alarm sounds. The rest of the calculation would depend on the amount of time necessary for employees to exit the space from their work locations inside the permit space, which could also be tested, factoring in an appropriate safety buffer of time.

Several commenters asserted that OSHA should allow an employer to use natural ventilation alone, or suction, to control a hazard under the alternate procedures specified by final § 1926.1203(e). OSHA addressed these comments in the earlier discussion of the definition of ''ventilate or ventilation'' in this preamble.

There was a considerable amount of discussion in the record about whether the alternative procedures should be available for isolated spaces in sewers and other continuous spaces (see, *e.g.,* ID–75.1, p. 4; –210, Tr. pp. 176–177, 185–93, 206–208; –211, Tr. pp. 144–159). For an employer to apply final § 1926.1203(e) to a sewer, the employer would have to demonstrate total isolation of the section of the sewer from other potential sources of hazards (*e.g.,* the sewer distribution system) to guard against the introduction of new hazards into the space; the employer then must demonstrate that the ventilation system is maintaining the space sufficiently below the trigger limits for the atmospheric hazard (*e.g.,* below 10 percent LFL or an applicable PEL) so that employees would have time to escape if the ventilation failed. Total isolation of sewer manholes or selected sections of piping may not be practical or feasible to prevent hazards (*e.g.,* flammable gases) from entering the space because employers normally perform entries with the system in service. See Aug. 15, 1996, letter to Larry Brown. Final § 1926.1203(e)(1)(ii) includes a clear requirement that an employer that relies on continuous forced-air ventilation to maintain spaces safe for entry must be able to establish that other measures are not necessary to protect entrants. For additional information about isolating spaces within sewers and other continuous confined spaces, see the discussion of § 1926.1204(c)(3).

Paragraph (e)(1)(iii). Final § 1926.1203(e)(1)(iii), which is identical to the general industry standard at § 1910.146(c)(5)(i)(C), is the third condition required before an employer may use the alternative procedures. It also is substantively similar to proposed § 1926.1216(a)(2) and (a)(3), which provided that employers must test the atmosphere and document the results; this final provision, however, is less detailed than the proposed provisions. This final provision requires the

[14] The general industry standard does not allow employers to use the alternative entry procedures in § 1910.146(c)(5)(ii) if any physical hazard remains in the space, even if that hazard is temporarily ''removed'' or ''isolated'' in accordance with the standard. See October 12, 1995, memorandum to Linda Anku. OSHA does not adopt that interpretation for this construction rule.

employer to develop monitoring and inspection data that supports the demonstrations required by paragraphs (e)(1)(i) and (e)(1)(ii), *i.e.,* the elimination or isolation of physical hazards such that the only hazard in the space is an actual or potential hazardous atmosphere, and that continuous forced-air ventilation is sufficient to maintain the space safe for entry. The atmospheric-monitoring data must show that ventilation will keep the atmosphere inside the permit space safe for entry. In this context, the final rule uses ''monitoring'' to match the general industry language, but the term encompasses both the initial testing of atmosphere and the subsequent measurements. The data required by paragraph (e)(1)(iii) are essential for the employer and employees, as well as OSHA, to determine whether the employer can maintain the space safe for entry with the use of ventilation alone.

Paragraph (e)(1)(iv). Final § 1926.1203(e)(1)(iv), which is identical to the general industry standard at § 1910.146(c)(5)(i)(D), is the fourth criterion employers must meet to use the alternative procedures. This provision also is similar to proposed § 1926.1204(b)(2). This final provisions specifies that, if an initial entry into the permit space is necessary to obtain the data required by paragraph (e)(1)(iv), the employer must perform the entry in compliance with final §§ 1926.1204–1211 (*i.e.,* the full permit-space program).[15] This entry requirement, which was in the proposed rule, is necessary to protect employees from hazards that the employer did not fully identify or assess. The rule requires employers to obtain monitoring and inspection data without entry when feasible, but acknowledges that in many instances it will be necessary to perform an initial entry into the space to make the necessary determinations. This requirement will ensure that the initial entry is safe.

Paragraph (e)(1)(v). Final § 1926.1203(e)(1)(v), which is identical to the general industry standard at § 1910.146(c)(5)(i)(E), sets out the fifth criterion for using the alternate procedures. It also is similar to proposed § 1926.1216(a)(3), though less detailed. This final provision mandates that employers document the determinations and supporting data required by paragraphs (e)(1)(i) through (e)(1)(iii) of this final rule, and make this documentation available to employees who enter the spaces under the terms of final § 1926.1203(e), or to their authorized representatives. This documentation will enable the employer, employees, their authorized representatives, and OSHA to evaluate the validity of the determinations made under final § 1926.1203(e) for a particular permit space.

Paragraph (e)(1)(vi). Final § 1926.1203(e)(1)(vi), which is identical to the general industry standard at § 1910.146(c)(5)(i)(F), is the final condition that employers must meet to use the alternate procedures. The section does not correspond to any section of the proposed rule due to the different organization of the proposal. It requires that employers perform entry under the alternate procedures specified by final § 1926.1203(e) in accordance with the specific procedures required by final § 1926.1203(e)(2).

Paragraph (e)(2). Final § 1926.1203(e)(2), which is similar to § 1910.146(c)(5)(ii), sets forth the procedures that employers must follow for permit-space entries made under final § 1926.1203(e)(1). The introductory paragraph in § 1926.1203(e)(2) is identical to the introductory paragraph in the general industry standard. This introductory paragraph does not correspond to any section of the proposed rule due to the different organization of the proposal.

Paragraph (e)(2)(i). Final § 1926.1203(e)(2)(i), which is identical to the general industry standard at § 1910.146(c)(5)(ii)(A), requires that employers must, before removing an entrance cover, eliminate any conditions that make it unsafe to do so. It also is similar to proposed § 1926.1216(c)(1). Some conditions in a permit space may make it hazardous to remove a cover from the space. For example, if the atmospheric hazards within the space cause high pressure in the space, the cover may blow off in the process of removing it. To protect employees from such hazards, employers must make a determination as to whether it is safe to remove the cover. Such a determination requires the employer to examine the conditions expected to be in the permit space. Under high-pressure conditions, employers must check the cover to determine if it is hot; if so, the employer must loosen a cover fastened in place gradually to release any residual pressure. The employer also must determine whether conditions at the site could cause a hazardous atmosphere to accumulate in the space, which would make it unsafe for employees to remove the cover. The employer must not remove the cover until it is safe to do so.

Paragraph (e)(2)(ii). Final § 1926.1203(e)(2)(ii), which is nearly identical to the general industry standard at § 1910.146(c)(5)(ii)(B), requires employers to guard openings to permit spaces after removing entrance covers to protect employees from falling into the space and to protect employees in the permit space from injuries caused by objects entering the space. It also is similar to proposed § 1926.1216(c)(2), though less specific than the proposed provision. The guard could be in the form of a railing, a temporary cover, or any other temporary barrier that provides the required protection. If the opening to the space would not allow employees and objects to fall into the space, then no additional guarding is necessary. Final § 1926.1203(e)(2)(ii) differs from § 1910.146(c)(5)(ii)(B) in that it requires the opening to be ''immediately'' guarded by a railing, temporary cover, or other temporary barrier. The general industry rule requires employers to provide the guarding promptly. The Agency made this change to clarify that the guarding must happen as soon as possible.

Paragraph (e)(2)(iii). Final § 1926.1203(e)(2)(iii), which is substantively identical to the general industry standard at § 1910.146(c)(5)(ii)(C), requires the employer to test the internal atmosphere of the permit space with a calibrated, direct-reading instrument before any employee enters the space. This provision also is similar to proposed §§ 1926.1216(d)(2) and 1926.1205(a)(1), though not as detailed as the testing required by proposed § 1926.1205(a). If the employer can demonstrate that testing prior to entry is infeasible, then the employer must at a minimum comply with permit program requirements during the testing process in accordance with § 1926.1203(e)(1)(iv).

The employer must test the atmosphere, in sequence, for oxygen content, flammable gases and vapors, and potential toxic gases and vapors. Employers must first perform a test for oxygen because most combustible gas meters are oxygen dependent and will not provide reliable readings in an oxygen-deficient atmosphere. Employers must test for combustible

[15] OSHA recognizes that compliance with final § 1926.1204(e)(1) requires employers to test conditions in the permit space to determine if acceptable entry conditions exist before entry is authorized to begin. An employer will be in compliance if the employer can demonstrate that initial entry is necessary to gather the data to comply with § 1926.1203(e)(1)(iii), and enters under a permit program that complies with all other provisions except the pre-entry testing in § 1926.1204(e)(1). Note that the alternative entry procedures are not available if the work space is part of a continuous system and has not been effectively isolated.

gases next because, in most cases, the threat of fire or explosion is both more immediate and more life threatening than exposure to toxic gases. The testing must be appropriate for the space; for example, if there is a stratified atmosphere where gases of different densities layer within a confined space, the employer must perform testing at different depths.

This testing is necessary to determine whether ventilation alone will maintain the space safe for entry. The results of this testing must be within the expected range for the space, based on the employer's determination under paragraph (e)(1)(ii), or the employer may not enter under the alternative procedure.

Paragraph (e)(2)(iv). Final § 1926.1203(e)(2)(iv), which is identical to the general industry standard at § 1910.146(c)(5)(ii)(D), prohibits employees from occupying the space when a hazardous atmosphere is present in the space. This provision has the same purpose as proposed § 1926.1216(e)(2)—namely, to ensure that there is no hazardous atmosphere in an alternate procedures space during entry. However, due to the different organization of the proposed and final rules, the language and organization of these two provisions are different. To ensure that there is no hazardous atmosphere in a permit space when an employer enters using the alternate procedures, final § 1926.1203(e)(2)(iv) requires employers conducting any entry into a permit space containing a hazardous atmosphere to comply with the full permit-space program requirements in final §§ 1926.1204–1211. See also the discussion of final § 1926.1203(e)(2)(vii)(A) below.

Paragraph (e)(2)(v). Final § 1926.1203(e)(2)(v), which is identical to the general industry standard at § 1910.146(c)(5)(ii)(E), sets out requirements for using continuous forced-air ventilation to maintain the permit space safe for entry. Final § 1926.1203(e)(2)(v)(A) also is identical to § 1910.146(c)(5)(ii)(E)(*1*) and similar to proposed § 1926.1216(d)(3). It requires that no employee may enter the space until the forced-air ventilation eliminates any hazardous atmosphere in the space. Final § 1926.1203(e)(2)(v)(B) is identical to § 1910.146(c)(5)(ii)(E)(*2*), and shares the purpose of proposed § 1926.1216(e)(2) to ensure that the ventilation will continue to control the atmospheric hazards while the employer is conducting entry operations. It requires the employer to direct the ventilation so as to ventilate the immediate areas where an employee is, or will be, present in the space, and requires the ventilation to continue until all employees leave the space. Final § 1926.1203(e)(2)(v)(C) is identical to § 1910.146(c)(5)(ii)(E)(*3*), and has no corresponding section in the proposed rule. It requires that the air supply for the ventilation must be from a clean source, and must not increase the hazards in the space. These provisions ensure that the atmosphere in the permit space will remain safe during the entire entry operation.

Paragraph (e)(2)(vi). Final § 1926.1203(e)(2)(vi), which is similar to the general industry standard at § 1910.146(c)(5)(ii)(F), requires entry employers to continuously monitor the atmosphere in the permit space. Employers may use periodic monitoring, rather than continuous monitoring, only if the employer can demonstrate that the equipment for continuous monitoring is not commercially available or that periodic monitoring is sufficient to ensure that the conditions in the PRCS remain within planned limits. This final provision also clarifies that employers must use some form of monitoring during confined space operations, and that they must use periodic monitoring if continuous monitoring is not used to ensure that there is always monitoring of the space occurring.

OSHA retained in this final rule the requirement in the proposal that employers use continuous monitoring (see proposed § 1926.1216(e)(2)). This requirement for continuous monitoring differs from the general industry rule, which requires ''periodic testing.'' In the typical PRCS found at construction sites, it is often difficult for the employer to predict with reasonable certainty the levels of hazardous atmospheres in a PRCS. In many instances, the employer will have little or no past experience with the particular PRCS, and will lack reliable historical data on hazardous atmosphere levels. Also, conditions in a PRCS may vary as construction work progresses, causing unexpected increases in hazardous atmosphere levels. For example, alterations to the wall of a PRCS may allow a hazardous gas to enter the PRCS, thereby increasing the level of the hazardous gas in the PRCS from the level measured before altering the wall. In addition, construction equipment in the space may not operate as expected, resulting in a discharge of hazardous gasses into the space at a higher rate than anticipated. In short, construction work tends to follow a somewhat unpredictable course and, thus, requires frequent atmospheric monitoring. Because of this high level of unpredictability, OSHA believes that continuous monitoring is necessary to ensure that affected employees, especially entrants, receive adequate protection. Continuous monitoring enables employers to quickly recognize deteriorating conditions, including the introduction of new atmospheric hazards into the confined space, and then to take timely actions to protect employees. For additional discussion of the need for continuous monitoring and its implementation, see the discussion of final § 1926.1204(e)(2) (discussion of continuous monitoring of permit spaces entered under a full permit program, rather than the alternative procedures).

Final § 1926.1203(e)(2)(vi) also requires the continuous-monitoring equipment to have a functional alarm that will notify all entrants when an atmospheric hazard reaches a specified threshold designed to give entrants an opportunity to escape before a ''hazardous atmosphere'' develops, or check the monitor with sufficient frequency to alert other entrants when an atmospheric hazard reaches that specified threshold. The purpose of continuous monitoring is to protect entrants by ensuring that the atmospheric hazards remain at or below levels specified by final § 1926.1203(e)(1)(ii), and having an alarm will immediately warn entrants when the atmospheric hazards reach those levels. The monitoring equipment serves no purpose if the employer does not convey the monitoring results to entrants in a timely manner. Requiring employers to check the monitor ''with sufficient frequency'' is a performance measure that means that the employer must demonstrate that the permit space is monitored such that a change in atmosphere or other potential hazard will be identified in time to allow entrants to exit the permit space safely. Checking the monitor regularly also will alert entrants if the monitor malfunctions.

Several commenters supported the requirement for continuous monitoring (ID–106, p. 2; –220, p. 7; –211, Tr. pp. 44–45). However, some of these commenters also urged the Agency to require continuous monitoring without exception (ID–106, p. 3; –220, p. 7). The Agency recognizes that in some PRCSs, especially when an employer conducts numerous entry operations in the same PRCS and finds through repeated monitoring that the atmosphere in the PRCS is stable, the employer may be able to show that periodic monitoring is sufficient to ensure that the conditions in the PRCS remain within planned limits. Nevertheless, when the employer uses periodic monitoring, it must be of sufficient frequency to ensure the control of atmospheric hazards as planned and must be able to detect new hazards in time to protect employees. In some cases, continuous monitoring may not be possible; for example, continuous monitoring may not be available when the atmospheric hazard is a particulate. Therefore, when the employer shows that periodic monitoring is adequate, or demonstrates that the technology for continuous monitoring is not available, this final provision permits the employer to use effective periodic monitoring instead of continuous monitoring. The proposed rule contained the same exceptions.

The Agency also retained the language from the general industry rule that the monitoring must ensure that the continuous forced-air ventilation is preventing the accumulation of a hazardous atmosphere. The monitoring required by final § 1926.1203(e)(2)(vi), in combination with the continuous forced-air ventilation required by final § 1926.1203(e)(2)(v), ensure that entrants remain protected the entire time they are present within the permit space.

Finally, final § 1926.1203(e)(2)(vi) specifies that the employer must provide any entrant, or his or her authorized representative, with the opportunity to observe the monitoring required by this paragraph. This paragraph does not require employees and their authorized representatives to observe the monitoring; however, it provides employees and their authorized representatives with the option of observing should they choose to do so. OSHA believes that allowing employees and their authorized representatives to participate in this manner will contribute to the successful implementation of safe entry operations by enhancing their awareness of the status of the hazards in the confined space.

Paragraph (e)(2)(vii). Final § 1926.1203(e)(2)(vii), which is similar to the general industry standard at § 1910.146(c)(5)(ii)(G), specifies what an employer must do if it detects a hazard in a space regulated by the § 1926.1203(e) alternate procedures during entry. Final § 1926.1203(e)(2)(vii) differs from the general industry rule in that it expressly applies to any hazard, not just a hazardous atmosphere. This final provision is similar to proposed § 1926.1216(f), which also referred to physical, as well as atmospheric, hazards. The Agency made this change to ensure that this paragraph was consistent with final § 1926.1203(e)(1)(i), which allows employers to use the alternate procedures of final § 1926.1203(e) after eliminating or isolating all physical hazards in the space. Thus, the employer must implement the requirements of this final paragraph when there is a new physical hazard, a previously recognized physical hazard no longer remains isolated, or there is a hazardous atmosphere present.

Paragraphs (e)(2)(vii)(A)–(C). Final §§ 1926.1203(e)(2)(vii)(A)–(C), which are similar to general industry §§ 1910.146(c)(5)(ii)(G)(*1*)–(*3*), set the requirements for what an employer must do after detecting a hazard in a space regulated by § 1926.1203(e) during entry. Final § 1926.1203(e)(2)(vii)(A) is identical to the general industry standard at § 1910.146(c)(5)(ii)(G)(*1*), and requires employees to exit the permit space immediately after detecting a hazard. Final § 1926.1203(e)(2)(vii)(B) is similar to the general industry standard at § 1910.146(c)(5)(ii)(G)(*2*), except that it applies to all hazards, not just atmospheric hazards as the general industry requirement does. The final rule requires the employer to evaluate the permit space to determine how the hazard developed. Final § 1926.1203(e)(2)(vii)(C) is similar to the general industry standard at § 1910.146(c)(5)(ii)(G)(*3*), though it too refers to all hazards (physical and atmospheric). It requires the employer to implement measures to protect employees from the hazard before reentering the space under the alternate procedures specified by final § 1926.1203(e). Detecting a hazardous atmosphere during entry indicates that the employer did not maintain the permit space safe for entry, so before authorizing any subsequent entries into the space under final § 1926.1203(e), the employer must determine what went wrong and take whatever measures are necessary to prevent a recurrence.

Paragraph (e)(2)(viii). Final § 1926.1203(e)(2)(viii) requires an employer to provide a safe means of access and egress during confined space entries under final § 1926.1203(e). For example, when employees are working in an underground vault, the employer must provide, and ensure the use of, a safe means of entry into and exit from the underground vault, and ensure that the method complies with applicable OSHA requirements (*e.g.,* 29 CFR part 1926, subpart X—Stairways and Ladders). Providing proper entry and exit equipment such as ladders is critical under emergency-egress conditions to ensure that employees exit a PRCS in a timely and safe manner. Proposed § 1926.1216(c)(3) required that employers provide a safe method of entry and exit, and that this method comply with applicable OSHA requirements. This final provision retains the proposed requirement for a safe means of entry and exit, but did not retain the language requiring compliance with other ''applicable OSHA requirements'' because it is unnecessary: Such requirements apply regardless of whether this statement is included in the final rule. If another OSHA standard covers the means of entry and exit, the employer must comply with that applicable standard.

One commenter supported the proposed rule's requirement for safe entry and exit (ID–220, p. 8). Two others commenters agreed that assuring safe entry and exit is necessary, but asserted that it is often infeasible to use stairways that meet the requirements for stairways or ladders that comply with 29 CFR part 1926, subpart X's 4:1 ratio because of the configuration of these spaces (ID–075, p. 10; ID–124, p. 9). Subpart X contains many requirements for safe stairways and ladders, including the spacing between steps and rungs, the condition of the ladders, and the ratio of 4:1 for the vertical angle of portable non-self-supporting ladders relative to the structures supporting the ladders (see 29 CFR 1926.1050 *et seq.*). These comments seem to be requesting a blanket exemption from these OSHA requirements, but this request is overly broad. Even these commenters did not argue that all requirements of subpart X would be infeasible, or that the requirements in question are always infeasible. Employers may assert on a case-by-case basis under this standard, as they could under any other OSHA standard, that a requirement is infeasible in a particular situation. In such a situation, the employer has the burden of proving infeasibility. The employer also must make every effort to abate the hazard caused by having the ladder at a steeper angle than permitted, possibly by securing the top and bottom of the ladder while it is in use so it will not slip, and by training employees on climbing at a steeper angle.

Final § 1926.1203(e)(2)(viii) also requires that an employer use hoisting systems designed and manufactured specifically for personnel hoisting. This provision includes an exception to this requirement that allows for the use of job-made hoisting systems if a registered professional engineer approves these systems for personnel hoisting prior to use in entry operations regulated by § 1926.1203(e). Unlike the proposed rule, the final rule requires engineer's approval to be in writing to ensure that the specifications and limitations of use are conveyed accurately to the employees implementing the job-made hoist, and that the approval can be verified. However, the final rule prohibits the use of commercial hoisting systems not designed and manufactured specifically for personnel hoisting because OSHA believes that employers cannot use such hoisting systems safely for this purpose. The requirements of final § 1926.1203(e)(2)(viii) for hoisting systems will eliminate further injuries and deaths of employees that could occur from the use of a hoisting system not designed specifically for personnel hoisting. This final rule provides employers with flexibility in choosing personnel hoisting systems by allowing a registered professional engineer to approve a job-made system. OSHA believes that either option ensures that the personnel hoisting system will meet the design specifications needed for employees to safely access a space. This final provision ensures that authorized entrants will always have a safe and effective means of entering and exiting the space, including escaping during an emergency.

There is no corresponding general industry provision that has requirements similar to final § 1926.1203(e)(2)(viii) for the alternative entries regulated under § 1910.146(c)(5). Section 1910.146(d)(4)(vii) requires safe access and egress, but that provision does not explicitly apply to the alternate procedures used under § 1910.146(c)(5). However, hazardous conditions may still arise in these spaces, particularly if the ventilation system stops functioning, thus making safe exit of entrants necessary. None of the comments OSHA received on proposed § 1926.1216(c)(3) provided a reason to exclude these requirements from the final standard. The same reasons provided in this preamble for requiring safe access and egress during permit-space operations governed by final § 1926.1204 also apply to the spaces regulated under final § 1926.1203(e) and, therefore, OSHA adopted the proposed requirement in this final rule.

Paragraph (e)(2)(ix). Final § 1926.1203(e)(2)(ix), which is identical to general industry § 1910.146(c)(5)(ii)(H), requires the employer to verify that the permit space is safe for entry and that the employer took the measures required by final § 1926.1203(e)(2). This provision also is similar to proposed § 1926.1216(d)(4), though it is less detailed than that proposed provision. The verification must be in the form of a certification that contains the date, the location of the space, and the signature of the certifying individual; the employer must make the certification available to entrants. The certification, in combination with the documentation required under final § 1926.1203(e)(1)(v), will document the employer's efforts to comply with final § 1926.1203(e)(2), enable OSHA and the employer to evaluate compliance with the standard, and, if permit-space incidents occur, assist OSHA and the employer in ascertaining the causes of those incidents.

One commenter supported the more detailed documentation requirements specified by the proposed rule, and the requirement in proposed § 1926.1216(a)(3) and (d)(1) to verify prior to entry that physical hazards remain isolated (ID–220, pp. 6–7). The commenter noted that these requirements serve as an ''important check that measures that may have been taken in weeks, days, or . . . a previous work shift are still in place and effective'' (id.). This final rule preserves the important check function because it also requires documentation of the isolation or elimination of physical hazards, in final § 1926.1203(e)(1)(v), and provides that entry under final § 1926.1203(e)(2) can occur only under the conditions set forth in final § 1926.1203(e)(1). This final rule, however, does so with the flexibility of the more performance-orientated language of the general industry standard.

Final § 1926.1203(e)(2)(ix) also requires that the employer date the certification and make it available to entrants. This requirement ensures that the certification provides information to the entrants about the latest conditions in the space the entrants will soon be entering. One commenter complained that requiring the name and signature of the individual who completed the isolation work, as the proposed rule did, could cause unspecified logistical problems (ID–114, p. 2). OSHA believes that requiring the signature only of the individual who provides the certification, as required by the general industry standard, will resolve any logistical problems.

Another commenter noted that using the term ''verification document'' in the proposed rule for spaces equivalent to the spaces regulated by final § 1926.1203(e), while using the term ''entry permits'' for other permit spaces in the proposed rule, was confusing (ID–099, p. 3). The documentation requirement in proposed § 1926.1216 was more detailed than the documentation requirement in this final rule and, thus, more similar to an entry permit. Final § 1926.1203(e)(2)(ix) uses the term ''certification,'' and this certification contains much less information than the entry permits required for other permit spaces and, therefore, is distinct (see final § 1926.1206). The general industry standard also uses this terminology, and, given the differences in documentation for the two types of spaces in the final rule, the Agency believes that the terminology is clear.

Paragraph (f). Final § 1926.1203(f), which is nearly identical to the general industry standard at § 1910.146(c)(6), addresses the reevaluation of confined spaces. This final provision requires each entry employer to reevaluate non-permit required confined spaces when there is a change in use or configuration that may increase the hazards to entrants, and to reclassify the space as a permit space if necessary. The Agency believes this requirement is necessary because conditions around and in confined spaces may change, especially when multiple employers are performing various construction activities around or in the space. Consequently, when indications of changes in the previous conditions arise that may increase the likelihood for a hazard to develop, the employer must reevaluate the confined space to ensure adequate employee protection. Final § 1926.1203(f) differs from the general industry rule in that it refers to ''each entry employer'' rather than ''the employer'' to emphasize that reevaluation is the responsibility of each employer that conducts entry operations in a confined space.

Several commenters were unsure what type of new information would trigger reevaluation under final § 1926.1203(f) (ID–098, p. 1; ID–124, p. 8). These commenters asked, for example, whether working with gasoline equipment near a confined space or driving a vehicle near a confined space would trigger reevaluation. Whether these conditions would trigger a reevaluation depends on whether it is foreseeable that the operation of the equipment or vehicle could increase the hazards in the space, such as by creating emissions that could enter the space or sparks that could ignite a fire in the space. Indications of a need for reevaluation may include, but are not limited to: (1) A change in the configuration or use of, or in the type of work conducted or materials used in, the confined space; (2) new information regarding a hazard in or near a confined space; and (3) when an employee or authorized employee representative provides a reasonable basis for believing that a hazard determination is inadequate (see also § 1926.1204(e)(5)). OSHA does not expect employers to reevaluate spaces when trivial changes occur that do not affect the characteristics of the space or the work performed in the space.

One commenter suggested that OSHA include the time lapse since the initial evaluation as an indication of the need for a reevaluation (ID–013, p. 4). This commenter seems to be addressing situations in which several days or weeks could elapse between entries into a confined space, during which changes in environmental conditions and other conditions could occur that may increase hazards in the confined space. For example, a container of coating chemicals left slightly ajar in a space, or a substance that is leaching slowly through the soil into a new construction space, might release fumes at a slow rate so that they would not become concentrated or hazardous over the course of a single day if the space has some ventilation, but could create a hazardous atmosphere if left in a closed and non-ventilated confined space for a longer period of time. OSHA agrees that employers should consider elapsed time since the last evaluation in determining when to reevaluate a confined space because of the possibility that hazards may increase during this period. Unlike proposed § 1926.1207, which listed conditions that would require reassessment, this final provision uses the more performance-oriented language of the general industry rule. Therefore, this final provision does not list all the conditions that could trigger a reevaluation of the space because the circumstances that could increase the hazards in a space and prompt a reevaluation are too numerous to list.

One commenter was unsure how the entry employer would be able to detect whether changing conditions would require reevaluation (ID–086, p. 5). According to this commenter, the language of proposed § 1926.1204(b) did not require the employer to obtain information necessary to classify a space. The commenter's reading of the proposed rule is incorrect, and would also be incorrect of the final rule. Final § 1926.1203(a) requires each employer that has employees who may work in a confined space to ensure that a competent person identifies all confined spaces on the site, and to determine, through initial testing as necessary, which of these spaces are permit spaces, and to consider and evaluate other elements of the confined space. Therefore, under § 1926.1203(f) of this final rule, the entry employer must also ensure that a competent person compile the information necessary to determine whether a reevaluation is necessary, and conduct the reevaluation when necessary.

Paragraph (g). Final § 1926.1203(g), which is similar to the general industry standard at § 1910.146(c)(7), allows an employer to reclassify a permit space as a non-permit confined space only under the limited circumstances set forth in final § 1926.1203(g)(1)–(4). Final § 1926.1203(g) is substantively similar to proposed § 1926.1217(a). When there is no actual or potential hazardous atmosphere present in the space, and the employer eliminates all physical hazards in a space, this section allows an employer to reclassify the space as a non-permit confined space. The Agency believes that, in some instances, the procedures specified by final § 1926.1203(g) will be more efficient and less costly to implement than permit-space requirements. The Agency made three non-substantive changes from § 1910.146(c)(7) in the introductory paragraph of final § 1926.1203(g). First, OSHA added the word ''only'' to the provision. Second, OSHA changed ''under the following procedures'' to ''when all of the applicable requirements in paragraphs (g)(1) through (g)(4) have been met.'' OSHA made these non-substantive changes to clarify that an employer may use only these procedures to reclassify a permit space under this rule, and that the employer must comply with each of the provisions under final § 1926.1203(g) to reclassify a permit space. Third, to provide consistency with the requirement that an employer use a competent person to conduct the initial evaluation of the space, the final rule specifies that a competent person must also conduct the reevaluation and reclassification of the space.

One commenter requested that OSHA clarify whether employers must provide attendants or retrieval systems for spaces when final § 1926.1203(g) applies (ID–099, p. 4). Another commenter asserted that OSHA should require attendants for spaces regulated by final § 1926.1203(g) (ID–060, p. 3). Final § 1926.1203(g) does not require compliance with the attendant or rescue provisions of this final rule once the space has been reclassified as a non-permit space. Prior to the reclassification, however, the full permit program requirements apply. In general, such requirements are unnecessary for a space that has been reclassified as a non-permit space under § 1926.1203(g) because, to qualify as a non-permit space, there can be no actual or potential hazards in the space. However, an employer may elect to comply with the PRCS requirements, including the attendant and rescue provisions, even if the employer reclassifies the space as a non-permit space under final § 1926.1203(g).

Paragraph (g)(1). Final § 1926.1203(g)(1), which is identical to general industry § 1910.146(c)(7)(i), ensures that an employer may only reclassify a PRCS as a non-permit space if no actual or potential atmospheric hazards are present and the employer eliminates all other hazards in the space. This final provision also is similar to proposed § 1926.1217(a)(1) and (d)(1). OSHA expects that this provision will apply primarily to spaces where the employer eliminated or isolated the physical hazards. While this final provision would allow employers flexibility in the methods and procedures they use to identify and eliminate physical hazards, it would not relieve them from conducting a thorough assessment of the space and identifying hazards that include: Existing or potential liquids, solid materials, and electricity associated with processes; the use of equipment, ductwork, and conduits with exposed valves or that terminate in the confined space; exposed and energized electrical conduits; connected rooms and reservoirs that present engulfment hazards; and any other recognized hazards covered by OSHA construction standards or the general duty clause, 29 U.S.C. 654(a)(1). OSHA believes that eliminating or isolating all physical hazards in the space protects employees who perform construction work in the space. For additional information about isolating spaces within sewers and other continuous confined spaces, see the discussion of § 1926.1204(c)(3).

Paragraph (g)(2). Final § 1926.1203(g)(2), which is similar to the general industry standard at § 1910.146(c)(7)(ii), requires an entry employer considering reclassification to eliminate or isolate confined space hazards, when possible, without entering the space. This requirement parallels the requirement in final § 1926.1203(e)(1)(iv), and OSHA is including the requirement here for the same reasons, although it applies to different spaces. If it is not possible for an entry employer to eliminate or isolate confined space hazards without entering the space, then final § 1926.1203(g)(2) requires the entry employer to comply with all PRCS procedures in final §§ 1926.1204–1211 until elimination or isolation of the hazards is complete.

Final § 1926.1203(g)(2) differs slightly from the general industry requirement in that it contains a new first sentence clarifying that the entry employer must eliminate or isolate the hazards without entering the space unless it is infeasible to do so. This slight revision, which

OSHA based on proposed § 1926.1217(a)(3), improves employee protection by reducing unnecessary entry into permit spaces for classification purposes. OSHA received no comments on the parallel provision in the proposed rule.

In the final rule, OSHA also allows employers to isolate physical hazards, rather than eliminate them entirely. The effect must be the same—employees must be effectively protected from any potential exposure to any hazard—and it is therefore substantively similar to the general industry rule. OSHA included the isolation option, however, in response to comments indicating that full permit program requirements were not necessary when employers can use engineering controls to prevent employee exposure to physical hazards, even if the item causing the hazard is not totally removed from the space (see, *e.g.,* ID–210, Tr. pp. 56, 308–309, 327–328).

For the purpose of reclassifying a permit-required confined space that has potential energy sources in it, the methods the employer must use depend on the types of energies requiring elimination or isolation. OSHA's lockout/tagout requirements address electro-mechanical hazards, but lockout/tagout will not eliminate hazards associated with flowable materials such as steam, natural gas, and other substances that can cause hazardous atmospheres or engulfment hazards in a confined space. See OSHA Directive CPL 02–00–147: The Control of Hazardous Energy—Enforcement Policy and Inspection Procedures, at pp. 3–10 (Feb. 11, 2008). Employers can isolate these hazards by using the techniques described in the definition of the terms ''isolate'' or ''isolation'': blanking, blinding, misaligning or removing sections of lines or pipes, and a double-block and bleed system. See also August 25, 1995, letter to William K. Principe.

''Elimination'' means no on-going measures are necessary to keep the space free of a hazard; if continued operation of ventilation is required to address a hazard, for example, then the hazard is controlled, not eliminated. See, *e.g.,* September 19, 1994, letter to Edward Donoghue. If the employer uses ventilation to eliminate an atmospheric hazard from a space (as opposed to controlling the hazard), the employer must perform verification monitoring with the ventilation system off to establish the elimination of any atmospheric hazards before reclassifying the space. See November 11, 1993, letter to Trey Mayfield. Employers usually may not reclassify some confined spaces, such as tank containers, as non-permit spaces because residues may persist, resulting in potential atmospheric hazards. For example, the tank shell could oxidize, former contents could leach after absorption into the tank coating or lining, and contents trapped between the lining and the tank shell could leak. See September 20, 1994, letter to J.B. Saunders.

OSHA notes that the elimination of a hazard as required by final rule § 1926.1203(g)(2) will not necessarily result in the re-classification of the space as a non-permit space. The employer must still ensure that a competent person performs a full reevaluation of the permit space before reclassifying the space. For example, if an employer completes an initial evaluation of a space and determines that there is a single electrical hazard that can be locked out, but no atmospheric hazards, the employer must lock out the electrical hazard, entering the permit space under the full permit program requirements of § 1926.1204 if entry is necessary. Because the person who locks out the energy hazard may or may not be focused on the evaluation of the entire permit space, that employer's competent person must still verify that that the hazard is properly isolated, and that no other hazards are present, before the employer may re-classify the space as a non-permit space.

Final § 1926.1203(g)(2) also includes the note from the general industry standard stating that control of atmospheric hazards through forced-air ventilation does not constitute elimination of the hazards. Final § 1926.1203(e), not § 1926.1203(g), covers permit-space entry when the employer can demonstrate that the forced-air ventilation alone will *control* any atmospheric hazards within in the space. Final 1926.1203(g) requires the complete elimination of such hazards.

OSHA revised ''hazards'' to ''atmospheric hazards'' in the second sentence to reflect the change in final § 1926.1203(e)(1)(i), which will permit employers to use the alternative procedures if they isolate or eliminate all physical hazards. Employers may reclassify the space as a non-permit space under final § 1926.1203(g) even if a physical hazard remains, so long as the hazard is completely isolated such that employees cannot be exposed to it. OSHA does not view this as a substantive change from the general industry standard, which allowed employers to treat isolation of physical hazards as elimination of those hazards for purposes of reclassifying a permit space. See October 12, 1995, memorandum to Linda Anku.

OSHA refers to ''atmospheric hazards'' in the note to § 1926.1203(g), rather than using the term ''hazardous atmosphere'' as in § 1926.1203(e), to emphasize the distinction between control and elimination of airborne hazards. A ''hazardous atmosphere'' requires certain levels of contaminants in the air (*e.g.,* a flammable gas over 10 percent of its LFL or a concentration of a substance exceeding its PEL). The alternative procedures in final § 1926.1203(e) may be used when the employer eliminates any ''hazardous atmosphere'' even if the employer anticipates some presence in the air of a hazardous substance that must be controlled through practices to keep the substance at safe levels. Therefore a § 1926.1203(e) space remains a permit-required space that can be entered without a permit so long as the controls remain effective. Final § 1926.1203(g), in contrast, requires the total elimination of ''atmospheric hazards'' prior to entry, which means that the breathing atmosphere contains no potentially hazardous substance that would make it a potentially hazardous atmosphere; therefore, the employer has no need to maintain practices to control it (hence, it is not a permit-required space). For example, an employer can eliminate a ''hazardous atmosphere'' of methane by reducing the concentration of methane in the space from 12 percent of its LFL to 9 percent. However, the methane is still an ''atmospheric hazard'' at the lower 9 percent concentration because, without the alternative procedures that include ventilation, the level of methane could rise and injure or kill the workers inside the space. To eliminate the ''atmospheric hazard'' caused by methane, the employer must eliminate all of the methane from the space, and maintain this condition without forced-air ventilation or other practices.

Paragraph (g)(3). Final § 1926.1203(g)(3), which is nearly identical to the general industry rule at § 1910.146(c)(7)(iii), requires an entry employer seeking to reclassify a permit space to document the basis for determining that it eliminated all permit-space hazards through a certification that contains the date, the location of the space, and the signature of the certifying individual. In addition, the employer must make the certification available to each employee entering the space or his or her authorized representative. The employer must substantiate all determinations so that employers, employees, and the Agency have the means necessary to evaluate those determinations and ensure compliance with the conditions that would enable the employer to conduct entry operations using the alternate procedures following reclassification.

This final provision is necessary to protect employees from physical or atmospheric hazards on initial entry into the space under final § 1926.1203(g), and to ensure that the space remains safe during entry operations. The requirement to make the certification available to employees or their authorized representatives ensures that entrants have the information necessary to detect developing hazards while they are working in the space.

Proposed § 1926.1219(d) provided that the employer must maintain an equivalent verification document until the work in the confined space is complete. One commenter asserted that OSHA should require employers to maintain records of these determinations for years to aid OSHA and the National Institute for Occupational Safety and Health (NIOSH), and to protect a company from potential litigation in the future; the commenter, however, did not specify exactly how OSHA and NIOSH would use these records (ID–060, p. 2). Another commenter stated that employers only need to maintain the certification until the completion of the project (*i.e.,* as long as there are entrants, the certification must be available to those entrants) (ID–108, p. 3). Nevertheless, the Agency recognizes that confined spaces not classified as PRCSs do not involve hazards as defined in this standard. Therefore, unlike permit-space entry permits, the Agency believes that it is not necessary for entry employers to maintain the certification required under final § 1926.1203(g)(3) for review and evaluation after completion of the work. The Agency agrees with the latter commenter that the purpose of certification is to allow employees and employers to detect any changes from the original entry conditions during confined space operations, and believes that the minimal useful information gained from these records likely would not justify the burden of maintaining them. Furthermore, no provision in this final rule prohibits an entry employer from maintaining this information for a period longer than the period required by the final rule.

Paragraph (g)(4). Final § 1926.1203(g)(4), which is similar to § 1910.146(c)(7)(iv), requires that whenever a hazard arises in a space reclassified under final § 1926.1203(g), employees must evacuate the space, and the entry employer must reevaluate the space. This final provision also is similar to proposed § 1926.1217(e)(2). The Agency believes that this final provision is necessary to protect entrants when conditions around and in confined spaces change, especially when performing construction activities around or in the space. Having a hazard arise in a reclassified space indicates that the previous evaluation was insufficient or that there has been a significant departure from the previous conditions; therefore, a thorough reevaluation of the entire space is critical.

This provision indicates clearly that entry employers retain responsibility for the safety of employees who enter spaces after they reclassify the spaces as non-permit confined spaces. The employer must determine if it is still appropriate, under the circumstances identified through the reevaluation, to classify the space where the hazard arose as a non-permit confined space. A reevaluation aimed at reestablishing compliance with final § 1926.1203(g) will involve the demonstrations, testing, inspection, and documentation required in paragraphs (g)(1) through (g)(3) of this final rule. OSHA anticipates that some employers will seek to reestablish compliance with final § 1926.1203(g), while others will choose to conduct the remainder of its entries in that space in accordance with the full permit-space program requirements specified by final §§ 1926.1204–1211. The Agency's concern is that the approach chosen must adequately protect employees who enter the spaces.

In some cases employers might need to require their employees to exit the space temporarily during a limited event where the hazard is already known and temporary, such as when an employer temporarily removes workers from an underground confined space while other work is conducted above the underground confined space. In this situation, the employer can allow employees to re-enter without re-classifying the space as a permit space after completing a reevaluation of the structural integrity of the space to make sure that the work above the underground confined space did not affect that space. In other cases, however, a new unanticipated hazard in the space means that the status of the space reverts to a permit-required confined space until the employer can identify and address the hazard and reclassify the space as a non-permit space under § 1926.1203(g). As a result, all of the provisions of this standard applying to a permit space apply, and entry must be conducted in accordance with the permit program requirements of § 1926.1204 and permitting requirements of § 1926.1205. The fact that the spaces addressed in § 1926.1203(g) were previously permit spaces before reclassification as non-permit spaces means that it is imperative for the entry employer to proceed with caution whenever a new hazard emerges.

Section 1926.1203(h) and (i)—Information Sharing and Coordination Duties at Multi-Employer Worksites

The discussion of paragraphs (h) and (i) has three parts:

(1) An overview of host employers and controlling contractor responsibilities;

(2) OSHA's authority to require host employers and controlling contractors to share information to protect the employees of others; and

(3) A paragraph-by-paragraph explanation of § 1203(h) and (i).

(1) Overview of Host Employers and Controlling Contractor Responsibilities

Timely information exchanges and coordination of work activities can be critical in safeguarding employees performing confined-space work, particularly on multi-employer worksites where one employer's actions can affect the health and safety of another employer's employees. As OSHA noted in its explanation of the proposed rule, there are a number of contractors and subcontractors performing jobs on most construction worksites, and there may be employees of different employers performing work within the same confined space. In many instances, employees of one subcontractor will enter a confined space after another subcontractor's employees complete their work within the space.

OSHA recognizes that both the controlling contractor and the host employer may have crucial information about confined spaces at a construction worksite. Therefore, in the proposed standard, OSHA adopted the information-sharing duties specified for the host employer in the general industry standard (§ 1910.146(c)(8)) and proposed applying them to both the host employer and the controlling contractor. As one labor organization noted, based on the experience of its members in both general industry and construction settings, worker safety is affected by timely information sharing in both general industry work and construction:

> [T]he problem posed by contracting out work in both situations is nonetheless the same—how to ensure that subcontractors that are in a work location for a limited period of time have the best possible information to

identify the location of confined spaces, assess their hazards, and ensure that their employees can perform their assigned duties safely.

(220.2, pg. 10.)

The same commenter also explained that information sharing may be even more critical in the construction setting because different workers may perform many different activities in the same space at different times, which can result in hidden dangers:

Many chemical substances used in the construction industry, once in place, are neither detectable nor hazardous until exposed to a particular work process. For example, surface coatings such as paints and epoxies are seemingly stable—and are generally undetectable through air monitoring—once applied and dried. However, these same substances may create significant safety and health hazards to employees who perform welding and other processes involving heat while working in a confined space. A contractor that performs the routine assessment of physical and atmospheric hazards required by the standard would not necessarily identify these potential hazards.

(ID–213.1, pg. 1.) Similarly, polyurethane is often used for spray foam insulation. When welding or heating in a confined space is performed near spray foam insulation that contains polyurethanes, the heat could cause the polyurethanes to break down and produce hazardous fumes. A contractor may not recognize this hazard during a routine assessment of the space, and would rely on information from a host employer or controlling contract about the potential hazard.

Hidden dangers may also arise while working with equipment in confined spaces. For example, operating internal combustion engines, such as air compressors, pressure washers, and generators in a confined space could lead to carbon monoxide exposure. Because carbon monoxide is a colorless, odorless gas, it is difficult to detect without a monitor or testing equipment. A host employer, controlling contractor, or subsequent entry employer may not realize that carbon monoxide levels in a confined space have changed without communicating with the employer who operated the engine in the space. Similarly, when working with live circuits, an entry employer may reenergize a once de-energized circuit to perform work in a confined space. Communication about reenergized circuits will give the host employer, controlling contractor, and any subsequent entry employer's indication that conditions within the confined space may have changed.

In this final rule, as in the proposed rule, OSHA requires communication and coordination among controlling contractors and subcontractors, and between host employers and controlling contractors. The coordination and information-exchange duties in the final rule are largely the same as the duties required by the proposed rule, although the final rule makes communication with entry contractors the responsibility of the controlling contractor rather than the host employer, and does not contain the proposed rule's additional requirements for identifying the separate classifications of spaces. (See proposed § 1926.1204.)

Based on the record as a whole, OSHA finds that the information-sharing and coordination responsibilities of host employers and controlling contractors required by this final standard are critical means of identifying hidden or latent dangers in permit spaces and for preventing the actions of one employer from exposing another's employees to hazards in a permit space. These provisions will enhance the safety of workers in confined spaces by ensuring that all employers have the previously identified information at their disposal before entry to avoid hidden hazards and to make adequate preparations to protect employees entering permit spaces.

The rule places controlling contractors at the center of this process. Before any employer enters a permit space, the final rule requires controlling contractors to obtain relevant information about confined spaces on the worksite from the host employer, and then to relay that information, along with any other relevant information, to each contractor that will enter the confined space or that will be performing work that could foreseeably result in a hazard within that confined space. (See § 1926.1203(h)(1) and (h)(2).) The controlling contractor is also responsible for coordinating work in and around confined spaces so that no contractor working at the site will create a hazard inside the confined space. (See § 1926.1203(h)(4).) After the entry employer performs entry operations, the controlling contractor must debrief the entry employer to gather information that the controlling contractor then must share with the host employer and other contractors who enter the space later. (See § 1926.1203(h)(5).) Section 1926.1203(i) assigns the role of the controlling contractor to a particular employer in the event there is no controlling contractor for the project. Please see the discussion of § 1926.1203(i), below.

Some commenters expressed concern that the final rule imposes a duty on controlling contractors or host employers to verify the accuracy of the information they receive from other employers (ID–117, pg. 21; ID–078, pg. 1; ID–098, pg. 1). Consequently, one commenter predicted that this duty would cause controlling contractors and host employers to spend too much time and money overseeing their subcontractors' work (ID–120, pg. 2). Two different commenters, however, indicated that a controlling contractor should have even more responsibility, particularly when multiple employers will be working in the same area. The latter commenters argued that the controlling contractor should ''share in'' the ''responsibility'' and costs of permit space entries, including verifying the training of subcontractor employees and communications among employers, particularly when multiple employers enter and work in the permit spaces at the same time (ID–108, pg. 4; ID–210, pg. 60). One of these latter commenters expressed concern that, without controlling contractor verification, ''untrained or unqualified persons would be likely to enter the spaces where a self-declaring system of monitoring is employed'' (ID–108, pg. 4).

The final rule does not require the controlling contractor or host employer to verify entry-employer information (testing, monitoring, etc.) or to have its own employees enter any confined space or take other direct actions to discover new information; requiring controlling contractor employees to enter permit spaces might *increase* exposure of unqualified persons to the hazards of permit spaces. Unless the controlling or host employer allows its own employees into a permit space, the final rule only requires the controlling contractor or host employer to share information that is already in its possession or that it receives from other employers. OSHA agrees that it is important to prevent untrained or unqualified persons from entering the space. The type of information that the controlling contractor must share with subcontractors, and that the host employer must share with the controlling contractor, is identical to the type of information that the host employer must share with contractors under the general industry standard. (See § 1910.146(c)(8).) Separately, controlling contractors still have the same duty they have always had to exercise reasonable care to ensure compliance with the requirements of other applicable standards (*e.g.,* welding standard, respirator standard) in accordance with OSHA's multi-employer citation policy. The specific communication and coordination requirements imposed by this rule are discussed in the paragraph-by-paragraph explanation of § 1926.1203(h) that follows the discussion of OSHA's authority for these requirements.

(2) OSHA's Authority To Require Host Employers and Controlling Contractors To Share Information To Protect the Employees of Others

Two commenters argued that OSHA lacks the authority to impose any requirements on host employers or controlling contractors except with respect to their own employees. (112.1, p. 14–15; and 117.1, pg. 7–12.) One of these commenters stated that a ''controlling contractor . . . may not be cited if it did not create a cited hazard and it has no employees exposed to the hazard,'' explaining that the ''legal analysis supporting this point is set forth well'' in the Occupational Safety and Health Review Commission (OSHRC) decision in *Secretary of Labor* v. *Summit Contractors, Inc.,* 21 BNA OSHC 2020 (No. 03–1622, 2007). (112.1, p. 15.) OSHA notes that both the reviewing federal court and the Commission itself subsequently rejected that view in *Solis* v. *Summit Contractors, Inc.,* 558 F.3d 815 (8th Cir. 2009) and *Secretary of Labor* v. *Summit Contractors, Inc.,* 23 BNA OSHC 1196, 1202–03 (No. 05–0839, 2010).

OSHA has clear authority to require host employers and controlling contractors to comply with the information-sharing and coordination provisions in the final rule. The preamble to the proposed rule discussed in detail OSHA's authority to impose the duties in this standard (see 72 FR 67358–67360, Nov. 28, 2007), and the Agency reasserts the same basis with respect to this final rule, along with the 2009 and 2010 *Summit* decisions. First, the plain language of the OSH Act and its underlying purpose support OSHA's authority to place requirements on employers that are necessary to protect the employees of others. As explained later in this section of the preamble, the overall sharing of information that will occur in accordance with the final host-contractor provisions will help protect the employees of both host employers and contract employers. Second, congressional action subsequent to passage of the OSH Act recognizes this authority. Third, OSHA consistently interprets its statutory authority as permitting it to impose obligations on employers that extend beyond their own employees, as evidenced by the numerous standards (including several construction standards) that OSHA promulgated previously with multiemployer provisions. OSHA provided several examples of these standards in the preamble to the proposed rule, and OSHA subsequently promulgated additional rules requiring controlling entities and utilities to take steps to protect other employers' employees during crane operations. (See 29 CFR 1926.1402(c), 1926.1402(e), 1926.1407(e), 1926.1408(c), and 1926.1424(b).) Finally, numerous courts of appeal and the OSHRC have upheld OSHA's authority to place obligations on employers that reach beyond their own employees. In addition to the authorities listed in the preamble to the proposed rule, the Third Circuit upheld the information-sharing requirements in the Asbestos Standard for the construction industry, noting: ''We are not convinced that the Secretary is powerless to regulate in this [way], especially given the findings she has made regarding the importance of building owners in the discovery and communication of asbestos hazards.'' *Secretary of Labor* v. *Trinity Indus., Inc.* (*Trinity*), 504 F.3d 397, 402 (3d Cir. 2007).

(3) Paragraph-by-Paragraph Explanation of § 1926.1203(h) and (i)

Final § 1926.1203(h) is substantively similar to the corresponding provision for general industry confined spaces at § 1910.146(c)(8), but modified to include requirements for controlling contractors that were included in the proposed rule. The type of information that the controlling contractor must share with entry contractors, and that the host employer must share with the controlling contractor, is identical to the type of information that the host employer must share with contractors under the general industry standard. The primary difference in this area between this rule and the general industry standard is that this rule makes the controlling contractor the central point of the information exchange, while the host employer is the central point in the general industry standard. The final rule also structures the requirements in chronological order to make them easier to follow, setting out the information sharing and coordination duties prior to entry, and then setting out the duties during and after the entry. These requirements are an efficient and necessary way to ensure that all employers have important information about the confined-space hazards so each employer can provide adequate protection to employees it directs.

OSHA is designating the controlling contractor, rather than the host employer, as the information hub for confined-spaces information-sharing and coordination because the controlling contractor's function at a construction site makes it better situated than the host employer (assuming the host employer is not also the controlling contractor) to contribute to, and to facilitate, a timely and accurate information exchange among all employers that have employees involved in confined-space work. General industry worksites, such as a refinery or factory, are likely to be stable, and owned and under the control of the host employer for a substantial length of time. The host employer is well suited in that scenario to facilitate information sharing because the host employer is most likely to have control of the site and information about it before another employer performs confined space work there. On a construction worksite, the controlling contractor has overall authority for the site and is best situated to receive and disseminate information about the previous and current work performed there. Evidence introduced at the hearing indicated that the controlling contractor communicates with entry employers more frequently than the host employer does (ID–210, pg. 315–320). In contrast, the record shows that host employers are not always directly involved in the construction process and, therefore, are often less well situated than controlling contractors to facilitate information-sharing (ID–220, pg. 14–15).

The final rule is substantively similar to the proposed rule, except that the proposal would have required the host employers to communicate directly with entry employers. For the reasons discussed in the prior paragraph, OSHA assigned the controlling contractor that function in this final rule, giving only limited information-exchange requirements to the host employer. In the final rule, OSHA also clarified the scope of the information exchanges by requiring the controlling contractor to coordinate and share information with entities whose activities could foreseeably result in a hazard in the confined space, as opposed to all contractors ''near'' the permit space. Most other differences between these requirements in the proposed rule and the final rule are stylistic in nature and intended to bring it closer to the text of general industry rule.

In the following, more detailed discussion, paragraph (h)(1) contains the pre-entry duties of host employers, (h)(2) the pre-entry duties of controlling employers, and (h)(3) the pre-entry duties of entry employers. Paragraph (h)(4) then describes the coordinating responsibilities of controlling and entry employers, and (h)(5) explains their duties during and after entry. Finally, paragraph (i) explains requirements when there is no controlling employer.

Paragraph (h)(1)—Pre-entry duties of host employer. The host employer serves an important role in providing information because the host employer is likely to be the employer most familiar with the property and the most likely to retain, between separate construction projects, information about permit spaces on the property, particularly in construction involving existing facilities. (ID–141, pg. 3.) As a result, the host employer may have information about hidden dangers or other information that can help reduce employee exposure to hazards in permit spaces.

Final § 1926.1203(h)(1) requires the host employer to share information it has about the location of known permit spaces, and any previous steps that it took, or that other employers took, to protect workers from the hazards in those spaces. Telling other employers about each known permit space on the worksite is essential to achieving the purpose of the information-exchange requirements, which is to ensure that contractors with employees entering confined-spaces are aware of the type and degree of these hazards and can take necessary safety precautions. Having information about the previously identified hazards in a space, and the previous efforts to address them, will assist the entry employer in ascertaining if those hazards still exist, and help the entry employer avoid problems addressing the hazards that previous entry employers encountered. Final paragraph (h)(1) is similar to the corresponding provision for general industry confined spaces and to proposed § 1926.1204(a), although the host employer must share the information with the controlling contractor instead of the entrants. The controlling contractor then shares it with the entry employers. OSHA did not receive any comments specifically opposing the inclusion of this information in the information-exchange requirements.

The proposed rule provided that host employers had to share the information about known hazards only ''if they have it,'' and to identify confined spaces when the host employer or controlling contractor ''actually knows'' that they are confined spaces. (See 72 FR 67407.) The purpose of including these phrases in the proposed rule was to clarify that the controlling contractor and host employer need not engage in extensive and burdensome investigations of the history of the worksite, and, most importantly, that these employers ''are not required to enter a confined space to collect the relevant information.'' (See 72 FR 47933.) OSHA is retaining the same approach in the final rule, but refers to ''known'' permit spaces instead of the more awkward ''space that the host actually knows is a confined space.'' The final rule also narrows the requirement by focusing specifically on known *permit* spaces, rather than to all confined spaces, because these spaces pose the greatest hazards to employees. Narrowing the requirement also reduces the number of information exchanges and matches the type of information that the host employer must share, which is linked to the nature of the space as a permit space, *i.e.,* information about the hazards that make the space a permit space, and the previous efforts to address those hazards. This narrowed approach will appropriately focus the exchanges on those spaces with known hazards. In the event that an employer is both a host employer and the controlling contractor, the employer has the information that complies with the provisions of final § 1926.1203(h)(1), (h)(2), (h)(4), and (h)(5).

For example, a host employer hires a controlling contractor to build an underground storage facility and discovers during that process that there is an underground stream below the property. Years later the host employer hires a different controlling contractor to expand the underground storage facility in a manner that will include several confined spaces. In this example, the host employer must share the plans for the existing storage facility and identify the location of the underground stream so that the controlling contractor and the relevant subcontractors can develop a permit-space program appropriate to address potential engulfment hazards. The host employer also would be responsible for disclosing the storage of any potentially hazardous chemicals or other substances in the existing storage facility. However, the final rule would not require the host employer to drill for additional undiscovered underground rivers, conduct soil tests, or test the air in the existing storage facilities.

Paragraph (h)(2)—Pre-entry information-sharing duties of controlling contractors. In paragraph (h)(2), OSHA requires controlling contractors to obtain the information specified in paragraph (h)(1) from the host employer (*i.e.,* the location of permit spaces, the known hazards in those spaces, measures employed previously to protect employees in that space). Then, before permit space entry, it must relay that information to any entity entering the permit space and to any entity whose activities could foreseeably result in a hazard in the confined space. (See § 1926.1203(h)(2)(ii).) The controlling contractor must also share any other information that it has gathered about the permit space, such as information received from prior entrants.

The final rule varies slightly from the proposal in requiring controlling contractors to share the information with any ''entity,'' rather than other contractors or employers, to ensure that the controlling contractors also share this information with independent contractors who are not ''employers'' under the OSH Act. These contractors pose the same issues as do employers when working in or around permit spaces, *i.e.,* they may increase hazards for others working in or around the space if they do not comply with the provisions of this standard. OSHA concludes that it is equally important for controlling contractors to pass along information about permit space hazards to independent contractors, and to coordinate their activities as required in this standard. Although OSHA is not directly requiring independent contractors to share information in accordance with the standard, OSHA expects that controlling contractors will be able to obtain the necessary information as a result of their control over the worksite.

OSHA requires the controlling contractor to obtain the information from the host employer before entry operations begin so that the controlling contractor can share the information with the entities specified in § 1926.1203(h)(2)(ii) in time to minimize potential employee exposure to hazards in the confined spaces. This provision was not in the proposal; the proposal required both the host employer and controlling contractor to share information directly with the entry employer. (See proposed § 1926.1204(a).) OSHA added this provision to the final rule to conform to the final rule requirement that the host employer share information with the controlling contractor rather than the entry employer. The final standard makes it explicit that the controlling contractor and host employer have separate duties with respect to the same information: the controlling contractor must obtain it under final § 1926.1203(h)(2)(i) and the host employer must share it under final § 1926.1203(h)(1).

These complementary duties also address the concerns of some commenters that host employers are often state or local government entities not subject to the OSH Act. (ID–78, p. 2; ID–141, pg. 3.) The commenters expressed concern that it might be difficult for the controlling contractor to obtain the information from a government entity not subject to § 1926.1203(h)(1), and that the host's failure to provide the information could subject the controlling contractor to heightened liability. In such cases, OSHA expects the controlling contractor to exercise due diligence in attempting to obtain the information from the host employer, and believes that most hosts will provide it when the controlling contractor explains that it needs the information in order to perform the job safely and in accord with law.

Final § 1926.1203(h)(2) is similar to the corresponding provisions for general industry confined spaces with a few distinctions. General industry § 1910.146(c)(8)(i) requires the host employer to share the specified information with ''the contractor.'' This final rule requires an exchange of the same information, but § 1926.1203(h)(2) requires the controlling contractor to exchange that information with both the entity entering the permit space and with other contractors working around the permit space.

The general industry rule requires the host employer to inform other employers that they can conduct permit-space entry only by complying with a permit-space program meeting the requirements of the standard (see § 1910.146(c)(8)(i)). There was no specific parallel in the proposed construction rule. This final rule also does not contain a specific parallel requirement because the entry employer's duty to use a valid permit program is explicit in § 1926.1203(d).

OSHA has clarified the requirements for communication with entities whose activities outside a confined space may affect workers inside the space. Many commenters found the terminology of the general industry rule (referring to work ''in or near permit spaces'' in § 1910.146(c)(8)(iii)) and the proposed rule (referring to ''employers'' in proposed § 1926.1209(b)(3).) confusing in the context of a construction worksite.[16] Therefore in this final rule, OSHA refines this requirement by requiring the controlling contractor to provide the information to other entities on the worksite when the activities of these other entities could foreseeably result in a hazard within the confined space. This information-exchange requirement also is similar to the information-exchange requirement in § 1926.65(b)(1)(iv) (Hazardous waste operations and emergency response). Both rules require employers to inform contractors and subcontractors about hazards of the work the contractor will be performing, including hazards of the worksite.

OSHA designed this requirement to protect authorized entrants and others who are part of the permit-space entry process (*e.g.,* the attendant) from a wide variety of potential activities, including those that may be beyond the scope of the permitting process. Therefore, the information-exchange requirement applies to activities outside the permit space that could foreseeably result in a hazard within the permit space, either alone or in conjunction with the activities inside the space. Examples include use of a heavy gas that could enter the space and cause oxygen deficiency or sparks from a welding operation outside the space that could ignite flammable gas inside a confined space. To prevent the creation of confined-space hazards, final § 1926.1203(h)(4) supplements this requirement by requiring the controlling contractor to coordinate the activities of entities either entering the permit space or engaged in actions that could foreseeably result in a hazard within the space.

Paragraph (h)(2)(i). As noted above, final § 1926.1203(h)(2)(i) requires the controlling contractor to obtain from the host employer, before permit-space entry, the host's information regarding permit-space hazards and previous entry operations. OSHA included this provision in the final rule as part of the change to limit the host employer's involvement in the information-exchange process, and to centralize the role of the controlling contractor. The controlling contractor needs this information for dissemination to entities entering permit spaces (final § 1926.1203(h)(2)(ii)), and to fulfill its duty to coordinate permit-entry activities with other work occurring in and around the permit space (see final § 1926.1203(h)(4)).

Paragraph (h)(2)(ii). The final rule requires the controlling contractor to pass along the information it received from the host employer about the permit spaces on the worksite. The controlling contractor is at the hub of the information exchanges in the final rule, so this step is critical to ensuring that the host employer's information reaches the entities entering the permit space and others whose work may create hazards inside the permit space. The parallel provision of the proposed rule, § 1926.1204(a)(1), was potentially duplicative and ambiguous because it required the controlling contractor *and* host employer to provide the same information to the same entities.

Final § 1926.1203(h)(2)(ii)(A) and (B) require the controlling contractor to share with the entities entering the permit space, and any other entity at the worksite whose activities could foreseeably result in a hazard in the permit space, the information that the controlling contractor received from the host employer, as well as any additional information the controlling contractor has about the topics listed in paragraphs (h)(1)(i) through (iii) (*i.e.,* the location of permit spaces, the hazards in those spaces, and any previous efforts to address those hazards). These paragraphs are substantively similar to the general industry requirements at § 1910.146(c)(8)(ii) and (iii). Having information about the previously identified hazards in a space will help the entry employer ascertain whether those hazards still exist.

For employers or other entities whose activities could foreseeably result in a hazard in the confined space, this information will improve their ability to assess whether those activities will create such a hazard, to avoid creating the hazard or to minimize any hazard they create, to prevent their employees' unauthorized entry into a permit space, and to help them prepare for coordination of their activities under final § 1926.1203(h)(4).

Final § 1926.1203(h)(2)(ii)(C) is similar to the general industry standard at § 1910.146(c)(8)(iii) in that it requires the controlling contractor to share with each specified entity any precautions or procedures that the host employer, controlling contractor, or any entry employer implemented earlier for the protection of employees working in permit spaces. This provision also is similar to the proposed standard at § 1926.1204(a)(2)(iii). This final provision requires the controlling contractor to notify the specified entity of the procedures currently used, or previously used, at the permit space, thereby alerting each new entering entity to information that it can use to improve its entry plans and permit program. This provision does not require the controlling contractor to develop entry programs for its contractors.

One commenter urged OSHA to alter the information-exchange requirements in proposed § 1926.1204(a) by requiring the controlling contractor to share all information about precautions or procedures implemented by any employer within a given permit space,

[16] For a discussion of the term ''near'' see the overview of § 1926.1205 in this preamble.

not merely the precautions and procedures the host employer or controlling contractor implemented for that space (ID–220, pg. 16). OSHA agrees, and the final rule requires controlling contractors to share this information because it is likely to be helpful to subsequent entry employers as they assess the spaces and develop their own procedures. This information may also reduce the amount of time it takes subsequent entry employers to develop their own entry procedures. The controlling contractor's experience with a permit space includes information gathered from other entry employers and other sources; the controlling contractor will share this information with subsequent entry employers. If the information about previous procedures came from an entry employer who worked on projects before the controlling contractor became involved, then the controlling contractor would obtain that information from the host employer. If the previous procedures came from an entry employer who worked under the controlling contractor, then the controlling contractor would have obtained the information pursuant to other provisions of this rule.

Examples of Pre-Entry Information-Exchange Duties of Host Employers and Controlling Contractors

Example 1. A controlling contractor is walking the worksite and notices a significant amount of water pooling so that it might enter an underground permit space. The controlling contractor must alert the subcontractor working in that space of the potential for water entering the space or weakening the structure, and must also inform other entities in the area whose activities could foreseeably result in a hazard inside the confined space (*e.g.,* entities whose activities may be contributing to the pooling water, may convey an electric charge through the water into the confined space, or may weaken the structure around the confined space to allow the water to enter the space).

Example 2. The controlling contractor hires a subcontractor to apply a flammable epoxy coating to the walls of a confined space; the subcontractor does so under a permit program, and then cancels the permit in compliance with this final rule. The controlling contractor must inform subsequent employers entering the space about the application of that epoxy and the procedures used to address hazards in the space.

Example 3. If a host employer stored hazardous chemicals in a confined space during a period when leaching of the chemicals could occur, the host employer must disclose that previous use of the space.

Example 4. The controlling contractor hires a welder to weld a new structure inside a fully-enclosed above-ground permit-required confined space. The welder sets up a ventilation system that complies with all applicable OSHA requirements. The controlling contractor also hires a different subcontractor to perform unrelated excavation work 75 yards away from the permit space. The controlling contractor must alert the excavation contractor to the fact that a welder is working in the confined space, that the space has been designated a permit space and must not be entered by any of the excavation contractor's employees, and that the welder is relying on a ventilation system that must not be impacted by the excavation contractor's activities, such as by blocking the ventilation system or by operating heavy machinery, generators, etc. in such a way that their fumes could enter the confined space. In this example it is foreseeable that the excavator might otherwise place dirt from the excavation (the ''spoil pile'') in a location that could interfere with the welder's ventilation system, or add fumes into the confined space. Either action would foreseeably result in a hazard in the permit space. However, absent some other abnormal condition such as an underground gas pipeline running between the excavation site and the permit space, the controlling contractor would not need to ensure any coordination between the excavating activities and the welding activities because the excavation itself (aside from the placement of the spoil pile) is 75 yards away and would not foreseeably result in a hazard in the permit space.

In example 1, the entry employer might not be aware of the hazard from the pooling water or of other hazards that could arise from the activities of others outside the site in conjunction with the pooling water. In examples 2 and 3, both types of information could be critical to employers performing subsequent welding or other tasks that might ignite remaining fumes or release vapors inadvertently.

These information exchanges, in combination with separate OSHA requirements that entry employers share specific information about the permit spaces with controlling contractors, will ensure that each ''downstream'' employer (the employer performing the permit-space entry) receives important information about the relevant permit space in time to address hazards that could endanger employees it directs.

One commenter questioned whether the information duties would apply to all information—both written and oral—the host employer or controlling contractor may receive, rather than merely information that is readily available (ID–153, pg. 18). The obligations in this final rule apply to all information, including both written and oral information the host employer or controlling contractor receives about hazards or potential hazards in a permit space. It is the responsibility of the host employer and controlling contractor to retain this information, which protects employees who are performing permit-space work, and to communicate this information to entry employers and the others identified in the standard.

A different commenter asserted that employers will have difficulty managing and recording the information they are required to communicate (ID–078, pg. 2). However, the record indicates that many construction employers already are following the general industry confined spaces standard, which requires host employers to share similar information (see § 1910.146(c)(8)(ii) and (c)(8)(iii)). This final rule also does not prescribe how employers are to gather, record, or maintain this information. This commenter urged OSHA to provide a database of relevant information that all employers could access; however, such an action is beyond the scope of this rulemaking.

The National Association of Home Builders asserted that the information-exchange requirements would not be beneficial in the context of residential construction because conditions change too rapidly (making it likely that the information will be inaccurate when exchanged), and that the ''small likelihood that the provision would ever be of any use to employee safety'' should not outweigh the ''burden of compliance'' in residential construction (ID–117, pg. 20). This comment misses the point: this is an important safety issue because the information exchange protects workers from exposure to harmful conditions. The rapidly changing confined-space conditions on residential construction sites is a major reason OSHA is requiring these information exchanges. Moreover, only the presence of a permit-required confined space triggers the information-sharing requirements, and every entry into a permit-required confined space, by definition, exposes the entrants to a hazardous atmosphere or other serious hazard absent the measures implemented through the permit program. The commenter offers no support for the assertion that sharing information to help entry employers identify these hazards as quickly as possible, and before employee exposure occurs, would not be of ''any use to employee safety.'' In light of the record as a whole, OSHA believes that there will be an important safety benefit, and, therefore, does not find the commenter's argument persuasive.

The same commenter offers another reason for objecting to the information-sharing requirement: On large commercial construction projects, it is common to exchange information at the start of the project, but this information may be incomplete or partial (ID–117, pg. 20). In some cases, as construction progresses, the controlling contractor obtains more information as it becomes available. Consequently, this commenter asserted that the controlling contractor or host employer will exchange information with the entry contractor in a piecemeal fashion unless OSHA requires the entry employer to request all of the information available (See also ID–219.2, pg. 37 (marked as pg. 34)). The commenter's suggested approach to avoiding piecemeal information exchanges is to have the controlling contractor or host employer withhold relevant information if the contractor does not request it. This approach is contrary to the purpose of this paragraph: To ensure that employers have as much information as possible, and in a timely manner, when preparing to work safely in a confined space. Subcontractors are not likely to be aware of hidden dangers, and are, therefore, unlikely to request information about them. To protect their employees working inside a confined space, subcontractors would likely submit a *pro forma* request for information to the controlling contractor and host when they initially begin work at any site, but it is not clear that such a process would be substantively different from the approach specified in this final rule, except that it would be involve an extra step.

In any event, OSHA has specified when the controlling contractor must share the information: ''before entry operations begin.'' The controlling contractor must share the information obtained from the host employer, and any other information that the controlling contractor gathered from other sources (*e.g.,* previous entries into the same space as part of the same construction project), with the entry employer before entry. If such permit-space work is to occur near the midpoint of a project, a single conversation shortly before the evaluation and entry may fulfill the requirements of the final rule. There is no reason the controlling contractor cannot send all of the information at once rather than sending updated information in a piecemeal fashion as the commenter noted, as long as the information is shared with the entry employer prior to entry. The key parts of the provision are that the controlling contractor remains informed, and ensures that the information is conveyed to the entrants. Therefore, employers involved in permit-space entry on construction worksites have flexibility to decide the manner in which to exchange this information (*e.g.,* whether orally or in writing, whether the entry employer or controlling contractor initiates the exchange); however, they all have a duty to ensure that they share the information.

Paragraph (h)(3)—Pre-entry information-sharing duties of entry employers.

This provision, which sets forth the information-exchange requirements for entry employers, is similar to the proposed provision and to the corresponding provision for general industry confined spaces standard at § 1910.146(c)(9), although it uses slightly different terminology. Here, OSHA uses the term ''entry employer'' to clarify that the paragraph applies to employers who perform permit-space entry operations. And as in the rest of this section, the controlling contractor, rather than the host employer, is the focal point of the information exchange. OSHA believes that these requirements will contribute significantly to the increased safety and health of the employees of entry employers involved in permit-space entry operations.

Paragraph (h)(3)(i). This provision requires an entry employer to obtain information about the permit-space entry operations from the controlling contractor, and works with final § 1926.1203(h)(2), which requires the controlling contractor to share information about permit-space entry operations with the entry employer. OSHA believes that the reciprocal obligations in this final rule, which are consistent with the general industry standard, will increase the effectiveness of the information exchange by placing the duty to share this information on both parties. Both employers will now have the duty to exchange information, although they will likely accomplish their duties in a single interaction. The information exchange will ensure that the entry employer understands the type of space it will be evaluating, and will allow it to anticipate the permit-space hazards that may be present during entry.

Paragraph (h)(3)(ii). The final rule requires an entry employer to inform the controlling contractor of the permit-space program that the entry employer will follow, including information about any hazards likely to be confronted or created in each permit space. This exchange must take place prior to entry to ensure that the controlling contractor is informed of all the hazards in a timely manner and can take action, if needed, to prevent an accident or injury before entry operations begin. OSHA expects this exchange to occur after the employer has completed its assessment of the permit space, which is generally necessary to identify the hazards in the space and ensure that a proper permit-space program is selected. Consistent with the approach in the proposed rule, separating this pre-entry exchange from the subsequent entry report required by § 1926.1203(h)(5)(ii) clarifies that these two information exchanges must take place at two distinct stages of permit-entry operations.

One commenter objected to the proposed requirement that the entry employer inform both the controlling contractor and host employer of the procedures the entry employer planned to use in the permit space. The commenter asserted that the proposed provision was ''an unnecessary burden [that] in some cases may be infeasible'' (ID–124, pg. 6). This final rule eliminates the requirement that the entry employer share this information with the host employer, eliminating any difficulties an entry employer may have communicating with a host employer, and is consistent with the rule's overall designation of the controlling contractor as the focal point of the information-exchange process. As explained elsewhere, the controlling contractor needs this information to coordinate entry as necessary, and the exchange provides the controlling contractor with another opportunity to inform the entry employer about the hazards of the permit space as required by § 1926.1203(h)(2).

Paragraph (h)(4)—Coordination duties of controlling contractors and entry employers. Final § 1926.1203(h)(4) requires controlling contractors and entry employers to coordinate permit-space entry operations in two circumstances: (1) When more than one entity performs entry operations at the same time, or (2) when permit-space entry is performed at the same time any activities that could foreseeably result in a hazard in the permit space are performed. The controlling contractor and each entry employer have separate duties under this provision, and each can be cited for failing to perform its part of the coordination. Similar obligations were included in the proposal, but were not stated as clearly as they are here, and also are present in the general industry standard. Minor differences between this final rule and the general industry and proposed rules are matters of terminology or reflect the key role of the controlling contractor in this construction rule.

There is a need to coordinate entry operations whenever multiple entities are performing work simultaneously in or around a permit-space because of the possibility that one entity's activity might create a hazard for workers employed by a different entity (*e.g.,* welding next to the application of a flammable coating). The purpose of this provision is to protect employees from foreseeable hazards that could result from a lack of coordination between entry entities in the permit space, or with entities outside the space whose activities could create hazards inside the permit space. This paragraph works in concert with the requirement that entry employers inform the controlling contractor of the permit-space program that the employer will use and the hazards they are likely to encounter in the space, including hazards created after entry. The controlling contractor can use this information to coordinate the entry operations to ensure safety for all workers in the space.

It is important for the controlling contractor to participate in each coordination effort because construction worksites are constantly evolving, with multiple employers performing work. Consequently, the controlling contractor, as the employer with overall responsibility on the worksite, is in the best position to coordinate the entry operations. This provision also requires the entry employer to coordinate entry with the controlling contractor because it is the entry employer who evaluates a confined space, who will have employees it directs entering the space, and who may have the most current information about the space.

For example, a properly informed controlling contractor will be aware of excavation work on a site directly above an underground permit space, and will coordinate work to ensure that no employees are in the permit space when the excavation work could foreseeably cause part of the underground space to collapse. Similarly, the controlling contractor must ensure that, when an employer is using a crane in the vicinity of a permit space, lifts are planned and implemented so that the crane would not be carrying its load over an occupied permit space or its entry/exit. In those scenarios, the entry employer would be responsible for informing the controlling contractor when it plans to have employees inside the permit space. Coordination would typically involve the controlling contractor scheduling the activities appropriately, working with all of the employers involved to ensure that they adhere to the schedule, implementing a plan to remove the employees from the permit space at the appropriate times, and designating locations to keep the employees clear of the load during the lifting operation.

This coordination requirement responds to a concern that proposed § 1926.1204(d) did not account for the fact that work taking place near a permit space can create hazards that could harm other employers' employees inside the space (ID–210, pg. 317–18). The commenter raising this concern provided an example of an employer that uses gas that is heavier than air near a confined space; such a gas could create an atmospheric hazard in the space by displacing oxygen.

OSHA agrees with this comment and the final standard requires the type of coordination that will address this concern. It specifically requires the controlling contractor to coordinate entry operations of any entities whose activities could foreseeably result in a hazard in the confined space. This requirement is consistent with the requirements of final §§ 1926.1204(k) and 1926.1210(f). Final § 1926.1204(k) requires an entry employer to account for such coordination as part of its permit program, while final § 1926.1210(f) requires the entry supervisor to determine, on transferring responsibility for permit operations, that entry operations remain consistent with the terms of the entry permit and that entry conditions are acceptable.

Other commenters objected that controlling contractors are not in the best position to coordinate because they often are not on the site to provide coordination, do not have the knowledge or experience to correctly identify the hazards of a permit space, and may not know of the planned entry (ID–117, pg. 21; ID–075, pg. 6). These commenters also argued that if the final standard requires coordination, such coordination should be between the involved host employer and entry employer(s), as is the case under the general industry standard (ID–117, pg. 22; ID–075, pg. 6).

OSHA disagrees with these comments. An employer that meets the standard's definition of controlling contractor has ''overall responsibility for construction at the worksite.'' As noted earlier, other commenters agreed that controlling contractors were better suited than host employers to serve at the center of this process in construction activities. (ID–210, pg. 315–20; ID–220.2, pg. 14–15). By virtue of their responsibility for the entire worksite, controlling contractors schedule and coordinate activities among different subcontractors to ensure that they perform construction tasks in the correct sequence, in the proper manner, and with minimal delay between the steps on a project. The vague hypothetical scenarios presented by the commenters do not persuade the Agency that the coordination required by this final rule is a significant departure from the type of coordination required on a regular basis under existing work practices. Accordingly, OSHA concludes that controlling contractors, as the entities actually managing construction activities at a worksite, are better able than host employers to coordinate the activities of the other employers whose employees work in or around a permit space. Coordination of entry operations under final § 1926.1203(h)(4) is a critical component of this standard.

Nevertheless, OSHA has structured the coordination provision in the final rule to minimize additional responsibilities and provide appropriate flexibility for controlling contractors. If the controlling contractor's employees will not enter the permit space, the controlling contractor may fulfill its coordination duty by relying on information provided by entry employers. The controlling contractor does not necessarily have to be on the site at all times or have expertise on permit space hazards to coordinate entry operations, just as the controlling contractor does not need to be on site at all times to coordinate material deliveries or subcontractor assignments. In addition, the final rule does not specify how the controlling contractor and entry employers must coordinate entry operations. Controlling contractors and entry employers may coordinate entry operations using any method that is effective, and this coordination need not involve a lengthy process.

One commenter expressed a concern that the coordination requirements would impose strict liability on controlling contractors for safe permit-space entry operations, meaning that the controlling contractor would be liable for another employer's breach of safety policy (ID–141, pg. 2). The final rule does not impose strict liability or any responsibility to ensure other contractors' compliance with the standard. Controlling contractors who are not entry employers have information sharing and coordination duties.

Another commenter asserted that, in an effort to comply with this coordination duty, the controlling contractor may impose redundant and unnecessary safety measures on other employers to protect the controlling contractor from liability (ID–120, pg. 2). This comment is speculative and unsupported by specific examples, so it is difficult for the Agency to respond to it other than to note that the final rule does not impose duplicative requirements on employers, nor does the final rule require the controlling contractor to do so. OSHA believes that the final rule provides employers with sufficient flexibility in discharging their coordination duties. This flexibility should reduce duplication of effort and any associated costs.

Lastly, this commenter asserted that it would be difficult for a controlling contractor to fulfill the coordination duties absent explicit contractual authority to do so. *Id.* But under this final rule, controlling contractors are the only employers at a worksite that ''have overall responsibility'' for the site, so they are in the best position to coordinate the work schedule. If controlling contractors prefer to augment their authority through contractual provisions with subcontractors or host employers, this final rule does not prevent them from doing so.

Paragraph (h)(5)—Post-entry duties of controlling contractors and entry employers. This paragraph, which imposes obligations similar to those in the general industry standard, requires the controlling contractor to debrief an entry employer at the end of entry operations about the permit-space program followed and any hazards confronted or created during entry operations, and then relay appropriate information to the host employer. It also requires the entry employer to share the same information with the controlling contractor. These requirements serve three purposes. First, they ensure that the controlling contractor requests the information. Second, they establish an affirmative duty for the entry employer to provide this information. Third, they ensure that the host employer will receive information relevant to future permit-space entries. The intent is for entry employers to identify and share information about additional hazards, new procedures, or other new information not previously identified in the required pre-entry information exchange.

OSHA believes it is appropriate to place the duty on the entry employer to provide this information, as well as to require the controlling contractor to request it. The entry employer, by virtue of performing permit-space entry operations, will be the first employer to have access to new information. If the entry employer fails to communicate the information to the controlling contractor during the course of entry operations, the information transfer will occur during the entry employer debriefing.

There were no comments indicating the debriefing is unworkable or overly burdensome. OSHA made this duty reciprocal in the final rule, and removed the duty for the entry employer to provide information to the host employer to keep the rule internally consistent and consistent with the general industry standard, and to increase the effectiveness of the information exchange by placing the duty to share this information on both parties to the exchange, thereby ensuring that both the controlling contractor and entry supervisor exchange the specified information. Accordingly, § 1926.1203(h)(5)(i) requires the controlling contractor to retrieve the information, and § 1926.1203(h)(5)(ii) requires the entry employer to provide the information. OSHA does not view this as a significant change from the proposed rule because the proposal also required the same debriefing to occur, and it required the parties to share the same information (see proposed rule § 1926.1204(c)(2)). If no new hazards arose during entry and the entry employer's program did not change, the information exchange can be brief, just confirming that the original program was followed.

The final rule contains a new requirement for the controlling contractor to notify the host employer of any information it receives from debriefing the entry employer. OSHA added this provision to close a potential gap in the information-exchange process that could result because the final rule makes the controlling employer the hub of the information and exchange and does not require entry employers to provide information directly to the host employers, as the proposed rule did (see proposed rule § 1926.1204(c)(2)). As discussed above, OSHA has determined that the controlling contractor is in the best position to coordinate the exchange of this information. Therefore, the final rule shifts the duty to the controlling contractor. The host employer will still receive the information, but from the controlling contractor. OSHA expects that in many cases there will be no need for a separate exchange because the controlling contractor can relay this information as part of its regular communications with the host employer.

One commenter objected to the debriefing requirement, stating that it was unnecessary if other employers were not already scheduled to enter the space. If another employer does eventually enter the space, the commenter asserted, the subsequent employer's independent hazard assessment should suffice (ID–124, pg. 6). OSHA disagrees. The subsequent employer must make an independent hazard assessment, but the rationale for requiring information exchanges in the final rule still applies: that assessment may not reveal previously identified hidden or latent dangers or conditions, and the new entry employer would be less prepared to protect its employees than if it obtained the information that the controlling contractor received from debriefing the previous entrant.

A different commenter asserted that host employers have no need for information about newly constructed confined spaces, and that the requirement to provide information to the host employer is an unnecessary paperwork burden (ID–017, pg. 2). OSHA disagrees. It is important for the controlling contractor to notify the host employer of information about the host's property, particularly any new hazards identified during the entry. In many cases, the same controlling contractor may not be present for future construction activities involving the space, so the host employer's information will helpful for future entries.

Note to § 1926.1203(h)—host employer and controlling contractor not required to enter a confined space. The final standard also includes the note from proposed § 1926.1204(a) explaining that, unless a controlling contractor or host employer has, or will have, employees in a confined space, neither of these employers need to enter any confined space to collect the information specified in paragraph (h) of this section. This note applies to all of paragraph (h). This protects the employees of the controlling contractor and the host employer because entering confined spaces could expose those employees unnecessarily to the hazards of that space. Controlling contractors and host employers should not conduct such an entry unless there is a purpose to the entry other than just gathering information.

Paragraph (i)—Absence of a controlling contractor. Final § 1926.1203(i) provides that, in the event no employer meets the definition of a controlling contractor on a particular worksite, the host employer or other employer that arranges for permit-space entry work must fulfill the information-exchange and coordination duties of a controlling contractor. The general industry rule does not have any requirements for a controlling contractor and, therefore, has no corresponding provision dealing with the absence of a controlling contractor. OSHA added this requirement in response to a comment noting that some construction worksites do not have an employer that meets the definition of a controlling contractor (ID–124, pg. 6). Because the controlling contractor is at the hub of the information-exchange and coordination requirements, failing to address this issue would leave a serious gap in a critical provision of the standard. When no employer on a worksite meets the definition of controlling contractor, it is still necessary for one employer to be responsible for information exchange and coordination, thereby ensuring that entry employers are aware of the known hazards associated with the space, and that different entities do not create new hazards to each other.

The employer that has the duty specified under final § 1926.1203(i) can be any employer that arranges for permit-space entry. It could be the host employer, a different contractor, or an entry employer that arranges for another entry employer to conduct entry operations. It is possible that the employer that has this duty will change based on the stage of construction. For example, if there is no controlling contractor for the project, but a contractor on the site arranges for entry employer A to enter a permit space, the final rule requires the contractor to share the information identified in final § 1926.1203(h) with entry employer A and to fulfill the controlling contractor's coordination and other information sharing duties in the standard. If entry employer A, after completing its entry operations and cancelling its permit, arranges for entry employer B to enter the permit space, then entry employer A assumes the controlling contractor duties with respect to entry employer B's confined space activities.

Requirements in § 1926.1203(h) and (i) do not alter contractual relationships between host employers or controlling contractors and subcontractors. One commenter noted that subcontractors often perform confined-space work because of their expertise in working in those spaces, and asserted that OSHA should not ''force general contractors to interject themselves into the work tasks of their sub-contractors'' in a way that would ''disregard . . . both specific contractual responsibilities and the expertise of sub-contractors.'' (124.1, pg. 3.) OSHA agrees, and crafted this rule to ensure that subcontractors have the information necessary to perform their work safely, particularly information about hidden or latent hazards that the subcontractor may not be able to discover quickly without endangering its entrants. A subcontractor may have expertise in welding inside a confined space, but that expertise will not help it avoid an invisible hazard it has no reason to suspect. (See ID–213.1, pg. 1, *supra,* for example of hidden dangers.) In this case, the host employer and controlling contractor need not develop welding expertise; instead, they must share information about hazards that they, or other employers with the appropriate expertise, previously identified.

Several commenters asserted that ''OSHA is attempting to force certain employers to assume a sufficient degree of control over confined space entry'' to ''substantially expand'' the tort law exposure of those employers (ID–078, pg. 2; ID–120, pg. 2–3; 153, pgs. 19–20). OSHA does not agree, and notes that comments urging OSHA to reduce potential employer liability in private rights of action are not relevant to OSHA's statutorily mandated obligations to promote worker safety.

Congress enacted the OSH Act to ''assure so far as possible every working man and woman in the Nation safe and healthful working conditions.'' 29 U.S.C. 651(b). Congress gave the Secretary of Labor the authority to promulgate mandatory occupational safety and health standards to achieve that goal.[17] *Id.* section 655. As OSHA explained in an October 23, 2006, letter to U.S. Congressman Cass Ballenger,

> nothing in health or safety standards issued by OSHA . . . determines the tort remedies available to injured workers. That matter is determined by the laws of the individual states. It is not our role at OSHA either to foster or to foil the efforts of plaintiffs' lawyers in state court proceedings. It is our responsibility, however, to undertake reasonable efforts '' . . . to assure so far as possible every working man and woman in the Nation safe and healthful working conditions,'' and OSHA's standards are therefore focused on addressing workplace hazards.'' In general, tort law remedies present entirely separate bodies of law that are available at common law, or as the result of state action, to anyone in the general public (including workers) who might be harmed by a wrongful act; they are not aimed specifically at correcting workplace hazards.

The OSH Act does not contain any private right of action allowing employees to recover for injuries or illnesses caused by hazardous work conditions. Instead, Section 4(b)(4) of the OSH Act makes clear that any effect of OSHA standards on state tort law is limited: ''Nothing in [the OSH] Act shall be construed to . . . enlarge or diminish or affect in any other manner the common law or statutory rights, duties, or liabilities of employers and employees under any law with respect to injuries, diseases, or death of employees arising out of, or in the course of, employment.'' (29 U.S.C. 653(b)(4).) The plain language of section 4(b)(4) thus indicates that any standard OSHA promulgates generally has no effect on, and certainly cannot ''substantially expand,'' employees' rights under the state tort system with respect to workplace injuries and illnesses. See, for example, *Crane* v. *Conoco, Inc.,* 41 F.3d 547 (9th Cir. 1994) (''OSHA violations do not themselves constitute a private cause of action''); *Atlas Roofing Co., Inc.* v. *OSHRC,* 430 U.S. 442, 445 (1977) (''existing state statutory and common-law remedies for actual injury and death remain unaffected'' by the OSH Act); *Frohlick Crane Serv, Inc.,* v. *OSHRC,* 521 F.2d 628, 631 (10th Cir. 1975) (''It would appear that by this particular provision [section 4(b)(4)] Congress simply intended to preserve the existing private rights of an injured employee, which rights were to be unaffected by the various sections of the Act itself.''); *Jeter* v. *St. Regis Paper Co.,* 507 F.2d 973, 977 (5th Cir. 1975) (''It seems clear that Congress did not intend [the OSH Act] to create a new private cause of action, but, on the contrary, intended private rights to be unaffected thereby.'') .

OSHA recognizes that state courts in some circumstances use OSHA standards, including these final host-employer and controlling-contractor provisions, as evidence in a negligence action. (See, for example, *Knight* v. *Burns, Kirkley & Williams Constr. Co.,* 331 So.2d 651 (Ala. 1976).) But when they do so, any effect on tort law is a function of these state court decisions and is not in any way dictated by OSHA's standard. See *Summit Contractors, Inc.* v. *Sec'y of Labor,* 442 Fed.Appx. 570, 572 (D.C. Cir. 2011) (rejecting arguments that OSHA's multi-employer duties would increase common law liability for general contractors because ''such liability would arise only from a court's (hypothetical) later action under state law—not from the OSH Act itself'').

Other commenters submitted a variety of objections about the information-exchange provisions, including that the controlling contractor and host employer information-sharing requirements ''do not reflect an appropriate application of responsibilities, and expand the duties of general contractors in the residential construction industry'' (117.1, pg. 7), thereby requiring the host employer to maintain extensive files about each confined space located on its property, which ''would be impractical and infeasible in today's business context'' (153, pgs. 18–19). Commenters also complained that the coordination requirements were ''unworkable'' (219.2, pg. 40 (marked as pg. 37)). However, another commenter responded:

[17] The Secretary delegated those responsibilities to the Assistant Secretary for Occupational Safety and Health, who heads OSHA. See 77 FR 3912 (Jan. 25, 2012).

Throughout the hearings, participants argued, on the one hand, that OSHA should simply extend the general industry standard to construction and, on the other, that the proposed standard would impose unprecedented and unwarranted burdens on controlling contractors, which would expose them to substantial liability. . . . [T]here is, in fact, little new in the proposed multi-employer provisions. And, there is nothing in the record that . . . suggested that the information-sharing requirements under § 1910.146 have proven to be either burdensome or unnecessary. . . . [Based on the record,] the provisions requiring information sharing between the entity that has the greatest familiarity with the worksite and contractors coming into the worksite for brief, discrete periods of times have proven to be effective means of assuring that employees can work safely in confined spaces without imposing notable burdens or liability on the host employers.

(220.2, pg. 13–14.) OSHA agrees with this comment. There are not many substantive differences between the new standard and the general industry standard, and employers have not raised significant obstacles to compliance with the general industry standard during the two decades following OSHA's promulgation of that standard. OSHA is confident that the new construction standard will also be workable.

Section 1926.1204—Permit-Required Confined Space Program

The permit-required confined space program is a critical component of new subpart AA. Except for ventilation-only entries conducted in accordance with § 1926.1203(e), the Agency requires each employer with employees who will enter a permit space to implement a written permit-space program that meets the requirements set out in this section (see final § 1926.1203(d)). Final § 1926.1204 is, therefore, specifically tailored to work activities conducted inside a space that meets the definition of a ''permit-required confined space'' (''permit space'') in final § 1926.1202. Technically, final § 1926.1204 sets out information and actions that must be included in the permit program, and the requirement to implement these steps is in final § 1926.1203(d), but employers should view § 1926.1204 as the main set of requirements for protecting their employees when entering a permit space.

In the preamble to the general industry confined spaces standard, the Agency observed that ''an employer who waits until the last minute before entry operations begin to develop a permit space program is unlikely to have properly trained and equipped personnel available'' (58 FR 4495 (Jan. 14, 1993)). Accordingly, OSHA designed final § 1926.1204, which is similar to § 1910.146(d), to require entry employers to plan the entry, and to implement the entry in accordance with that plan, to avoid endangering employees during the entry.

For the reasons identified in the Background section, above, OSHA is conforming the language of the permit-required confined space provisions in § 1926.1204 of the final rule to the corresponding provisions for general industry confined spaces at § 1910.146(d). The substance of this section generally is the same as the general industry standard. OSHA explains below the differences between the other paragraphs of the final rule and the general industry standard, and the significant differences between the final rule and similar provisions in the proposed rule. There is no discrete section of the proposed rule that corresponds directly to this section of the final rule, but OSHA also included most of the duties imposed by this final rule in the proposed rule. See, *e.g.,* proposed §§ 1926.1205 (atmospheric monitoring and testing); 1926.1209(c) (limiting entry) and (f) (safe termination procedures); 1926.1210(f) (attendant required); 1926.1210(j) (equipment); 1926.1212(a) (safe termination procedures); and 1926.1218 (equipment).

One commenter noted that a particular provision in the proposed rule (§ 1926.1218(a)(4)) referred to ''confined space operations,'' and suggested OSHA change that reference to ''confined space *entry* operations'' (ID–025, p. 4). The regulatory text in § 1910.146 refers to both ''permit space operations'' (§ 1910.146(g)(2)(iii)) and ''permit space *entry* operations'' (§ 1910.146(d)(3)) [emphasis added]. In this final rule, OSHA changed all references to confined space operations and permit-space operations to confined space *entry* operations or permit-space *entry* operations to maintain consistency. The terms ''confined space entry operations'' or ''permit-space entry operations'' refer to both actual entry into a space, and any planning or preparation made for the entry (*i.e.,* an employer can be engaged in ''entry operations'' before actually entering a confined space).

The introductory language in final § 1926.1204 provides that the entry employer must perform the procedures set forth in that section. OSHA simplified the introductory language from the language in § 1910.146(d), and edited the language to reflect this final standard's use of the term ''entry employer'' when discussing an employer who decides that employees it directs will enter a permit space. OSHA made this change to clarify which employers must comply with these procedures on a multi-employer worksite.

Paragraph (a). Final § 1926.1204(a), which is identical to § 1910.146(d)(1), requires an employer to implement an effective means of preventing all unauthorized entry into a permit space. These measures are necessary to prevent unauthorized entry into PRCSs, and to protect employees from encountering PRCS hazards. Under the final rule, it is the entry employer's responsibility to ensure that all unauthorized persons stay out of the established permit space, regardless of who employs them. Any unauthorized employer who enters a permit space could pose a danger not only to themselves, but also to workers already inside the space. The entry employer's duty to prevent unauthorized entry also extends to the prevention of unintentional entry, such as a person falling into a space or accidently entering a permit space because of confusion about where an entrance to a space leads. The duty also extends to members of the public passing near the construction site (*e.g.,* a sewer manhole) in order to protect the employees in the permit space.

This final provision makes no substantive change from the proposed rule. Proposed § 1926.1209(c)(1)(i) provided that employers use barriers or high-visibility physical restrictions, such as a high-visibility warning lines, to prevent unauthorized entry into a space. One commenter asserted that circumstances arise that make it unsafe to use the physical restrictions specified in proposed § 1926.1209(c)(1)(i) (ID–104, p. 3). For example, when employees perform work to rehabilitate or install a protective coating in a sewer, the employer must use devices such as cables and hoses that run from a compressor to the airless spray pump, and then into the manhole to the spray gun, resulting in a tripping hazard that could cause someone to fall into the manhole. In such situations, this commenter suggested that OSHA require only that the employer post danger signs. OSHA expects that signs by themselves will generally be inadequate to prevent an inadvertent fall into a manhole. Even if the employer has full control of the entrance to the permit space to and can guard against members of the public who cannot see the signs or read them, there are too many activities on a typical construction site for an employer to ensure that workers would not be distracted and fail to see the sign or the manhole. Manholes, like other fall hazards at a typical worksite, must be guarded in a manner that meets the requirements of this standard and the applicable specifications of 29 CFR part 1926, subpart G—Signs, Signals, and Barricades and subpart M—Fall Protection.

Because OSHA is duplicating the general industry standard in this portion of the final rule, it does not specify the particular means of compliance. This approach provides employers with flexibility in complying with this provision by not limiting the measures required under this provision to physical restrictions only. The employers' means of preventing entry will be evaluated based on its effectiveness at accomplishing that task. The same explanation that OSHA provided for the general industry rule applies in the construction context as well:

[I]f the workplace is so configured as to prevent access of unauthorized entrants into areas containing permit spaces, training, alone or in combination with signs, may prevent the unauthorized access to the spaces. Otherwise, covers, guardrails, fences, or locks will be necessary. It is the employer[']s responsibility to use whatever measures are necessary to prevent unauthorized entry.

58 FR 4495.

Paragraph (b). In final § 1926.1203(a), OSHA requires employers to identify and evaluate the hazards of permit spaces that employees will enter. Final § 1926.1204(b), which is identical to § 1910.146(d)(2), requires an employer that authorizes employees to enter a permit space to first conduct a thorough evaluation of that permit space to identify the presence and location of all hazards within the permit space. This hazard evaluation is necessary to ensure that the spaces are correctly assessed to make the permit-space program as effective in protecting employees as possible. This evaluation may be combined with the initial evaluation required by final § 1926.1203(a), or it may be conducted separately. OSHA anticipates that most employers who intend to enter a space will conduct a single evaluation that complies with the requirements of both §§ 1926.1203(a) and 1926.1204(b).

Paragraph (c). Final § 1926.1204(c), which is similar to § 1910.146(d)(3), requires an employer to develop procedures needed to facilitate safe entry operations into most permit spaces. The paragraph lists eight measures that employers must take. However, this list is not comprehensive: Some spaces may include unique hazards, locations, or configurations that require additional steps to ensure the safety of entrants. The subparagraphs in final § 1926.1204(c) provide specific elements of these required procedures.

Paragraph (c)(1). Final § 1926.1204(c)(1), which is identical to § 1910.146(d)(3)(i), requires an employer to identify the entry conditions that employers must meet to initiate and conduct the entry safely. For example, when an atmospheric hazard exists in the space and an employer must use personal protective equipment (PPE) to protect employees from the hazard, the employer must include in the acceptable entry conditions the type of PPE employees are to use (such as type of respirator) and the exposure levels at which the PPE would protect the employees from the atmospheric hazard. If the permit space contains physical hazards, the entry employer must ensure that the acceptable entry conditions include the methods used to protect employees from the physical hazards. If the employer does not satisfy the conditions specified in either example, or in any list of acceptable conditions, then the result is a prohibited condition, meaning that employees must not enter the space and must evacuate if they are already in the space.

When determining the acceptable entry conditions, the employer must consider the work employees will perform and the hazards that may result from that work. For example, an employer that plans to weld inside a confined space must account for the hazard resulting from the welding fumes and gases when identifying acceptable entry conditions. As another example, an employer who plans to introduce gases into a space to inert potentially flammable gases must take into consideration the effect of the inerting gases on the atmosphere because that process will generally result in an IDLH atmosphere.

Paragraph (c)(2). Final § 1926.1204(c)(2), which is identical to § 1910.146(d)(3)(ii), requires an employer to provide each authorized entrant or that employee's authorized representative an opportunity to observe any monitoring or testing performed in a permit space. Final § 1926.1204(c)(2) does not require employees and their authorized representatives to observe the specified activities; however, it provides employees and their authorized representatives with the option to observe should they choose to do so. OSHA added this requirement to § 1910.146 in 1998, along with several other employee participation requirements. The Agency explained that those requirements would ''function to provide a 'check' on human error in those cases where monitoring was improperly performed, and the Agency pointed to data demonstrating that human error in monitoring of a hazardous atmosphere was a critical element in many deaths in confined spaces (63 FR 66032 (Dec. 1, 1998)). OSHA also noted that its record indicated that many entrants would not choose to request to observe the monitoring, but stated ''it is reasonable to assume that allowing authorized entrants or their designated representatives to observe the testing of spaces will prevent a substantial portion of the accidents attributed . . . to human error'' (*id*). OSHA believes that this will also be the case under the final rule.

OSHA also believes that allowing employees and their authorized representatives to participate in this manner will contribute to the successful implementation of safe entry operations by enhancing their awareness of the hazards present in the confined space. Moreover, as OSHA noted when it added these observation requirements to the general industry standard, the employee participation requirements are consistent congressional intent and with a number of OSHA health standards that provide employees with the opportunity to participate actively in protecting their own safety and health and that of their co-workers (see discussion at 63 FR 66020–66021).

Paragraph (c)(3). Final § 1926.1204(c)(3), which is similar to § 1910.146(d)(3)(iii), requires an employer to include measures in the permit program to isolate a permit space or, where applicable, a physical hazard within the permit space (such as isolating mechanical hazards through lock out). The general industry standard refers only to ''isolating the permit space,'' while the new final rule also addresses isolating physical hazards within the permit space, such as by placing a physical barrier inside the permit space to eliminate the potential for employee contact with a physical hazard inside that space, for the reasons provided in the explanation of § 1926.1203(e)(1)(i) and (g)(1). It is important to isolate the entrants from the hazards that may exist in the continuous space, or may enter into the continuous space and eventually migrate to engulf the entrants. For example, if an entry employer has not isolated a particular area of a continuous system such as sewer system, then the entire continuous system is a confined space. If any part of that system contains material that has the potential for engulfing an entrant then the entire system is a permit space.

If an employer is able to isolate all of the physical hazards, then the employer might be able to reclassify the space as a non-permit space or enter under the alternative procedures in § 1926.1203(e). However, employers may still choose to enter under a permit program or may be required to do so if, for example, they isolate a physical hazard but cannot control an atmospheric hazard and must enter using respirators. The requirement to include the isolation measures in the permit program is critical to employee safety in those situations, as well when the employer is relying on isolation to prevent hazards from entering a space. Requiring the listing of the isolation method as part of the permit program is also useful to remind employers that if they are relying on the isolation to enter a confined space under the alternative procedures in § 1926.1203(e) or the reclassification under § 1926.1203(g), they must maintain that isolation or the permit program requirements will apply immediately.

If the employer is using isolation to protect the employees during the entry, then paragraph (c)(3) requires that the program include a method to ensure that the hazards remain isolated for the duration of the entry. Isolation methods provide the highest degree of assurance that the hazard will be kept away from the employees in the space, because isolation does not generally depend on the continued, proper operation of machinery (such as ventilation equipment) or PPE (such as respirators). If the space is such that the employer can demonstrate that it is infeasible to isolate the hazards, the employer need not include isolation measures in the permit program, but must eliminate or control the hazards in accordance with final § 1926.1204(c)(4) and § 1926.1204(e) (see final § 1926.1204(e)(1)). If the employer cannot maintain isolation or control the hazards, then the employer must terminate entry operations immediately.

Three commenters provided examples of how they believed it was possible to isolate portions of a confined space from other portions of the space. The first commenter addressed a scenario in which the employer is applying a protective coating to a sewer (ID–104, pp. 2–3). The commenter, an association representing members who apply protective coatings in sewers, asserted that the employer can isolate the permit space from the other sections of the sewer by running a bypass line upstream with pneumatic pipe plugs installed that provide a tight seal to prevent passage of air and liquids.

The second commenter, an association representing utility contractors who work regularly in sewers, noted that employers can sometimes block the flow of effluent into one part of a sewer system from a larger confined space by using pipe plugs upstream from where employers will conduct the work (ID–210, Tr. p. 187). In some cases, employers also use plugs to block off a portion of the sewer downstream from where an employer will conduct the work, and then purge and clean the workspace in between the plugs (ID–210, Tr. p. 188). In either scenario, the commenter stated that an employer can block the flow of air and effluent through the line by properly fitting pipe plugs to a pipe, pressurizing them with a few pounds of air, and either blocking in the plugs so they cannot fall out or using a ''double plug'' system (inserting two plugs into the same pipe ''so if one slips you will have a backup'') (ID–210, Tr. pp. 187, 189, and 199). The commenter acknowledged that there had been ''failures'' where the plugs exploded or did not function correctly and ''killed and injured workers,'' but characterized such incidents as occurring ''rarely'' and only as a result of incorrect installation or procedures (ID–210, Tr. p. 208). The commenter agreed that the proper procedures would normally include installing a bypass line upstream of the pipe plug to redirect any effluent and ensure that pressure does not build behind the pipe plug (ID–210, Tr. p. 208).

A third commenter, a different sewer-services association, also agreed that, in many cases, employers can use pipe plugs along with bypass lines and ''gate valves'' to prevent effluents from entering a section of a sewer system, but indicated that employers rarely use pipe plugs on pipes greater than 10 inches in diameter for significant periods of time (ID–211, Tr. p. 156).[18]

OSHA finds that the record is not conclusive as to whether pipe plugs, with or without bypass systems, are a reliable and effective means of isolating a sewer space to protect workers from engulfment and atmospheric hazards moving through a continuous system. The record, which also includes a number of fatalities and injuries associated with the use of pipe plugs (see the Final Economic Analysis), indicates that these plugs may fail as a result of improper installation and may not be appropriate for extended use in larger pipes, and that bypass systems are sometimes required to relieve the buildup of pressure that could dislodge the plugs. There is no evidence that the pipe-plug failures that occurred, even if the failures were purely the result of improper installation, would not occur again in the future for the same reason. Moreover, it is not clear from the record that a significant force such as a storm surge could not dislodge the pipe plugs, or that the failure of a bypass system could not lead to pressure building behind a pipe plug and dislodging it. Isolation through a bypass system, unlike the other examples of methods used to isolate hazards listed in the general industry standard and this final rule, would depend on the continuous operation of machinery. The pipe plugs and bypass systems may, therefore, merely be a means of controlling the hazards, rather than isolating them, because it is not clear that they would completely protect workers from exposure to these hazards.[19]

Paragraph (c)(4). Final § 1926.1204(c)(4), which is identical to § 1910.146(d)(3)(iv), applies to permit spaces with hazardous atmospheres and requires an employer to purge, inert, flush, or ventilate the permit space to eliminate or control the hazardous atmosphere before entry. The purpose of

[18] The same commenter also stated that most sewer manholes do not present an engulfment hazard because ''80 to 85 percent of all of the sewer manholes have pipe diameters of eight and ten inches or smaller entering them,'' and that it would take hours for engulfment to occur under these conditions because the Environmental Protection Agency engineering standards ''require that those pipes be sized to flow at 50 percent of maximum capacity during high flow periods'' (ID–211, Tr. p. 156). OSHA does not agree that limiting flow rate and capacity will eliminate the engulfment hazard; the engulfment would just take longer. These conditions do not isolate or eliminate the hazard, and the effluent could engulf or drown an employee who is unconscious or otherwise unable to leave the space before it fills the manhole, particularly if the employee is not able to keep his or her head above the floor. Therefore, the full permit-program protections in § 1926.1204 apply under these conditions unless the employer isolates or eliminates the hazard. However, if an employer can demonstrate that it can limit the rate and capacity of the flow, the employer could factor the potential time for engulfment or drowning resulting from this procedure into determining the type and location of an early-warning system that would provide adequate time for employees to exit a space.

[19] OSHA is leaving open the possibility that an employer could demonstrate that using pipe plugs in conjunction with bypass systems is an effective means of isolating a permit-required workspace from a continuous system. To do so, the employer must ensure that the procedure is appropriate for the conditions and use properly installed pipe plugs in conjunction with a bypass system to effectively isolate a workspace in a sewer system. Accordingly, the employer must ensure that the procedure isolates the workspace in fact from any engulfment hazard; OSHA would not view failure of the pipe plug or bypass system as an unforeseeable outcome. One of the commenters recommended using continuous air monitoring even if the space appears to be isolated (ID–210; Tr. pg. 202 (Kennedy)). OSHA agrees, and recommends that employers use continuous air monitoring under these conditions to provide early detection of any problems with the seal of the pipe plug.

this provision is to reduce employee exposure to atmosphere hazards in the permit space. Reducing exposure to hazards in the permit space through engineering practices, rather than relying on PPE as the primary protection for employees, is the most direct and effective means to reduce risk to the employee, whether the airborne substances pose a health risk of inhalation or a safety risk of fire or explosion.[20]

In § 1926.1204(c), OSHA requires these means of reducing exposure levels—purging, inerting, flushing, or ventilating—''as necessary'' to eliminate or control atmospheric hazards. With respect to the actions in paragraph (c)(4), ''as necessary'' means that an employer must take at least one of these actions if the permit space has a hazardous atmosphere. The only permit spaces where these actions are not necessary are those in which the space does not have a hazardous atmosphere, as defined in § 1926.1201, but is designated as a permit space because it contains another hazard, such as an engulfment hazard, inwardly converging walls, or other recognized serious safety or health hazard.

The means used to reduce risk must be appropriate to the characteristics of the hazardous atmosphere and it must also ''eliminate or control'' the hazard to produce ''safe permit space entry operations (§ 1926.1204(c)). For example, inerting a space that already has an oxygen-deficient atmosphere would be an inappropriate action, whereas ventilating with additional outside air would help to increase oxygen levels.

The Agency notes that it previously issued letters responding to questions about the conditions under which the general industry standard permitted employers to work in a space with flammable gas in concentrations greater than 10 percent of the LFL. See August 15, 1996, letter to Larry Brown, and September 4, 1996, letter to Macon Jones. OSHA subsequently clarified its position on those issues in a 2011 response to the U.S. Chemical Safety and Hazard Investigation Board, stating that the general industry standard ''prohibits entry into atmospheres greater than 10 percent of the [LFL], unless the flammable/explosive hazard has been controlled through inerting of the space to reduce the oxygen content below that needed to support combustion.'' (ID–223, p.3).

OSHA takes the same approach with respect to this construction standard. While employers may use a variety of means to reduce the LFL to 10 percent or below, thus avoiding an LFL hazardous atmosphere as defined in § 1926.1202, OSHA reiterates that this new final rule for confined spaces in construction prohibits employees from working in any atmosphere above 10 percent LFL *except* when the employer successfully inerts the space so as to effectively remove the hazard of an explosion. See discussion of paragraph (1) of the definition of ''hazardous atmosphere'' in § 1926.1202 of this final rule. Even when the space is successfully inerted, an oxygen-deficient atmosphere generally results such that employers must prohibit entry unless they provide appropriate PPE or other equipment that is capable of protecting the employee from the oxygen-deficient atmosphere. See definition of ''prohibited condition'' in final § 1926.1202 and § 1926.1204(c)(7). As of the promulgation date of this final rule, OSHA is unaware of PPE that could provide sufficient protection to an employee from an explosion involving a flammable atmosphere. OSHA notes that some practices such as the use of static electricity capture, non-static footwear, non-sparking tools, explosion-proof lighting, a nitrogen blanket, or misting may reduce the likelihood of igniting an explosion, but none of these practices would eliminate the possibility of ignition. Another example of a practice that would not provide protection from a spark, fire, or explosion in an LFL atmosphere is using fire watch personnel who have the responsibility of looking for a spark, fire, or explosion and then responding under emergency procedures. It is unlikely that fire watch personnel could react quickly enough to ensure that employees would not be exposed to an explosion. Therefore, the employer must not rely on these methods in a permit program to protect employees working in a hazardous atmosphere in excess of 10 percent LFL. A permit program must identify the means of reducing the atmosphere to or below the 10 percent LFL or provide for inerting and all necessary PPE. OSHA added a note to § 1926.1204(c)(4) to make explicit the requirement for an employer to inert a space and provide appropriate PPE if employees will work in a space where less than 10 percent LFL cannot be achieved.

Paragraph (c)(5). Final § 1926.1204(c)(5) requires an employer to determine that monitoring devices will detect an increased atmospheric hazard level in the event that the ventilation system malfunctions, and to do so in adequate time for employees to safely exit the space. This requirement is from proposed § 1926.1208(b). There is no corresponding provision specified in § 1910.146 that mirrors final § 1926.1204(c)(5) with respect to the use of ventilation to control atmospheric hazards as part of a permit program; however, the preamble to the alternative ''ventilation only'' procedures in § 1910.146(c)(5)(i)(B) noted a similar requirement as a condition of using the ''ventilation only'' approach instead of the full permit program requirements:

> In order for the space to be considered safe, the atmosphere within the space after ventilation may not be expected to approach a hazardous atmosphere. This is necessary so that, if the ventilation shuts down for any reason (such as loss of power), the employees will have enough time to recognize the hazard and either exit the space or restore the ventilation.

58 FR 4488. OSHA is including that requirement in the final rule as a condition of the ''ventilation only'' alternative procedures in final § 1926.1203(e), and OSHA is applying the same requirement to the use of ventilation to control atmospheric hazards under a full permit program because the atmospheric hazards that could be present in a PRCS are the same as the atmospheric hazards present in a final § 1926.1203(e) alternate-procedures space. Therefore, the need to plan for ventilation failure is the same: employers must have a system in place that quickly detects an increased atmospheric hazard in the event that the ventilation system stops so that employees can escape safely whether the entry is conducted under the permit program requirements of § 1926.1204 or the alternative ''ventilation only'' procedure allowed by § 1926.1203(e). As with the general industry standard (see explanation of § 1910.146(c)(5)(i)(B) above), compliance with this requirement means that employers must ensure that the mechanical ventilation will control the atmospheric hazards at levels that are *below* the levels at which they are harmful to entrants so that if the ventilation fails (for example, because of a loss of power) the employees will have sufficient time to escape without exposure between detection of an increase in atmospheric level and exit.

[20] This approach is consistent with longstanding industry safety practice and OSHA policy. Under its ''hierarchy of controls'' policy reflected in a number of standards, OSHA only allows employers to rely on respirators or other PPE to the extent that engineering controls to eliminate the hazard are not feasible. See, *e.g.,* §§ 1910.134(a) (respiratory protection) and 1926.103 (respiratory protection); 1910.1000(e) (air contaminants); 1910.95(b) (occupational noise exposure) and 1926.101 (hearing protection).

Proposed § 1926.1208(b)(2) contained provisions similar to those in final § 1926.1204(c)(5). One commenter requested that OSHA provide more detail as to how an employer can comply with this requirement, suggesting that employers take into consideration ''levels of detection by the monitoring system'' and ''increases in atmospheric hazards as workers are evacuating'' (ID–140, p. 5 (labeled p. 4)). The provision is performance-based, which allows each employer the flexibility to determine how it will use monitoring to comply with the requirement. As OSHA stated in the preamble to the proposed rule, monitoring is the primary method for detecting an increase in atmospheric hazard levels. OSHA therefore requires monitoring under this final standard to detect ventilation system failure. In addition, employers should be aware of other indicators of increasing atmospheric hazard levels, in addition to monitoring, that may be useful in supplementing monitoring to provide faster detection of ventilation failures, including changes in noise levels, air flow, or pressure, as well as signs, symptoms, and characteristic effects of exposure to the atmospheric hazard (72 FR 67365 (Nov. 28, 2007)).

Paragraph (c)(6). Final § 1926.1204(c)(6), which is identical to § 1910.146(d)(3)(v), requires an employer to provide entrants protection against external hazards. This requirement is in addition to the provision in paragraph (c)(2) of this section that an employer must provide barriers as necessary to prevent unauthorized entry. This requirement will protect employees in and around the PRCS, such as attendants, or employees entering or exiting the permit space, from being struck by individuals or objects outside the PRCS that may fall into the space, or that could injure the employees when they are near the PRCS. In some scenarios, employers must use guardrails, covers, signs, barricades, or other protective measures to achieve this purpose. Each of these measures must comply with the applicable specifications of 29 CFR part 1926, subpart G—Signs, Signals, and Barricades) and subpart M—Fall Protection.[21] For example, as stated in the preamble for the general industry rule, ''If entrants face a substantial risk of injury due to unauthorized entry, due to objects falling into the space, or due to vehicular hazards during entry into and exit from the space, then barriers would be required'' (58 FR 4997).

Paragraph (c)(7). Final § 1926.1204(c)(7), the first clause of which is identical to § 1910.146(d)(3)(vi), requires an employer to ensure that conditions remain acceptable for entry for the full duration of an authorized entry. The employer will often discharge this duty by complying with the entry-supervisor provisions in § 1926.1210(c) of this final rule. By requiring the employer to have an individual on site with this authority, there is a greater likelihood that the employer will conduct the required monitoring and adhere to the acceptable entry conditions, which is critical to the successful implementation of safe PRCS procedures.

OSHA also added a clarification in paragraph (c)(7) allowing employees to work in a permit space that contains a hazardous atmosphere, but *only if:* (1) ventilating or other measures prescribed in § 1926.1204(c)(4) will not reduce the hazardous atmosphere sufficiently to allow employees to work safely within the permit-space; (2) the employer can demonstrate that use of PPE will protect the employees from that atmosphere; *and* (3) the employer ensures that the entrants use the PPE correctly. Otherwise, the entry employer must prohibit entry, or ensure that authorized entrants exit the space immediately, whenever the atmosphere inside the space meets the definition of a ''hazardous atmosphere'' specified in final § 1926.1202. These provisions are implicit in the general industry standard, but OSHA made them explicit here to avoid any suggestion that an employer could specify an ''acceptable'' condition that would include a hazardous atmosphere, absent adequate PPE.

For example, if the employer plans to have employees in a portion of a storm sewer with an oxygen-deficient atmosphere, and it is not feasible to address the oxygen deficiency through measures prescribed in § 1926.1204(c)(4), then the employer may allow employees to enter with closed-circuit respirators that would protect the employees from the oxygen-deficiency hazard. If, however, the employer is unable to protect employees from these hazards using any of these methods, then it must prevent the employees from entering the space. Likewise, if a confined space contains a flammable atmosphere exceeding 10 percent, of the LFL, and the employer cannot feasibly reduce this level to the non-hazardous level (10 percent or below), then the employer must inert the atmosphere to address potential explosion hazards (and use supplied-atmosphere respirators to protect the employees from the oxygen-deficiency hazard), or terminate entry. See also the previous discussion of final § 1926.1204(c)(4).

Paragraph (c)(8). Final § 1926.1204(c)(8) requires an employer, before removing an entrance cover, to eliminate conditions that could make it unsafe to remove the cover. Some examples of such conditions are when the cover is under pressure or when the cover is preventing exposure to an ignition source near a hazardous atmosphere. There is no corresponding general industry provision that has requirements similar to final § 1926.1204(c)(8); it is drawn from the requirements in proposed §§ 1926.1210(b), 1926.1216(c) and 1926.1217(c).

As OSHA explained in the preamble to the proposed rule, conditions such as heat and pressure within the PRCS may pose a danger to employees removing an entrance cover. In such cases, the cover may be blown off in the process of removal, or superheated steam may suddenly escape and burn the employee. Another example involves removal of a sealed cover that results in the release of toxic gases (72 FR 67368).

To protect employees from the hazards inside the PRCS as required by this provision, the employer must make a hazard assessment before removing any cover. Accordingly, the provision does not permit removal of the cover to the PRCS until the employer identifies all hazardous conditions related to the cover's removal, and then eliminates those hazards.

One commenter recommended that OSHA refer to any ''hazardous'' condition, rather than just a ''condition,'' that could make it unsafe to remove the cover, and include language in the text of the final rule to address rescue personnel confronted with an entrance cover that is unsafe to open (ID–086, pp. 5–6). OSHA disagrees that adding the word ''hazardous'' to the provision would be helpful because the sentence already is clear that the condition at issue is such that removing the cover could be unsafe. The provisions of § 1926.1204 do not require entry employers to address in their permit programs the hazards that rescue personnel may face during rescue, nor do these provisions require the rescuers to develop separate written permit programs for rescue. However, § 1926.1211(b) requires that rescuers be informed of, and trained to recognize, hazards such as entry covers that would be unsafe to open and might affect the

[21] All additional requirements of subparts G and M remain in effect.

ability of the rescuers to perform rescues safely.

Paragraph (d). Final § 1926.1204(d), which is similar to § 1910.146(d)(4), requires each employer to provide all equipment used for confined-space operations at no cost to employees, maintain the equipment, and ensure that employees use the equipment correctly. OSHA believes that providing such equipment, and using it correctly, will prevent injuries and fatalities in permit spaces. Accordingly, the purpose of this paragraph is to ensure the availability and proper use of whatever equipment is necessary to reduce the dangers to employees posed by permit spaces.

In proposed § 1926.1218, OSHA required employers to provide several specific categories of equipment and included a catch-all ''any other equipment necessary for safe confined space operations.'' One commenter suggested that OSHA clarify that the employer must provide this equipment to employees at no cost (ID–211, Tr. p. 46). The § 1910.146(d)(4) language OSHA is adopting for this final rule specifies that employers must provide this equipment at no cost to employees. Final § 1926.1204(d) varies from the language of the general industry standard only in that it specifies that the employer must provide the listed equipment to ''each employee,'' whereas § 1910.146(d)(4) refers generally to ''employees.'' Accordingly, in appropriate cases, if an employer fails to provide the necessary equipment as required, OSHA may issue separate citations with respect to each individual employee not provided with the proper equipment.

Paragraph (d)(1). Final § 1926.1204(d)(1), which is identical to § 1910.146(d)(4)(i), requires an employer to provide necessary equipment for conducting adequate testing and monitoring. This equipment is essential for protecting employees from atmospheric hazards.

Section 1926.1204(a)(4) of the NPRM proposed requiring employers to use a direct-reading instrument to perform required testing or monitoring. One commenter asserted that direct-reading instruments are not available for ''airborne lead dust'' or ''paint that has a multitude of solvents in the formula'' (ID–077, p. 1). Another commenter asserted that the final rule should permit alternatives to direct-reading instruments when such instruments are not available (ID–025, p. 3). Final § 1926.1204(d)(1) requires an employer to test or monitor for atmospheric hazards that exceed PELs set to protect against immediate injury or illness, which is not the case with lead.[22] Furthermore, OSHA disagrees with the other commenters' premise that direct-reading instruments would be unavailable to detect solvents. It is the employer's responsibility to ensure that such equipment is available in spaces where the final rule requires such monitoring, and the commenter did not indicate that is infeasible to do so. For example, employers can use photoionization detectors for detecting solvents.

Another commenter suggested that OSHA should require equipment calibration daily to avoid equipment malfunction (ID–025, p. 4). OSHA is not making this change because the provision as written in this final standard provides employers with flexibility in complying with the requirements to maintain testing and monitoring equipment, and to use it properly. For example, the employer can follow the manufacturer's instructions, or the recommendations of a qualified person, regarding the frequency of equipment calibration. The manufacturers' instructions are sufficient for this purpose because equipment manufacturers are most familiar with the components, configuration, and safe and healthful operation of their equipment; this information places them in the best position to specify the proper maintenance, calibration, and use of this equipment under these circumstances. Alternatively, an individual who meets the definition of a qualified person in final § 1926.1202 would have, through a recognized degree or professional standing or through extensive knowledge, the demonstrated ability necessary to make decisions that will ensure the proper maintenance, calibration, and use of equipment used in confined spaces.

Another commenter suggested that OSHA should provide a specific calibration standard because manufacturers are starting to distinguish between various types of calibrations, such as ''bump calibration'' and ''field calibration'' (ID–028, p. 6). OSHA is not adopting this commenter's suggestion because developing a calibration standard is beyond the scope of this rulemaking.

Paragraph (d)(2). Final § 1926.1204(d)(2), which is identical to § 1910.146(d)(4)(ii), requires an employer to provide ventilating equipment necessary to establish acceptable entry conditions. For example, the employer must provide forced-air mechanical-ventilation equipment when using such equipment to establish acceptable entry conditions for entry operations under final § 1926.1204. Use of the required equipment when appropriate is a significant factor in protecting the employees from hazardous atmospheres.

Paragraph (d)(3). Final § 1926.1204(d)(3), which is substantively identical to § 1910.146(d)(4)(iii), requires an employer to provide all communications equipment necessary to ensure that an attendant can communicate effectively with entrants in accordance with §§ 1926.1208(c) and 1209(e). Not all spaces require equipment for effective communication between the attendant and entrants, but the employer must provide it when necessary. Such equipment may be necessary, for example, if the entrants cannot hear an attendant because the permit space is sealed off.

Another example where the employer must provide such equipment is when an attendant needs audio-visual equipment to perform his or her duties under the final confined spaces in construction rule for more than one permit space at a time. Examples of such equipment include electronic audio and video tools that enable the attendant to detect what is occurring inside the multiple PRCSs without the attendant having to, simultaneously, be physically present at each PRCS entrance. If an employer chooses to require an attendant to assess entrants' status in multiple PRCSs, the employer must provide all of the equipment necessary for the attendant to fulfill the required duties. OSHA believes that expecting an attendant to be able to adequately perform these duties without the equipment necessary to accomplish the attendant's duties under this final rule will jeopardize the health and safety of the entrants.

There is no provision in § 1910.146 or the proposed rule that explicitly requires electronic communication while attending multiple permit spaces, but that standard implies that such communication is necessary for the attendant to fulfill the required duties. In the proposed rule, OSHA requested comments on the means, other than electronic equipment, for an attendant to adequately assess entrants' status in multiple PRCSs. Both of the commenters who addressed this issue agreed that electronic equipment, either wireless or hard-wire, is the only means

[22] OSHA includes identification requirements in many of its hazard-specific standards, and employers working in a confined space must still comply with those requirements absent a specific exception, but those requirements are separate from this confined-space standard and are not subject to change as part of this rulemaking.

of accomplishing this duty, and there is no contrary information elsewhere in the record (ID–108, p. 2; –116, p. 3). The lone exception could be when an attendant is assessing entrants' status in two separate spaces that are immediately adjacent such that the employer can ensure assessment of both spaces with a single attendant positioned to fulfill the required duties without using observation equipment. Based on the information in the record as a whole, final § 1926.1204(d)(3) requires the employer to ensure each attendant uses electronic equipment as necessary when attending to multiple PRCSs that are not immediately adjacent to each other. This result also is consistent with final § 1926.1209—Attendant Duties.

Several commenters expressed concern that communications equipment would unnecessarily occupy limited room in a confined space when either spoken communication or line–of–sight communication would suffice (ID–033, p. 3; –061, p. 4; –077, p. 1; –101, p. 2). These comments ignore the premise of the requirement: final § 1926.1204(d)(3) explicitly states that the duty to provide communications equipment arises only when such equipment is necessary, which means that the employer must provide communications equipment only when verbal communication or line-of-sight communication are ineffective.

Another commenter asserted that radio communication is not always reliable (ID–094; p. 1). As OSHA stated in the preamble discussion of proposed rule § 1926.1210(j)(1), such equipment may consist of a variety of types (for example, cell phones, two-way hand-held radios), so long as it is effective (72 FR 67370 (Nov. 28, 2007)). If there is weak or unpredictable signal strength when using the device, the device would not comply with final § 1926.1204(d)(3) and the employer must remove the entrants until the attendant is situated to perform the required duties effectively. Effective, reliable communication equipment is essential in relaying information to attendants, entry supervisors, and other authorities regarding potentially dangerous changes in the PRCS conditions. Such information is critical to assess the hazards within the space and to provide information regarding methods appropriate for protecting or removing employees from those hazards.

Paragraph (d)(4). Final § 1926.1204(d)(4), which is identical to the general industry standard at § 1910.146(d)(4)(iv), requires an employer to provide PPE when feasible engineering and work-practice controls do not adequately protect employees. The employer must provide this equipment at no cost to the employees. When the employer uses equipment that is subject to an OSHA requirement, such as respirators or ear plugs, the employer must ensure that the equipment and its use comply with the applicable OSHA requirements. For example, failure to use the appropriate filters in a respirator can render its use ineffective, and would be a violation of the respiratory protection standard (§ 1926.103). The Note to paragraph (d)(4), which is not in the general industry standard, clarifies this point with respect to respirators because they are commonly used in confined spaces. OSHA believes that providing, using, and maintaining the appropriate PPE in accordance with OSHA requirements that address the identified hazard will protect employees from serious injury or death. However, as noted in the discussions of § 1926.1204(c)(4) and (c)(7) above, PPE cannot provide protection against some hazards such as explosions.

Paragraph (d)(5). Final § 1926.1204(d)(5), which is similar to § 1910.146(d)(4)(v), requires an employer to provide lighting equipment that complies with the illumination standard (29 CFR 1926.56) and is sufficient to allow employees to work safely and exit the space quickly in an emergency. The corresponding provision in § 1910.146(d)(4)(v) does not explicitly note that lighting equipment must meet other applicable OSHA standards; however, proposed rule § 1926.1210(j)(2) explicitly noted this requirement, and OSHA concludes that it is appropriate to include this clarification in the rule text. At least one commenter indicated that OSHA should explicitly cross-reference the applicable illumination standard (ID–011, p. 1), and OSHA did so here. OSHA also added language requiring approval of the lighting equipment for the ignitable or combustible properties of the specific, gases, vapors, dusts, or fibers present in the PRCS. OSHA took this additional language from the hazardous location requirements for the electrical equipment standard § 1926.407(b)(2)(i); a note to § 1926.407(b)(2)(i) references NFPA 70, the National Electric Code, which lists hazardous gases, vapors, and dusts by groups characterized by their ignitable or combustible properties. The additional language ensures that employees will use safe lighting equipment and wiring methods under the particular hazardous conditions present. This additional language does not increase employers' responsibilities under this final rule because the language merely reminds employers of an existing obligation they have under § 1926.407 when using lighting equipment under the specified conditions. As noted above, employers engaged in work covered by this standard must also comply with all other OSHA requirements unless specifically excluded.

OSHA believes that final paragraph (d)(5) will assist employees in conducting safe PRCS operations, including safe escape from a PRCS if necessary. OSHA notes that the provision would require an employer to provide lighting equipment that allows an employee to quickly exit a PRCS in the event of an emergency: For example, the loss of the primary power source. In this example, there are at least two ways in which an employer could fulfill this duty: (1) The employer can provide a reliable back-up power supply, or (2) the employer can provide employees with adequate flashlights, headlights, or similar hand-held lighting equipment. Providing adequate illumination for employees to exit quickly from a PRCS during such an emergency will enable employees to safely escape from a hazardous condition.

Paragraph (d)(6). Final § 1926.1204(d)(6), which is substantively identical to § 1910.146(d)(4)(vi), requires an employer to provide barriers and shields when required by this standard (see § 1926.1204(c)(6)). OSHA believes that this proposed requirement is necessary to keep unauthorized employees from entering the PRCS and to help protect employees inside the PRCS from being struck by objects and individuals falling into PRCSs. When providing this equipment, employers must ensure that it complies with other applicable OSHA requirements. For example, guardrails must meet the requirements of 29 CFR 1926.502(b) (Guardrail systems), and covers must conform to 29 CFR 1926.502(i) (Covers).

Paragraph (d)(7). Final § 1926.1204(d)(7), which is identical to § 1910.146(d)(4)(vii), requires an employer to provide equipment that facilitates safe entry to, and exit from, a PRCS. In doing so, employers must ensure that this equipment, including its use by employees, complies with the requirements of the applicable OSHA requirements (for example, 29 CFR part 1926, subpart X, for ladders and stairways, and 29 CFR part 1926, subpart L, for scaffolds). This equipment is critical under emergency-exit conditions to ensure that employees exit a PRCS in a timely and safe manner.

Paragraph (d)(8). Final § 1926.1204(d)(8), which is identical to § 1910.146(d)(4)(viii), requires an employer to provide rescue and emergency equipment as needed. Final § 1926.1204(d)(8) ensures that the proper equipment is available for rescuing authorized entrants in the event of an emergency in a PRCS, whether it is the employer's equipment or equipment belonging to a rescue service.

Paragraph (d)(9). Final § 1926.1204(d)(9), which is similar to § 1910.146(d)(4)(ix), requires an employer to provide any other equipment needed to safely enter or exit the permit space or to perform permit-space rescue. OSHA recognizes that there is a wide variety of permit spaces, and believes that the requirement to provide all additional equipment necessary to perform permit-space entry and exit ensures that the appropriate equipment is available at the job site so employees receive adequate protection from hazards present during permit-space operations. Similarly, OSHA believes the requirement to provide additional rescue equipment as needed addresses hazards that may be unique to a PRCS rescue, thereby ensuring that employees receive adequate protection from these hazards under emergency conditions. Accordingly, the employer must identify this additional equipment, if any, after conducting an assessment of the PRCS as required by the applicable sections of this final rule.

Proposed § 1926.1218(a)(4) specified that an employer provide any other equipment necessary for safe ''confined space operations.'' For consistency, a commenter suggested replacing the term ''confined space operations'' with ''confined space entry,'' which OSHA used frequently in the proposed rule (ID–025, p. 4). In response to this comment, OSHA adopted in final § 1926.1204(d)(9) the corresponding language in § 1910.146(d)(4)(ix), which uses the term ''entry.'' OSHA added the phrase ''safe exit from'' to this final provision to clarify that employers must provide equipment needed for employee safety during the entire period they are involved in confined space operations, which includes ensuring that employees can exit safely from the space.

Paragraph (e). Final § 1926.1204(e), is similar to § 1910.146(d)(5), but includes language from proposed § 1926.1215—Continuous system permit spaces, as well as editorial revisions to the introductory text.

Paragraph (e)(1). Final § 1926.1204(e)(1) requires an employer to test the permit space for acceptable entry conditions. Information obtained from testing is vital to the identification of atmospheric hazards in the space. In instances when the permit space is fixed or isolated, the testing will be straightforward. Final § 1926.1204(e)(1), however, also acknowledges that accurately testing the full extent of a permit space, or even a workspace within a larger permit space, may be infeasible because the PRCS is large or is part of a continuous system. The size of the space could limit the value of the initial testing of entry conditions because the conditions in the work space could be affected by substances in the connected spaces and, therefore, subject to change. In such cases, employers must comply with the additional procedures in final § 1926.1204(e)(1)(i)–(iii), which include pre-entry testing to the extent feasible, continuous monitoring if such monitoring is commercially available, and an early warning system that monitors continuously for non-isolated engulfment hazards.

Final § 1926.1204(e)(1) is similar to the corresponding provision for general industry confined spaces at § 1910.146(d)(5)(i), with three exceptions. First, OSHA reorganized the two requirements in § 1910.146(d)(5)(i), pre-entry testing followed by continuous monitoring, into separate paragraphs in final § 1926.1204(e)(1)(i)–(ii). Second, OSHA also added the requirement for employers to provide an early warning system in final § 1926.1204(e)(1)(iii). OSHA separated the two paragraphs to emphasize that an employer performing confined-space operations under final § 1926.1204(e)(1) may be performing work under a special set of conditions in a portion of a large space a continuous system. As such, the employer must comply with the special procedures in § 1926.1204(e)(1)(i) through (iii) (testing, continuous monitoring, and an early warning system), as well as paragraphs (e)(2) through (6), to account for migrating hazards. One example of this type of confined space is a sewer in which a storm or other activity at another location could send water or hazardous materials into the space in the sewer where employees are working.

Third, OSHA added language clarifying that it is the employer's responsibility to demonstrate that isolation of the space is infeasible. This requirement is implicit in § 1910.146(d)(5)(i), so OSHA added this language to make the requirement explicit and clarify that an employer who determines that isolation of a space is infeasible is most able to provide information that supports this decision.

Paragraph (e)(1)(i). Final § 1926.1204(e)(1)(i) requires an employer to test to ensure that acceptable entry conditions exist immediately before entry occurs. The testing must occur ''to the extent feasible,'' meaning that even if the employer makes a determination that it is infeasible to isolate the space and the test results may not accurately reflect all potential hazards in the space, that employer still has a responsibility to perform normal testing in the workspace prior to entry to ensure that a hazardous atmosphere does not already exist in that workspace.

Paragraph (e)(1)(ii). Final § 1926.1204(e)(1)(ii) requires an employer to continuously monitor a non-isolated permit space unless the employer can demonstrate that the equipment needed for continuous monitoring is not available commercially. Note that this requirement is different than the monitoring requirement for isolated spaces in § 1926.1204(e)(2) because paragraph (e)(1)(ii) does not include an option for periodic monitoring *unless* continuous monitoring is not commercially available (paragraph (e)(2) allows for periodic monitoring in certain other circumstances). Non-isolated permit spaces, relative to other PRCSs, have an enhanced risk of unexpected changes in hazardous atmosphere levels because atmospheric hazards could migrate from other areas, so OSHA only permitted periodic monitoring in non-isolated spaces in the absence of a viable alternative. By monitoring the space continuously, employers should detect rising levels of a hazardous atmosphere or the introduction of a new atmospheric hazard before it is too late to warn the authorized entrants and evacuate them from the space.

Final § 1926.1204(e)(1)(ii) is similar to the corresponding provision for general industry confined spaces at § 1910.146(d)(5)(i), except that OSHA allows for the absence of commercially available equipment that could make it infeasible to conduct continuous monitoring. In such instances, OSHA still requires periodic monitoring to increase the likelihood of identifying as quickly as possible a hazardous atmosphere migrating from another part of a continuous system. Several commenters were unsure what OSHA means by ''not commercially available'' (ID–106, p. 3; –129, p. 3; –152, p. 3). Typically, equipment is ''commercially available'' if it is offered for sale to the public or to the relevant employers. As OSHA stated in the preamble to the proposed rule, one example of when continuous monitoring may not be commercially available involves particulate atmospheric hazards (72 FR 67381). In these cases, the employer must be able to demonstrate that periodic monitoring is of sufficient frequency to ensure that the atmospheric hazard remains at a safe level, as planned (*id*). OSHA added a cross-reference to final § 1926.1204(e)(2) to inform employers of the frequency with which to monitor periodically for hazards if continuous monitoring is not commercially available.

Several commenters asserted that OSHA should require a competent person to perform the testing and monitoring (ID–025, p. 3; –086, p. 5). OSHA agrees that the tester must be competent, but is not revising the text of the regulation to refer to a competent person because OSHA believes that the existing language, taken directly from the general industry confined-spaces standard, adequately addresses the competency of the tester. In this regard, the general industry confined-spaces standard does not use the term ''competent person,'' but does use terms such as ''attendant'' and ''entry supervisor'' that require a level of experience and training regarding testing or monitoring equivalent to that of a ''competent person,'' as defined in § 1926.32(f). For example, final § 1926.1208(b) and § 1910.146(h)(2) both require an authorized entrant to possess the necessary knowledge to properly test the atmosphere within a confined space (see also § 1926.1204(d)). Under the training provisions of both § 1910.146(g) and final § 1926.1207, an employer must provide specific training to an employee designated as an ''authorized entrant''; this training must establish proficiency in the duties an authorized entrant must fulfill under these standards. In this respect, the scheme of both § 1910.146 and this final rule accomplish the commenters' objective, which is to design a procedure whereby the person performing the atmospheric tests has sufficient knowledge and experience to conduct the tests properly.

Different commenters asserted that OSHA should identify the specific locations for monitoring equipment in the permit space (ID–106, p. 2; –129, p. 2). For example, these commenters suggested that OSHA require an employer to place monitoring equipment at the merger point between the larger space and the non-isolated entry point. The continuous-monitoring requirement is a performance-based standard, and OSHA does not agree that it is necessary to specify particular locations for the placement of monitoring equipment, especially when technology and monitoring practices may evolve in the future. Accordingly, employers have flexibility to choose their preferred methods and equipment to monitor, so long as the monitoring equipment, when used in accordance with manufacturer requirements, detects rising levels of a hazardous atmosphere or the introduction of a new atmospheric hazard before it is too late to warn the authorized entrants and evacuate them from the space. For additional information about atmospheric monitoring, see May 12, 2009, letter to Edwin Porter, Jr.

Another commenter asserted that an employer must use more than one piece of continuous-monitoring equipment to effectively detect hazards (ID–031, p. 1). Final § 1926.1204(e)(1)(ii) does not require the use of more than one piece of continuous-monitoring equipment; however, the provision also does not specify that employers can accomplish monitoring using only one piece of equipment. The number of monitors an employer would need to ensure the isolation or control of atmospheric hazards depends on the PRCS's size, configuration, and conditions; the requirement here is that employers use whatever number of monitors is necessary to ensure the isolation or control of the atmospheric hazards. OSHA also selected the performance-oriented approach so that this standard will not become outdated through advances in monitoring technology.

Paragraph (e)(1)(iii). Final § 1926.1204(e)(1)(iii) requires an employer to provide an early warning system that will detect non-isolated engulfment hazards. OSHA included this requirement in proposed § 1926.1215(a)(2), but there is no corresponding § 1910.146 provision. As OSHA stated in the preamble to the proposed rule, this equipment addresses migrating engulfment hazards that are present in a non-isolated PRCS. For example, these hazards can result when runoff from a heavy storm upstream of a sewer flows downstream into the area in which employees are working. OSHA noted in the preamble of the proposed rule that migrating hazards, especially those hazards migrating from distant areas, are common in non-isolated spaces (72 FR 67382). Accordingly, this requirement is necessary to protect authorized entrants from the additional hazards associated with these spaces, including engulfment hazards.

One commenter suggested that the requirement for an early warning system will force employers to hire more employees for the purpose of monitoring the space (ID–059). Neither the comment nor the rest of the record provide support for this suggestion. To the contrary, employers have flexibility in determining whether to hire additional employees to comply with final § 1926.1204(e)(1)(iii). An employer may position detection and monitoring devices, without the need to hire additional employees, to provide the early warning. A full discussion of the costs of early warning systems is included in the Final Economic Analysis in this document.

One commenter appeared to assume that this provision required using equipment, not additional employees, to monitor engulfment hazards. This commenter asserted that such equipment is too expensive to maintain (ID–098, p. 1). This commenter did not provide any support for the assertion, or any specific information about problems associated with maintaining or operating such equipment. OSHA notes that the use of properly calibrated equipment to detect non-isolated engulfment hazards is a current practice by many in the industry and has been since before OSHA issued the proposed rule (see transcripts of stakeholder meetings, available at: *https://www.osha.gov/doc/reference_documents.html*). Without a specific reason why an early warning system is infeasible, OSHA retained this requirement in the final rule.

Another commenter asserted that an early warning system requirement will require an employer to evaluate and calibrate such systems for each potential hazard (ID–216). It is not clear from the comment, however, that the commenter understood that the early warning system described in the proposal (and this provision) must detect only non-isolated *engulfment* hazards, not each potential atmospheric hazard. Because engulfment hazards involve the movement of tangible substances (*e.g.,* water, mud, sand), systems may detect movement of different substances using the same methods (*e.g.,* a motion detector or other sensor triggered by the movement of water, mud, sand, or another substance through a particular area). The commenter did not provide any specific examples of equipment that would require calibration in a way that would be burdensome to the employer or diminish the effectiveness of the equipment in providing an early warning.

The same commenter suggested as an alternative requiring employers to disconnect, blind, lockout, or isolate all pumps and lines that may cause contaminants to flow into a confined space, and then continuously monitor that space. The alternative approaches mentioned by the commenter appear to be directed at isolating the hazards. If the employer effectively isolates or eliminates all physical hazards within the entire permit space, then it might be possible for the employer to avoid the permit program altogether if employees can enter the space through the alternative procedures in § 1926.1203(e), or if there are no atmospheric hazards and the permit space is reclassified in accordance with § 1926.1203(g). OSHA anticipates, however, that in most cases employers in non-isolated spaces will need to comply with § 1926.1204(e)(1)(iii) because it may not be possible for employers to eliminate all physical hazards from a continuous system.

Other commenters asserted that the requirement to use an early warning system exposes the individuals installing the system to hazards (ID–098, p. 1; –120, p. 4). OSHA disagrees with these commenters' assertion. There are many types of early warning systems available, including flow monitors that are suspended in an upstream manhole such that no employee needs to climb down into the confined space to place or retrieve the monitor. These devices are capable of detecting engulfment hazards approaching from upstream without exposing the individuals installing them to additional hazards. Employers may also be able to lower cameras or other devices into the space, or conduct visual inspections from above the space without entering at all.

One commenter was unsure when, where, and how an employer must implement an early warning system (ID–124, p. 5). Another commenter asserted that OSHA should explicitly recognize that the use of electronic monitoring constitutes an acceptable early warning system (ID–107, p. 3). In response to these comments, OSHA notes that, once the employer determines that isolation of the space is infeasible, then the employer must implement an early warning system in accordance with final § 1926.1204(e)(1)(iii). The employer has flexibility in determining what type of system to use based on information it receives about the space and its hazards, and based on the employer's experience working in similar spaces. The system can be as simple as posting observers with communication equipment in safe locations (*e.g.,* outside an open manhole) at distances far enough upstream from the work area to timely communicate a warning to the entrants working downstream. Another method would be to use detection or monitoring devices upstream that will alert an attendant, or activate alarms at the entrants' work area, in sufficient time for the entrants to safely avoid upstream engulfment hazards moving in their direction. So long as the use of electronic monitoring alerts authorized entrants and attendants of non-isolated engulfment hazards in sufficient time to safely exit the PRCS, the employer will be in compliance with final § 1926.1204(e)(1)(iii).

Paragraph (e)(2). Final § 1926.1204(e)(2) requires an employer to continuously monitor the space unless the employer can demonstrate that the equipment for continuously monitoring a hazard is not commercially available or that periodic monitoring is sufficient to ensure the control of atmospheric hazards at safe levels. Final rule § 1926.1204(e)(2) is similar to the corresponding provision for general industry confined spaces at § 1910.146(d)(5)(ii), except that final § 1926.1204(e)(2) generally requires continuous monitoring as did the proposed rule (see proposed § 1926.1215(a)(1)). Several commenters supported the requirement to monitor permit spaces continuously (ID–105, p. 2; –106, p. 2). One of these commenters asserted that ''periodic monitoring could be difficult to interpret, which could potentially lead to situations where an employer's monitoring scheme fails to adequately monitor rapidly changing atmospheric conditions that could pose risks to workers who enter a confined space'' (ID–105, p. 2).

In the typical PRCS in a construction setting, it is often difficult for the employer to predict with reasonable certainty the levels of hazardous atmospheres. In many instances, the employer will have little or no past experience with the particular PRCS, and will lack reliable historical data on hazard levels. Also, the PRCS may change as construction work progresses in ways that may cause unexpected increases in hazard levels. For example, changes to the wall of a PRCS may increase the level of hazardous gasses in the PRCS (see also ID–213.1, describing examples of how construction spaces can include hidden dangers, such as paints or sealants that can release toxic fumes if triggered by welding or other sources of heat.) In addition, construction equipment in the PRCS may discharge hazardous gasses into the space at a higher rate than anticipated.

In short, construction work follows a less predictable course than work covered by the general industry standard and, thus, requires more frequent atmospheric monitoring. Because of this high level of unpredictability, OSHA believes, generally, that continuous monitoring is necessary to protect affected employees, especially the entrants. This provision enables the employer to recognize deteriorating conditions quickly, and to identify new atmospheric hazards in time to take the actions required to protect employees.

However, the Agency recognizes that, for some PRCSs, especially those PRCSs entered and monitored repeatedly over a significant period of time and found to have a stable atmosphere (such as a remote location that is not near potential sources of atmospheric hazards), the employer may be able to show that periodic monitoring will be sufficient to ensure that the conditions in the PRCS remain within acceptable entry conditions. However, when the employer uses periodic monitoring, the monitoring must be of sufficient frequency to ensure the control of atmospheric hazards at planned levels, and capable of detecting new hazards in time to protect the employees. In some cases, continuous monitoring may not be possible; for example, continuous monitoring typically is not available when the atmospheric hazard is a particulate. Therefore, when the employer can show that periodic monitoring is adequate, or can demonstrate that the technology for continuous monitoring of the atmospheric hazard is not available, OSHA will permit the employer to use effective periodic monitoring instead of continuous monitoring.

The preamble discussion of proposed § 1926.1205(a)(3) provided the following factors that OSHA will consider in determining whether an employer has used an appropriate monitoring frequency: The results of tests allowing entry; regularity of entry (*e.g.,* daily, weekly, monthly); effectiveness of previous monitoring activity; and knowledge of the hazards (72 FR 67362). One commenter suggested adding the following factors to this list: (1) The type of the work performed in the space (*i.e.,* hot versus cold work); (2) the time period the confined space remains unmonitored (*i.e.,* requiring monitoring every 20–30 minutes), and; (3) lunch breaks (ID–132, p. 3). Knowledge of the hazards from the list in the proposed rule covers the first of these suggested factors (type of work), while regularity of entry from the proposal's list covers the third suggested factor (lunch breaks). Effectiveness of previous monitoring activity from the proposal's list addresses the second suggested factor (the time period the permit space remains unmonitored). Accordingly, an employer must account for the development of hazardous atmospheres during periods when no atmospheric monitoring occurs in the space to determine whether entry conditions remain at safe levels over these periods. For example, if the space remains unmonitored for just a few minutes prior to reentry, and previous monitoring regularly indicates that acceptable entry conditions continued to exist over this period, then an employer may conclude that it is not necessary to monitor again prior to reentering the space. However, if the space remains unmonitored for a longer time and previous monitoring indicates that atmospheric hazard levels increase over this period, then an employer must evaluate and monitor the space again before reentering it.

Some commenters asserted that OSHA must define the term ''periodic monitoring'' to avoid confusion among the regulated community (ID–075, p. 10; –129, p. 2;–152, p. 2). The frequency with which it is necessary to monitor a confined space differs based on the particular facts and circumstances. OSHA provided the factors listed in the previous paragraph to assist employers in determining when periodic monitoring is necessary; however, final § 1926.1204(e)(2) maintains performance-based language, which OSHA believes will provide employers with flexibility in complying with this final rule. Moreover, there was no indication in the record that the longstanding use of the term ''periodic testing'' in § 1910.146 is causing the level of confusion suggested by the commenters.

Paragraph (e)(3). Final § 1926.1204(e)(3), which is identical to § 1910.146(d)(5)(iii), requires an employer to test for particular substances in a pre-determined order: oxygen, then combustible gases and vapors, and finally toxic gases and vapors. The preamble to the general industry confined-spaces standard noted that this procedure represents generally accepted safe work practices, and explained the specified order as follows:

A test for oxygen must be performed first because most combustible gas meters are oxygen dependent and will not provide reliable readings in an oxygen deficient atmosphere. In fact, the Johnson Wax Company (Ex. 14–222) stated that 'there is [a] specific (sensor dependent) oxygen level below which the combustible gas sensor will *not* respond at all [emphasis was supplied in original].' Combustible gases are tested for next because the threat of fire or explosion is both more immediate and more life threatening, in most cases, than exposure to toxic gases.

(58 FR 4499). OSHA also included this same requirement in the proposed § 1926.1205(a)(1), and received no comments challenging the validity of this approach. OSHA remains convinced that the priority assigned to testing or monitoring atmospheric hazards by final § 1926.1204(e)(3) remains valid, and believes that this requirement is critical to the health and safety of employees involved in confined-space entry.

OSHA notes that final § 1926.1204(e)(3), like the proposed rule, does not require an employer to test for combustible dust. There currently are technological limitations on testing for airborne combustible dust in a timely manner; in addition, unlike flammable vapors, in situations in which airborne combustible dust reaches a minimum combustible concentration, the dust cloud generally is dense enough to detect with the naked eye.

Paragraph (e)(4). Final § 1926.1204(e)(4), which is identical to § 1910.146(d)(5)(iv), requires an employer to provide an authorized entrant or employee authorized representative with the opportunity to observe testing or monitoring. See the discussion of final § 1926.1204(c)(2) for an explanation of the importance of providing an opportunity an opportunity for observation to entrants or their representatives.

Paragraph (e)(5). Final § 1926.1204(e)(5), which is similar to § 1910.146(d)(5)(v), requires an employer to reevaluate a PRCS if there is ''some indication'' that the previous evaluation was inadequate and an authorized entrant or that entrant's authorized representative asks an employer to reevaluate the space. This requirement ensures that entrants, or their representatives, can provide a check on potential human error in the monitoring process before they are potentially exposed to harm. This requirement is consistent with other requirements to allow employee observation of testing results, the reasons for which are set forth in the explanation of § 1926.1204(c)(2). In some cases employees who did not observe the initial monitoring process may notice something about the equipment or space that calls into doubt the initial evaluation, but in other cases this requirement serves as a corollary to the general observation requirements: an employee or employee representative who observes the initial evaluation of the space pursuant to § 1926.1204(c)(2) and notes a problem with that testing may request a re-evaluation of the space under § 1926.1204(e)(5).

Section 1910.146(d)(5)(v) requires an employer to reevaluate when an authorized entrant or the entrant's authorized representative ''has a reason to believe'' the initial evaluation may have been inadequate. Otherwise, this provision of the final rule is identical to § 1910.146(d)(5)(v). Examples of indications that the evaluation of the permit space was inadequate include: improper use of monitoring equipment (*e.g.,* monitoring devices have low battery life or noticeable damage; monitoring devices improperly calibrated; measurements taken in improper locations); employees noting physical hazards not identified in the evaluation; and inconsistent monitor readings without adequate explanation.

Addressing an example in proposed § 1926.1207(a)(3), one commenter was unsure who would make the final decision of whether there is a reasonable basis for believing that a hazard determination is inadequate (ID–120, p. 4). Specifically, the commenter presented a situation in which an employee provides an alleged basis for believing that a hazard determination is inadequate, but the employer finds that the basis is not reasonable. Under final § 1926.1204(e)(5), the employer may repeat the test, alter the test to assess additional aspects of the space, or assess whether a change occurred in the use or configuration of the space after testing. If such a change occurred, then the employer must reevaluate the space. Therefore, compared to the more subjective language in the general industry standard (*i.e.,* ''has reason to believe''), the reevaluation requirement in this final provision (*i.e.,* ''some indication'') is more objective and based on the observable conditions, thereby reducing ambiguity.

Paragraph (e)(6). Final § 1926.1204(e)(6), which is identical to § 1910.146(d)(5)(vi) except for non-substantive clarifications and grammatical changes, requires an employer to immediately provide the results of testing conducted in accordance with final § 1926.1204 to each authorized entrant or that employee's authorized representative. This requirement will ensure that employees and their representatives have the information necessary to identify potential inadequacies in the testing and take action under paragraph (e)(5) of this section to avoid unsafe entries. In some cases the testing may reveal specific conditions that fall within an employee's expertise or may be relevant to an individual health condition of the employee. For example, if an employee knows that he or she has a particular sensitivity to even low levels of a substance that would not otherwise result in a hazardous atmosphere, the employee could review the test results and alert the employer if that substance is detected so that the employer can provide appropriate measures to protect the employee. See the discussion of final § 1926.1204(c)(2) for further explanation of this requirement.

Paragraph (f). The introductory text of final § 1926.1204(f), which is identical to § 1910.146(d)(6), requires an employer to provide at least one attendant outside a PRCS while an authorized entrant is performing confined-space operations. Although an attendant does not have the overall responsibility for employee safety and health assigned to the entry supervisor, the attendant is a crucial link between authorized entrants and the entry supervisor, and is essential for proper rescue operations. See the discussion in § 1926.1209 of this final standard for further explanation of the attendant's duties and the importance of the attendant in confined-space operations.

Paragraphs (f)(1) and (f)(2). In final § 1926.1204(f)(1), OSHA authorizes the permit program to allow for an attendant to perform his or her required duties, including assessing authorized entrants' status and meeting the requirements of § 1926.1209 for more than one permit space, similar to the requirement specified in the proposed rule at § 1926.1210(f)(3). Under final § 1926.1204(f)(2), the permit program may allow an attendant to fulfill his or her assessment duties for one or more spaces from a remote location provided the attendant is capable of fulfilling all attendant duties under § 1926.1209 for all spaces to which the attendant is assigned from that remote location. Final § 1926.1204(f)(1) and (f)(2) are similar to the note in the general industry confined-spaces standard at § 1910.146(d)(6). OSHA acknowledges that, although it is best to have an attendant outside each PRCS, there may be situations when one attendant can effectively fulfill the attendant duties in multiple PRCSs. The ability to assess entrants' status in multiple PRCS sites allows employers maximum flexibility in providing for the safety of employees when site-specific factors permit the attendant to do so. For instance, in some circumstances a single attendant equipped with modern technologies such as an automated monitor/alarm system and audio-video equipment may be able to assess entrants' status in multiple sites and react to emergency conditions as effectively as a single attendant at each space.

While paragraph (f)(1) sets forth performance-based measures, OSHA believes that an attendant's ability to assess entrants' status in multiple permit spaces while adequately performing attendant duties is dependent on several factors, that include: (1) the number of permit spaces the attendant assesses simultaneously; (2) the degree and number of the hazards; (3) how effective the assessment technology used is at assessing entrants' status and the conditions in the permit space (*i.e.,* is there a system in place for the attendant to track, from a remote location, who is coming in and out of a permit space); and (4) the distance between the multiple permit spaces. This provision may preclude a single attendant from serving as the attendant for multiple spaces if the employer also designated the attendant to provide non-entry rescue service. In most cases, an attendant with non-entry rescue responsibility must be physically present to retrieve immediately the entrant absent the availability of equipment that would enable the attendant to perform the rescue task remotely and successfully. As noted in the criteria above, the degree of the hazard may affect the timing of entrant retrieval and, thus, the physical proximity required for an attendant who has non-entry rescue responsibility (*e.g.,* if the permit space contains combustible gases that present a dangerous fire hazard, the attendant must be capable of retrieving the entrant immediately).

One commenter suggested that OSHA provide a maximum distance from which one attendant can assess entrants' status in multiple PRCSs (ID–059.1, p. 1). OSHA did not mandate a maximum distance because there are a number of factors that could influence the proper distance from which an attendant can assess entrants' status in multiple PRCSs while remaining in compliance with the applicable attendant requirements under this final rule. For example, some of the factors could be the particular circumstances at the worksite (the location and accessibility of the permit space), the visual acuity and observation skills of the attendant, and the equipment provided to the attendant. This approach provides the most flexibility to employers.

Paragraph (g). Final § 1926.1204(g), which is identical to § 1910.146(d)(7), requires an employer to specify, in its permit program, the means and procedures it will use to ensure that a single attendant is capable of effectively fulfilling the attendant duties for multiple confined spaces if an emergency occurs in one of the spaces. As specified in the final preamble to § 1910.146 and the note to proposed § 1926.1210(f)(3)(ii), effective assessment procedures include procedures to ensure that the attendant can respond adequately to emergencies. If the attendant needs to devote his or her entire attention to one of the spaces or conduct non-entry retrieval, the attendant must have a backup ready to assume the attendant duties for the other space or order the evacuation of that space.

A commenter asserted that paragraph (g) also should include requirements for: (1) testing and charging electronic equipment used to assess entrants' status in multiple PRCSs; (2) the use of equipment within acceptable limits in accordance with Federal Communications Commission (FCC) guidelines; and, (3) attendant training (ID–108.1, p. 2). In response, OSHA notes, first, that final § 1926.1204(d) requires employers to maintain equipment provided for compliance with this final rule, which includes properly testing and charging the equipment. Second, this final rule works in conjunction with other federal laws, and compliance with FCC guidelines is a matter best addressed by the FCC. Third, final § 1926.1207 requires the employer to train all employees, including attendants assessing multiple permit spaces, on the provisions of the standard so that the employees can effectively perform their designated duties under this standard. Thus, OSHA concludes that the final standard already includes the duties requested by the commenter, and that this final standard provides employers with appropriate flexibility in performing these duties.

Paragraph (h). Final § 1926.1204(h), which is identical to § 1910.146(d)(8) except for minor clarifications, requires each employer to specify the names of each person who will have a particular role in confined-space operations, characterize those roles, and train the named people accordingly. In the final rule, OSHA clarified that each employer must designate each and every employee assigned to a specific role under this final rule. This provision will enable employers, employees, and OSHA to identify which employees need to receive what training under final § 1926.1207.

One commenter was uncertain whether the attendant and the entry supervisor must be different employees (ID–124, p. 8). The definition of ''entry supervisor'' in final § 1926.1202 includes a note explaining that an entry supervisor also may serve as an attendant or an authorized entrant. This note is identical to the note in the general industry confined-spaces standard at § 1910.146(b). OSHA included this note to parallel the general industry standard and because OSHA's enforcement experience demonstrates that, when the entry supervisor has adequate training, he/she is capable of serving simultaneous roles effectively. Moreover, proposed § 1926.1210(h) specifically stated that an entry supervisor could serve simultaneously as an attendant or an authorized entrant, which is consistent with this final rule, and OSHA did not receive any comments indicating that this dual role was infeasible or inappropriate.

Paragraph (i). Final § 1926.1204(i), which is nearly identical to § 1910.146(d)(9), requires an employer to have and implement effective procedures for summoning rescue services (including procedures for summoning emergency assistance in the event of a failed non-entry rescue), performing rescue, and preventing unauthorized personnel from attempting rescue. The only difference from the general industry requirement is that OSHA added a parenthetical to note that employers have a duty to summon emergency assistance in the event of a failed non-entry rescue.

Several commenters were unsure which employer must summon rescue (ID–025, p. 4; –150, p. 3). Another commenter asserted that the attendant should summon rescue (ID–210, Tr. p. 357). Final § 1926.1204(i) applies to any employer, including a controlling contractor or host employer, that has its own employees performing confined space operations. Each such employer must designate an attendant, and final § 1926.1209(g) requires the attendant to summon a rescue service when needed. When multiple employers are operating in the same space, the employers must coordinate the procedures for summoning a rescue service as part of their general coordination duties under §§ 1926.1203(h)(4) and 1926.1204(k). This provision will ensure that procedures are in place for the timely and effective rescue of entrants when necessary.

Paragraph (j). Final § 1926.1204(j), which corresponds to the requirements in § 1910.146(d)(10), requires an employer to develop procedures for the development, issuance, use, and cancellation of an entry permit; the final provision also is similar to proposed § 1926.1212(a). The permit is one of the most crucial elements of a permit program because it provides specific instructions for monitoring and addressing hazards in a particular space. See the discussion to final §§ 1926.1205 and 1926.1206 for further explanation on the importance of developing and using entry permits for confined-space entry. In the final rule, OSHA added a clarification that these procedures must cover the safe termination of entry operations, which must include procedures for summoning emergency assistance in the event that non-entry rescue fails (see discussion of backup emergency assistance in final § 1926.1211).

One commenter was unsure which employers must comply with final § 1926.1204(j) (ID–120, p. 4). Final § 1926.1204(j) applies to any employer, including a controlling contractor or host employer, that has its own employees performing confined space operations.

Paragraph (k). Final § 1926.1204(k) requires an employer to develop and implement procedures for coordinating confined-space entry when multiple employers are performing work simultaneously that could affect conditions in a permit space, a requirement derived from proposed § 1926.1204(d). In the general industry confined-space standard, § 1910.146(d)(11) requires coordination procedures when multiple employers are working simultaneously ''as authorized entrants.'' This final provision differs from § 1910.146(d)(11) by addressing the need to coordinate work activities through the controlling contractor, as well with employers working outside the permit space when their work could foreseeably affect conditions within a confined space. The controlling contractor (or the employer specified in § 1926.1203(i)) and each entry employer are responsible for coordinating work activities among different employers to protect confined space entrants under final § 1926.1203(h)(4), and entry employers must ensure that their permit programs specify when and how they will share information with the controlling contractor in a timely manner in accordance with § 1926.1203(h)(4) and (h)(5)(ii). The permit program also must address how the entry employer's employees are to receive and transfer information about a confined space from the controlling contractor in accordance with § 1926.1203(h)(2), and how the entry employer will ensure that it implements coordination instructions from the controlling contractor. In addition, the entry employer still has the duty of including in its permit program steps to ensure coordination, even absent action by the controlling contractor. Such steps might include evaluation of work and practices being performed by other employers that could affect conditions inside the space, and coordinating with those employers to ensure safe conditions inside the confined space. For example, if an entry employer sees another employer setting up blasting equipment next to the permit space, the entry employer must check with that employer to ensure that the blasting activity will not take place when an entrant is in the permit space. For additional explanation of the entry employer's responsibilities for coordination, see the discussion of § 1926.1203(h)(4).

Paragraph (l). Final § 1926.1204(l), which is identical to § 1910.146(d)(12), requires an employer to develop and use procedures for terminating an entry permit and entry operations; the final provision also derived from proposed §§ 1926.1212(a) and 1926.1214(d). See the discussion of final § 1926.1205(e) for further explanation of the need to develop and use procedures for terminating an entry permit and entry operations, including closing the entry portal. Also, OSHA responded to the relevant comments to proposed § 1926.1212(a) in its discussion of final § 1926.1204(j).

Paragraph (m). Final § 1926.1204(m), which is similar to § 1910.146(d)(13), requires an employer to review its permit-space program whenever the procedures prove inadequate, and to revise those procedures when necessary. Section 1910.146(d)(13) requires the employer to review its program when *the employer has reason to believe that* the measures taken are inadequate. OSHA revised this language in this final rule by clarifying that the objective circumstances, not the employer's belief, must be the basis of the review. See the discussion of final § 1926.1205(f) for further explanation of the need to review an entry permit and to make revisions as necessary.

In addition, OSHA modified the note under paragraph (m) from the language used in the corresponding note to the general industry standard at § 1910.146(d)(13). OSHA added the phrase ''including, but not limited to'' in this final provision to clarify that the examples in the note are not an exhaustive list.

Paragraph (n). Final § 1926.1204(n) is identical to § 1910.146(d)(14) except for grammatical revisions, and requires an employer to review its permit-space program at least every year and make revisions to its procedures as necessary; this provision also expands upon, and clarifies, the proposed rule at § 1926.1214(b). The Agency moved the comma that appears after ''as necessary'' in § 1910.146(d)(14) to appear after ''1926.1205(f)'' in this final rule to clarify that this provision requires an employer to review cancelled permits within one year after each entry. The

Agency notes that, in interpreting the same language in the general industry standard, OSHA permitted employers to rely on documentation of quarterly reviews, rather than cancelled entry permits, in conducting its annual review, so long as that documentation contains the same information required to be in the cancelled entry permits, including ''any information regarding problems encountered during entry operations that was recorded to comply with paragraph (e)(6)'' and ''any revision of the program that resulted from such problems.'' See October 21, 1993, letter to John Anderson. The Agency will also accept the equivalent documentation under this construction final rule. Some commenters asserted that requirements to review the program are pointless because they do not ensure that employers will discover hazards in a timely manner (*i.e.,* they will discover any problems after the fact) (ID–075, p. 10;–099, p. 2;–101, p. 2). OSHA did not design final § 1926.1204(n) to ensure that employers discover hazards during a particular confined-space entry operation; the Agency designed other sections of this final rule for that purpose, such as § 1926.1203(h) and final § 1926.1204(m). As OSHA explained in 72 FR 67381 of the preamble to the proposed rule, the purpose of this annual review is to evaluate the effectiveness of the permit program and the protection provided to employees involved in PRCS entries during this period. OSHA understands that some employers will use the same comprehensive permit program for many different spaces in conjunction with more specific information provided on the permits for individual spaces. This requirement will help ensure that employers complete future PRCS entries in a similar manner if the entries were successful, or make changes to the permit program to improve future entry operations if any problems or concerns occurred (72 FR 67381).

One commenter was unsure whether OSHA based the 12-month review period on a calendar year or cancellation of a permit (ID–075, p. 10). This 12-month period is a calendar year because the purpose of final § 1926.1204(n) is to ensure that no more than 12 months separates the date the employer cancels or terminates a confined-space entry and the date the employer reviews its confined-space entry operations for deficiencies. OSHA's experience with the general industry standard indicates that a review, conducted once per calendar year, is sufficient to achieve this purpose, and OSHA did not receive any comments to the contrary. Therefore, if an employer conducted a review of its permit-space program each calendar year, regardless of how many entries it conducted in that calendar year, it will be in compliance with this requirement. Employers may conduct reviews more frequently as appropriate, but this final provision does not require this frequency and, therefore, provides employers with the most flexibility in determining when to conduct this annual review.

The note to paragraph (n), which is identical to the note following § 1910.146(d)(14), clarifies that employers need not conduct separate reviews of each individual permit program implemented during the calendar year; a single review of all entries during the calendar year will suffice. Another commenter asserted that OSHA should require a similar annual review for entry operations performed under the alternate procedures specified by final § 1926.1203(e) and 1926.1203(g)(1) (ID–060, p. 2). Employers who complete a confined space entry entirely under the alternative procedures set forth in final § 1926.1203(e) do not have to comply with the requirements of final § 1926.1204 (see final § 1926.1203(e)(1)). Employers need fewer precautions to ensure the safety of employees working within or near confined spaces when they can use the alternate procedures under final § 1926.1203(e) or reclassify the permit space under § 1926.1203(g)(1). If there is any change to these spaces that would result in a hazard not addressed by these alternative procedures, then the full permit program and the requirements of final § 1926.1204, including the annual review, will apply.

Section 1926.1205—Permitting Process

Section 1205 sets forth the required process for establishing, suspending and cancelling entry permits. This process is important because it helps the employer determine if conditions in the permit space are safe enough for entry, and it requires the involvement of the entry supervisor, thereby ensuring that a person with the qualifications needed to identify permit-space hazards, and the authority to order corrective measures for their control, will oversee entry operations. The provisions in final § 1926.1205 are similar to the provisions in the general industry confined spaces rule at § 1910.146(e); however, OSHA changed the title of the section from ''permit system'' in the general industry standard to ''permitting process'' in the final rule to minimize the possibility for confusion if a permit space was established that might be referred to as a system, such as a sewer system.

Paragraph (a). Final § 1926.1205(a), which is almost identical to § 1910.146(e)(1), requires each entry employer to prepare, prior to entry into a PRCS, an entry permit containing all of the information specified in § 1926.1204(c) (practices and procedures for ensuring safe entry). This provision differs slightly from § 1910.146(e)(1) because it refers to ''each entry employer,'' whereas § 1910.146(e)(1) refers to ''the employer.'' OSHA made this change to clarify which employer on a multi-employer worksite has duties under final § 1926.1205(a).

OSHA emphasizes that the process of preparing a permit is considerably more than preparing a simple checklist; it requires careful attention and planning. The permit must list all measures necessary for making the particular permit space safe for entry; if the permit omits some procedures, serious consequences could result. Entry permits are a critical component of the safety process for preparing to enter a confined space because they provide key information about hazards in the PRCS, and the methods used to protect employees from those hazards. The permits also specify who is authorized to perform work within the PRCS, their duties, and the extent of their authority with respect to safety in and around the PRCS. The Agency believes the use of this administrative tool is essential to the employer with employees entering a permit space to ensure that the employees will complete the work within a PRCS safely. The process of preparing the permit, as well as the permit itself, also can be useful to the controlling contractor and other employers working near the confined space because it provides a readily accessible means of identifying the work performed and the provisions needed to ensure worker safety. Making the information on the permit accessible to employers and employees in and around the PRCS also allows them to maintain an elevated awareness of the conditions within the PRCS, as well as the equipment and procedures necessary for safe PRCS entry operations.

One commenter noted that multiple employers may have employees working in the same space, and was unsure whether each employer must prepare an entry permit under final § 1926.1205(a) (ID–120, p. 4). When more than one employer is performing confined space entry, one permit will suffice, provided the controlling contractor and entry employers properly coordinate the entry operations of the multiple employers as required under §§ 1926.1203(h)(4) and 1926.1204(k), and the permit identifies all of the hazards and safety measures required for all of the work conducted in that space.

Paragraph (b). Final § 1926.1205(b), which is identical to § 1910.146(e)(2), requires the entry supervisor to sign the permit before entry begins. Although the employer remains ultimately liable for compliance with this standard, the entry supervisor's signature underscores to the employer and the entry supervisor the importance of their determination that the PRCS entry operation meets the prerequisites for safe entry listed in the permit. OSHA believes that signing the form makes it more likely that the entry supervisor and his or her employer will address the items listed on the form than if they do not have no to sign the form. Moreover, the entry supervisors may change during the course of the entry, so it is important to identify who completed each evaluation in the event that questions arise.

Paragraph (c). Final § 1926.1205(c), which is identical in substance to § 1910.146(e)(3), requires an employer to make the completed entry permit available to all authorized entrants, or their authorized representatives, at the time each employee enters the space. One of the keys to protecting employees from PRCS hazards is for both employers and employees to know the location of the PRCSs at the job site, the characteristics of the hazards, and their associated dangers. The provisions in this paragraph are designed to achieve this goal. Once entrants are provided with this information, they will then be able to make their own judgments as to the completeness of pre-entry preparations and point out any deficiencies that they believe exist. Employees will also be more likely to bring new hazards to the attention of the supervisor if they are discovered while working in the permit space if the employees are aware of which hazards have already been identified and which have not. Posting the permit for employees to see at the entry point can also be useful when multiple employers will be working in the same permit space.

Sharing this information with employee authorized representatives may help bring the representative's expertise to bear in identifying additional hazards not accounted for in the permit process. One commenter described a situation where he, as an authorized employee representative, was able to alert employees to additional atmospheric hazards that were generated by the adhesives used to join plastic pipe tubes in a room with inadequate ventilation (ID–010). Final paragraph (c) includes one variation from the language of the general industry standard. Under the general industry standard a single posting can be sufficient to inform multiple employees, but employers must still make sure that the permit is available to each entrant, or the entrant's representative, prior to entry into the permit space. For example, an employer does not fully comply with the standard by posting the permit after one of its employees has already entered the permit space. OSHA is including the same requirement in this final rule, but is also taking the opportunity to provide further clarification in this final rule that the information must be made available to ''each authorized entrant''; the general industry standard is less specific, referring to ''all authorized entrants.'' In appropriate cases, if an employer fails to make this information available as required, OSHA may issue separate citations with respect to each individual employee who enters a confined space without having access to this information.

Paragraph (d). Final § 1926.1205(d), which is identical to § 1910.146(e)(4), prohibits employers from making the entry permit's duration longer than the time needed to complete the related work. Otherwise, the conditions inside the space are more likely to change and entrants could be unnecessarily exposed to the residual hazards of permit spaces.

One commenter suggested that OSHA limit the duration of the permit's validity to one day or one shift to ensure that someone inspects the confined spaces that employees are entering to discover changed conditions (ID–060, p. 4). OSHA does not agree that such a fixed limit is warranted. This process would be more burdensome because it would require cancellation of entry permits even when there is no change in conditions or hazards. Final § 1926.1204(e)(2) requires an employer to monitor the conditions inside a confined space to determine if they become unacceptable. Furthermore, final § 1926.1205(e)(2) requires an employer to cancel the entry permit if an unacceptable condition arises. Taken together, these provisions provide a less burdensome, more flexible, and even more direct method of achieving the same safety mechanisms as the commenter's suggested approach. Moreover, the less limited requirements are consistent with the procedures required under the general industry confined spaces standard at § 1910.146. OSHA considered and rejected a similar request for a per-shift permit limit when promulgating the general industry final rule (see 58 FR 4505, 4506 (Jan. 14, 1993)).

Paragraph (e). Final § 1926.1205(e), which corresponds to § 1910.146(e)(5), requires an employer to terminate entry and cancel the entry permit under two conditions: when the employer completes the entry operations covered by the permit (final § 1926.1205(e)(1), which is identical to § 1910.146(e)(5)(i)), or when there is a condition inside or near the permit space that is not acceptable under the permit program established for that space (final § 1926.1205(e)(3), which is identical to § 1910.146(e)(5)(ii)). Requiring the entry supervisor to terminate the entry permit under either of these conditions increases the likelihood that the employees will exit the space before new hazards emerge, and that employees will avoid hazards arising from prohibited conditions within the PRCS. When an employer completes an entry without incident, the employer must cancel the permit by removing it from the entry site. If the employer cancels the permit in response to new hazards or changes in the condition of the permit space, the employer must record the reasons for the cancellation on the permit in accordance with § 1926.1205(f).

In response to comments, OSHA also is adding an additional provision in final § 1926.1205(e)(2) that is not in the general industry standard, but would provide employers additional flexibility in certain situations identified by the commenters. Some commenters asserted that it is unnecessary to require cancellation of the entry permit in every instance in which reevaluation is necessary, and that doing so was unnecessarily burdensome (ID–107, p. 4; –116, p. 3). A commenter representing a client involved in sewer construction suggested that, in the event an unacceptable condition arises that necessitates temporary evacuation and reevaluation, but does not present a new or increased hazard for employees working within the confined space, OSHA should allow employers to track these events on the existing permit rather than cancelling the entire permit and filling out a new permit. For example, if there is a temporary loss of power for five minutes such that the entrants must exit the permit space because the lighting conditions are inadequate, the employer would normally reenter once the power returns and the conditions inside the permit space are the same as they were for initial entry.

OSHA agrees that cancelling the permit may be unnecessary when a condition outside or inside the permit space requires an evacuation, but the permit space returns soon after to the same acceptable conditions specified under the permit. So long as the employer records on the permit the event that required evacuation, the employer conducts a full reassessment of the permit space that indicates restoration of the acceptable permit conditions before the employer permits reentry, there are no new gases or physical elements introduced into the space that are not addressed in the permit for that space, and there are no other significant changes to the space, OSHA believes that the employer can satisfy the purposes of the permit program without the additional burden of cancelling and replacing the entire permit. OSHA modified the text of the final rule accordingly by adding final § 1926.1205(e)(2) to allow for the ''suspension'' of the permit, as an alternative cancellation of the permit, when these criteria are met. During suspension, employers still must fulfill all applicable duties of an entry employer under the standard, such as preventing unauthorized entrance. An employer may temporarily suspend a permit in one of two ways: by removing it (leaving just the ''Do Not Enter'' sign or its equivalent that must be posted under § 1926.1203(b)(1) and remain there throughout the entry), or taking other steps, such as covering the permit, to ensure that no one will mistakenly rely on the permit to enter the space. Regardless of the method of suspension, the employer must also record the reason for the suspension on the permit (see § 1926.1205(f)).

It would still be necessary, however, to cancel the permit and complete a new one if there is any indication that the existing permit may not be adequate to ensure the safety of the entrants. Cancellation of the permit is also necessary if the employer is unable to identify the cause of the change in conditions that led to the evacuation, or if a new substance has entered the permit space or has increased in amount or concentration. For example, if there is gas in a permit space in a concentration held below safe levels by two ventilation fans located on the exterior of the permit space and operated in accordance with the employer's permit program, and one fan stops functioning, all employees would need to exit the space and the employer must suspend the permit until the space is returned to the allowable conditions specified in the permit program. If the employer is able to identify the source of the fan failure (*e.g.,* a burned-out motor), replace the fan, and return the gas in the space to a concentration below the applicable PEL, and nothing else has changed in the space, then the employer may permit its employees to re-enter after conducting a full reassessment of the space and noting the reason for the fan failure on the permit. Similarly, if the presence of a new gas is detected but the permit already anticipates that level of gas and includes a means of controlling that gas, the employer may control that gas in accordance with the existing permit instead of cancelling that permit and creating an entirely new permit. However, if the employer is unable to identify the reason for the fan failure, or that failure appears likely to occur again (*e.g.,* flickering power source), or there has been some additional change in the permit space (*e.g.,* monitoring detects the presence of a new gas not accounted for in the permit program, or condensation has formed within the space impeding entry or exit), then the employer must cancel the permit and develop a new permit that addresses those new conditions.

The final rule, similar to the general industry standard, requires employers to terminate the entry if there is an unacceptable condition ''in or near'' the permit space. Several commenters noted that the proposed rule included references to ''near'' in several different provisions and requested clarification. (See, *e.g.,* ID–061.1; –095; –101.1; –106.1; –120.1; –121.1; –124.1; –125.1; –131; –135; –136; –152; –220.) Many of these commenters, however, also urged OSHA to promulgate a construction standard that tracked the language of the general industry standard. OSHA, therefore, did not use ''near'' in this final rule except in § 1926.1205(e), which tracks the identical use of ''near'' in the general industry standard. The requests of numerous commenters urging OSHA to follow the general industry standard, and the absence of record evidence suggesting that employers have had difficulty complying with this general industry requirement, indicate that the use of this term in this context is sufficiently clear to employers engaged in permit-space work. The purpose of this provision remains the same in the construction context as in the general industry context: protection of employees working in confined spaces from exposure to additional hazards introduced into the permit space from outside. The use of ''near'' indicates a physical proximity to the permit space, but OSHA is not specifying a fixed distance because of the variety of potential hazards and the disparate distances from which the hazards could impact the confined space. For example, a small welding job may have no impact on a properly controlled permit space 15 feet away, but a demolition blast could easily result in a significant hazard for employees working in an underground permit space much farther away.

One commenter suggested that existing OSHA standards were already sufficient to protect employees from hazards near the confined space, while another commenter asked whether operating gasoline-powered equipment near the permit space would constitute a hazard, and whether an employer must cancel the entry permit for sewer work every time an automobile passed near the manhole to enter the sewer (see ID–131 and –098.1). The examples provided by the latter commenter demonstrate the need to address these external hazards in the confined spaces standard: activities not necessarily prohibited by any other standard and that usually do not pose a hazard to employees when used in open spaces, such as operating gasoline-powered equipment, can result in hazards when used in close proximity to a permit space. However, because operating gasoline-powered equipment or automobiles near a permit space is not inherently hazardous to the entrants working inside that space, the employer would not necessarily need to cancel the permit at each such occurrence. Instead, the employer must assess the hazards posed in each scenario. If the fumes from the gasoline-powered equipment are spewing into the confined space, then the employer likely would need to remove the entrants and reassess the acceptable conditions for work inside the space. Likewise, if the employer did not anticipate that automobiles would be driving near the entry to a permit space, and did not guard the entrance and establish barriers to adequately protect employees working in the permit space, then the employer would need to require the entrants to leave the space in a safe manner and then reassess the permit program if automobile traffic develops. If, however, the gasoline-powered equipment was operating at such a distance or in such a manner that it would not foreseeably result in a potential hazard to the permit-entrants, or if the employer planned for automobile traffic near the space and provided barriers and other appropriate protection, then the entry could continue and the permit program would remain in effect. Activities outside the permit space will only require entrants to leave if they could foreseeably result in a hazard not accounted for when the employer developed the permit program.

Paragraph (f). Final § 1926.1205(f), which is almost identical to § 1910.146(e)(6), requires the entry employer to ensure that the cancelled entry permits are saved on file for at least a year after cancellation. In addition, § 1926.1205(f) requires employers to note any problems encountered during an entry operation, particularly those that trigger cancellation or suspension of a permit under § 1926.1205(e), on the pertinent permit.

This provision differs slightly from § 1910.146(e)(6) because it clarifies that ''every entry employer'' must comply with these duties, whereas § 1910.146(e)(6) refers generally to the duties of ''the employer.'' OSHA made this change in recognition that there may be many different employers on a construction worksite, and that each entry employer has a responsibility to ensure that the records are saved. In some cases, this may involve coordination between different employers.

The purpose of this document retention requirement, and of the requirement to note problems directly on the permit, is to facilitate the evaluation of the effectiveness of protection provided to employees involved in PRCS entries during the annual review required under § 1926.1204(n). The requirements of § 1926.1205(f) help to ensure that employees complete future PRCS entries in a similar way if the previous entries were successful, or that employers improve future PRCS entries by resolving any problems or concerns discovered.

One commenter asserted that the retention period should end upon completion of the project (ID–099, p. 4). OSHA disagrees with this commenter because the lack of document retention would significantly affect the employer's ability to complete its required annual review. OSHA set this minimum retention period at one year to ensure that the documents still would be available when employers conduct the required 12-month review specified by final § 1926.1204(n).

As the Agency noted in the proposed rule, these document-retention requirements are in addition to the document-retention requirements required by other OSHA standards, such as the 30-year retention period for employee-exposure records required by 29 CFR 1910.1020(d) (Preservation of records) [23] (see note to proposed § 1926.1219(b)). In some cases, entry permits may constitute employee-exposure records. (See definition of ''employee exposure record'' at 29 CFR 1910.1020(c)(5).)

One commenter suggested that OSHA incorporate the language in the general industry confined spaces directive, CPL 02–00–100: Application of the Permit-Required Confined Spaces (PRCS) Standard, 29 CFR 1910.146 (May 5, 1995), to provide additional explanation of what constitutes an ''employee exposure record.'' OSHA agrees that the term has the same meaning in this final rule as in the general industry standard, and that the guidance from CPL 02–00–100 is equally applicable: ''[R]esults which show the composition of an atmosphere to which an employee is actually exposed (even if the employee is using a respirator) are exposure records under 29 CFR 1910.1020(c)(5).''

This requirement to maintain exposure records gives healthcare providers, in the event of an emergency, access to information about the substances and exposure levels the employee may have experienced while working within a confined space. This information will enable healthcare providers to administer medical care effectively to injured employees.

Section 1926.1206—Entry Permit

An employer conducting a permit-space entry must post an entry permit outside the permit space to document the employer's efforts to identify and control conditions in that permit space (see § 1926.1205(c)). The purpose of the permit is to provide a concise summary of the permit-space entry requirements for a particular entry that will be useful to the personnel who are conducting the entry operations, to rescue personnel, to the controlling contractor, to other employers working near the confined space, and to any personnel who need to review the conduct of entry operations after the employer terminates the operations. Making the information on this document accessible to employers and employees affected by the hazards in and around the permit space also allows them to maintain an elevated awareness of the conditions within the permit space, as well as knowledge of the equipment and procedures necessary for safe permit-space entry operations.

The introductory language in final § 1926.1206 requires the employer to include, on the entry permit, all of the information specified in § 1926.1206(a) through (p). Most of the information required on the permit is substantively identical to the general industry confined spaces requirements at § 1910.146(f). The exception is paragraph (e), which requires the employer to record the means of detecting an increase in atmospheric hazard levels if a required ventilation system stops working. OSHA included that requirement in the proposed rule and, for the reasons explained below, OSHA concludes that it is important to retain it in the final rule.

Proposed § 1926.1210(k) provided that the employer must document, on the entry permit, all ''determinations made'' and ''actions taken'' during PRCS procedures, as required by proposed rule § 1926.1214(a). Commenters appeared to interpret this proposed provision as a broad and overly burdensome requirement, which was not OSHA's purpose (see, *e.g.,* ID–095, p. 4). In light of the concerns about the proposed language, the Agency notes that the final rule is not requiring employers to include on the entry permit each determination or action taken with respect to the permit entry. However, employers still must make certain demonstrations about hazards, ventilation, monitoring, or equipment, and document other determinations, as required by the final standard, and make that information available to employees (see, *e.g.,* § 1926.1203(e)(1), (g)(2), (g)(3)). Final § 1926.1206 is otherwise generally consistent with proposed § 1926.1214(a).

Paragraph (a). Final § 1926.1206(a), which is identical to § 1910.146(f)(1), requires the employer to identify the permit space that workers are planning to enter. This information will ensure that employees use the correct permit for the permit space.

Paragraph (b). Final § 1926.1206(b), which is identical to § 1910.146(f)(2), requires the employer to record the purpose of the entry. As the Agency noted in the proposed rule, this information must be sufficiently specific, such as identifying specific tasks or jobs employees are to perform within the space, to confirm that the employer considered performance of each specific construction activity in the hazard assessment of the PRCS. (See proposed § 1926.1214(a)(1)(ii).) An entry employer's failure to evaluate construction activities performed within the PRCS for their effect on the conditions within the space could result in serious injury or death to employees.

[23] The note in 29 CFR 1926.33 makes the provisions of 29 CFR 1910.1020 (Access to employee exposure and medical records) applicable to construction operations.

It would be sufficient, for example, to state the purpose of entry as ''replacement of communications cable in sewer line,'' or ''welding upgraded component inside steel tank,'' but it would not be sufficient to state only ''communications work in sewer line'' or ''upgrade to tank.''

Paragraph (c). Final § 1926.1206(c), which is identical to § 1910.146(f)(3), requires the employer to record the date and authorized duration of the planned entry. The ''date'' refers to the day on which authorized entrants are permitted to enter the PRCS. The duration of the permit may not exceed the time required to complete the specified tasks or jobs, including the time necessary to set up and dismantle any tools or equipment required to perform the tasks or jobs (see § 1926.1205(d)). The employer need not list duration in terms of time, but instead may describe it in terms of the completion of tasks identified in the permit. For instance, the employer could describe the duration as ''welding and repair of water main'' or ''upgrading equipment in an electrical vault.'' One purpose of this provision is to ensure that employees engaged in PRCS operations are informed of the period during which conditions in the PRCS must meet acceptable entry conditions as specified in the entry permit. A second purpose is to place some reasonable limit on the duration of the permit, because a permit of unlimited duration is not likely to account for changed PRCS conditions.

Paragraph (d). Final § 1926.1206(d), which is identical to § 1910.146(f)(4), requires the employer to record the identity of the authorized entrants so that the attendant is capable of safely overseeing the entry operations. Employers can meet this requirement by referring in the entry permit to a system such as a roster or tracking system used to keep track of who is currently in the PRCS. The availability of this information would enable the attendant, entry supervisor, or rescue service to quickly and accurately account for entrants who might still be in the PRCS when an emergency occurs. A second purpose is to provide assurance that all authorized entrants have exited the PRCS at the end of entry operations. A third purpose would be to assist the attendant and entry supervisor in preventing unauthorized personnel from entering the space.

It is extremely important for the employer to confirm that all authorized entrants have exited the PRCS during an evacuation. Therefore, a tracking system that lists the names of the employees who the employer designates as authorized entrants, but does not accurately account for the number of employees inside the PRCS at all times, would not meet the requirements of this paragraph. Merely maintaining a list of authorized entrants, who may or may not be at the job site or inside the PRCS, would not help the employer determine how many authorized entrants are left inside the PRCS should an evacuation be necessary. Likewise, a tracking system that only accounts for the number of authorized entrants inside the PRCS, without providing their names or other identifiers, also is not acceptable; knowing the name or other identifier of each entrant makes it easier for the rescuers to determine where the entrant is assigned to work in the PRCS, and thereby determine the entrant's probable location.

Paragraph (e). When a permit program requires ventilation, OSHA requires employers to ensure that they have a monitoring system in place that will alert employees of increased atmospheric hazards in the event the ventilation system fails (see § 1926.1204(c)(5)). Final § 1926.1206(e) requires the employer to record the means of detecting an increase in atmospheric-hazard levels if the ventilation system stops working. It is important for employers to provide this information on the entry permit so that any new employees can easily access this information and respond appropriately and as quickly as possible to ensure the continued safety of entrants. For example, if the original entry supervisor is replaced by a new entry supervisor halfway through entry operations, the new entry supervisor can refer to the entry permit for this information.

Paragraph (f). Final § 1926.1206(f), which is substantively the same as § 1910.146(f)(5), requires the employer to record the names of each attendant. Final § 1926.1206(f) differs from § 1910.146(f)(5) only in that it clarifies that the name of ''each person,'' rather than ''the person,'' must be recorded on the entry permit. There is often more than one attendant during the course of entry operations, so this requirement would facilitate identifying attendants quickly and easily, thereby expediting communications with them, which is necessary for the performance of safe PRCS entry operations, and for the performance of specified duties during emergency situations. When a new attendant replaces the previous one, the employer must make it clear on the permit which attendant is on duty, such as by crossing out the previous attendant's name, so that there is no confusion about the identity of the current attendant Without this requirement, the employer could waste valuable time finding the attendant responsible for protecting authorized entrants during an emergency.

Paragraph (g). Final § 1926.1206(g), which is nearly identical to § 1910.146(f)(6), requires the employer to record the name of each employee currently serving as entry supervisor. The same reasons for requiring the names of the attendants apply for requiring the name of the entry supervisor here: it provides an assured means of distinguishing these important individuals quickly and easily so that employees may alert them of a developing hazard, and it provides the opportunity for these individuals to review the permit and entry conditions to ensure that entry conditions remain safe. The general industry standard requires a space for each entry supervisor's name, which implies that the entry supervisor names will be filled in, but in this final rule OSHA is modifying paragraph (g) to make that requirement explicit: The employer must ensure that the name of each entry supervisor is entered into that space. As with the changes to the attendants, the employer must ensure that the current supervisor is identified as such when one supervisor replaces another.

Paragraph (h). Final § 1926.1206(h), which is identical to § 1910.146(f)(7) and corresponds to proposed § 1926.1214(a)(2)(i)(A), requires the employer to record the hazards associated with the planned confined space entry operations. This list must include all hazards, regardless of whether the employer protects the authorized entrants from the hazards by isolation, control, or personal protective equipment. Providing this list will make it clear which hazards the employer already identified so that the entrants can confirm that they received training to work around such hazards, and will know to bring any other developing hazard to the attention of the entrance supervisor immediately.

Paragraph (i). Final § 1926.1206(i), which is identical to § 1910.146(f)(8) and corresponds to proposed § 1926.1214(a)(2)(i)(B), requires the employer to record the procedures used to isolate or control the hazards prior to entry. This information must be consistent with the requirements specified in final § 1926.1204(c), and must include the methods used to isolate or control the hazards, the type of personal protective equipment provided, the methods used to monitor each hazard (including the use of early-warning systems, if required by final § 1926.1204(e), and how frequently each hazard is to be monitored). Note that under final § 1926.1204(e), employers must use continuous monitoring of atmospheric hazards unless the employer demonstrates that periodic monitoring is sufficient. The permit need only refer to the procedures used to meet the requirements of this paragraph in sufficient detail to enable employees to determine what measures they must take, and how to perform those measures.

One commenter urged OSHA to require employers to identify the name(s) of the person(s) who performed all of the hazard-isolation or control procedures listed on the permit pursuant to § 1926.1206(i), such as the person(s) who operated a ventilation machine to control an atmosphere (ID–0625, p. 4). OSHA notes that employers must already include the names or initials of the person performing monitoring under final § 1926.1206(k). To the extent that the commenter intended to ensure the accuracy of the tests and measurements associated with the isolation or control procedures, OSHA notes that the entry supervisor must already verify the accuracy of this information (§ 1926.1210(b)). Therefore, OSHA concludes that, in the absence of additional evidence to indicate that these records would provide a discernible safety benefit, the additional records suggested by the commenter are not necessary.

Paragraph (j). Final § 1926.1206(j), which is identical to § 1910.146(f)(9), requires the employer to specify the acceptable entry conditions. The list of acceptable entry conditions includes energy control considerations and conditions such as the permissible levels allowed for oxygen, flammable gases and vapors, other hazardous substances during PRCS entry. Additional information regarding PRCS conditions includes, for example, the methods used to maintain a water hazard at safe levels. Another example included in the NPRM is when an employer decides to use PPE to protect employees from an atmospheric hazard, the acceptable conditions must include, at a minimum, the type of PPE the employees will use (such as type of respirator), and the levels at which the PPE would protect the employees from the atmospheric hazard. OSHA requires the employer to list the acceptable conditions on the permit so that the authorized entrants, attendants, and entry supervisors have this information on hand at the worksite, thereby ensuring safe entry operations.

This provision also requires employers, when applicable, to provide the ventilation-malfunction determinations made in paragraph (c)(5) of final § 1926.1204. As explained in the proposed rule, and above in the discussion of final § 1926.1204(c)(5), some permit spaces may require ventilation to control the atmospheric hazards at levels that are below the levels at which they are harmful to entrants so that entrants will have time to exit the PRCS safely (72 FR 67365). In these spaces, the employer will be responsible for identifying that level and monitoring the permit-space atmosphere to detect any increase of the potentially hazardous substance. The Agency's requirement that the employer include these determinations on the permit informs employees (for example, entry supervisors, attendants, and authorized entrants) about the time required for the entrants to evacuate the PRCS should the ventilation system fail, and allows authorized entrants, attendants, and entry supervisors to respond quickly to any deviations in these conditions, including ventilation-system failure.

OSHA notes, as it did in the explanation of this provision in the general industry standard, that there is likely to be overlap between this requirement to list the acceptable entry conditions and the separate requirement in § 1926.1206(i) to identify the hazard-control or elimination measures that the employer must also list on the permit (58 FR 4509 (Jan. 14, 1993)). The Agency anticipates that employers may elect to combine these two elements when filling out the permit, and such an approach is permissible so long as the employer includes all of the relevant information in some form that the authorized entrant, attendant, or entry supervisor can identify quickly.

Paragraph (k). Final § 1926.1206(k), which is nearly identical to § 1910.146(f)(10), requires the employer to record the dates, times, and results of the tests and monitoring performed, and the names or initials of the individuals who performed each test. Entering the testing and monitoring results in the permit enables the entry supervisor, attendants, and authorized entrants to determine readily whether acceptable entry conditions exist with regard to atmospheric hazards in the PRCS. The employer also could use this information to identify atmospheric conditions within the PRCS that need to be monitored frequently because atmospheric conditions tend to rise rapidly to hazardous levels. For example, if the oxygen concentration is 19.6 percent, the attendant and entrants should be alert for signs of oxygen deficiency, such as increased breathing rate, dizziness, rapid heartbeat, and headache. Furthermore, documentation of test results on the permit also facilitates the review of canceled permits required under paragraph (d)(14). If testing indicates that levels of hazardous substances are increasing, the increased hazard will be easy to recognize through a review of the recorded test results on the canceled permit.

Listing the names of those who performed the testing identifies a point of contact to which entry supervisors and attendants can direct questions they may have regarding the results and procedures. The date and time (or, for continuous monitoring, a time period) would provide a basis for detecting dangerous trends in atmospheric conditions that may indicate that more frequent observation of the atmospheric data is necessary.

The single difference between the final rule and § 1910.146(f)(10) is that the general industry provision requires documentation of ''initial and periodic testing,'' whereas final paragraph (k) of this final standard requires documentation of the results of all ''tests'' and ''monitoring.'' OSHA made these changes to address a significant difference between this final rule and § 1910.146: This final rule generally requires continuous monitoring, whereas § 1910.146 only requires periodic testing. For further explanation of this change, see the discussion to final § 1926.1204(e).

Consistent with data collection from continuous monitoring under § 1910.146, the continuous monitoring values recorded on the entry permit are ''real time'' concentrations. See December 10, 1996, letter to Michael Coleman, available at *www.osha.gov*. Although the final standard does not specify the frequency with which the employer must record continuous monitoring measurements, from a compliance perspective, the quantity of data entered on the permit must indicate the number of times the entry supervisor or other entrant examined the monitoring data. These measurements must be recorded with sufficient frequency to demonstrate that the permit space was monitored such that the employee could identify a change in atmosphere or other potential hazard in time to allow entrants to exit the permit space safely (See also discussion of § 1926.1203(e)(2) and 1926.1204(e)(2).) For continuous monitors with alarms, employers must record each time the alarm is triggered. Employers also must include the initial entry-monitoring results on the entry permit for the reasons explained above; these results also would serve as a baseline for subsequent measurements.

See December 10, 1996, letter to Michael Coleman, available at *www.osha.gov*.

Paragraph (l). Final § 1926.1206(l), which is identical to § 1910.146(f)(11), requires the employer to identify the rescue and emergency services required by this final rule, and the means by which these services will be summoned when needed. Identification of these services and the means for summoning them enables attendants to summon the appropriate service immediately in case of emergency. In some cases, an employer must include pertinent information, such as communication equipment and emergency telephone numbers, on the permit to sufficiently identify the means by which the rescue or emergency services will be summoned. The inclusion of this specific information would allow attendants to avoid errors and delays in contacting the rescue service.

Paragraph (m). Final § 1926.1206(m), which is identical to § 1910.146(f)(12), requires the employer to record all of the methods of communication used between authorized entrants and attendants during entry operations. OSHA notes that establishing a routine for maintaining contact between attendants and authorized entrants would help attendants detect problems within the PRCS. OSHA anticipates that the method of communication chosen may vary according to the circumstances of the particular workplace; however, the methods chosen must enable the attendants and the entrants to maintain effective and continuous contact. OSHA notes that, while such communication will normally be achieved through speech, other methods, such as tapping on a wall, may be acceptable as long as it achieves effective and continuous contact. See July 30, 1993, letter to Julie Emmerich, available at *www.osha.gov*.

Paragraph (n). Final § 1926.1206(n), which is identical to § 1910.146(f)(13), requires the employer to record the equipment it provides in accordance with the requirements of this final rule. This equipment would typically include, for example, personal protective equipment, testing equipment, communications equipment (including equipment needed to assess entrants' status in the space), alarm systems, rescue equipment, and other equipment that the employer would provide to ensure compliance with paragraph (d)(4) of final § 1926.1204 (personal protective equipment) or any other part of the standard. This requirement provides employees with a ready reference to the equipment required for safe entry operations.

Paragraph (o). Final § 1926.1206(o), which is substantively identical to § 1910.146(f)(14), requires the employer to record any additional information needed to ensure safe confined space entry operations. OSHA amended the language in § 1910.146(f)(14) slightly for clarity and conciseness. As OSHA explained in the preamble to the general industry standard, this provision is necessary for employee protection due to ''the wide-ranging types of hazards found in permit-required confined spaces, there are many hazards that cannot be adequately addressed with any precision in a generic permit space standard'' (58 FR 4510 (Jan. 14, 1993)). Examples of the information required by paragraph (o) may include: Problems encountered in the PRCS; problems that an attendant, entry supervisor, or authorized entrant believes may be relevant to the safety of the entrants working in the space; or any other information that may be relevant to employee safety under these conditions.

Paragraph (p). Final § 1926.1206(p), which is identical to § 1910.146(f)(15), requires the employer to record information about any other permits, such as for hot work, issued for work inside the confined space. If the employer identifies additional permits, these additional permits may be, but are not required to be, attached to the entry permit to provide information about the activity covered by the permit to employees involved in the entry operations so they can take appropriate precautions.

Section 1926.1207—Training

Final § 1926.1207 requires employers to train each employee who performs work regulated by this standard, and specifies the requirements of that training. The provisions in final § 1926.1207 are substantively similar to the provisions in the general industry confined spaces rule at § 1910.146(g). The substance of the training provisions in the proposed rule was similar to, but organized differently than, the training provisions in the general industry rule. The final rule includes a few provisions from the proposed rule to provide clarity and to ease documentation, as explained below, but follows the language and organization of the general industry standard. Proposed §§ 1926.1208, 1926.1213, 1926.1216, and 1926.1217 separated the training requirements based on the type of confined space involved. One commenter asserted that, in general, the training requirements were too scattered throughout the proposed rule (ID–099, p. 4). By organizing the training provisions according to the training provisions of the general industry confined spaces standard at § 1910.146(g), OSHA placed the training requirements together in one section.

Paragraph (a). Final § 1926.1207(a) sets forth the requirement, also found in § 1910.146(g)(1), that employers must train each employee who performs work regulated by this standard. OSHA modified this provision from § 1910.146(g)(1) to include some language from the proposed rule and to clarify two aspects of this requirement: (1) The employer must train each employee; and (2) the employer must provide training at no cost to the employee. Final § 1926.1207(a)(1) refers to ''each employee'' rather than ''all employees'' to emphasize that an employer's responsibility in this area flows separately to each employee. The provision of training at no cost is implicit in the general industry standard, and is consistent with OSHA's longstanding policy regarding employer responsibility for training. See, *e.g.,* 29 CFR 1926.1430(g)(3) (training under the Cranes & Derricks in Construction standard), § 1910.1001(j)(7)(iv) (asbestos awareness training for employees who perform housekeeping operation in an area that contains asbestos), and June 25, 1991, Memorandum to Regional Administrators, # 20315 (training under the HAZWOPER standard, 1910.120), available at *www.osha.gov*.

Paragraph (a) of the final rule also requires employers to provide training so that employees who perform work regulated by part 1926, subpart AA, acquire the understanding, knowledge, and skills necessary for the safe performance of the duties assigned under that section, including the safe operation of equipment and the proper use of PPE. Sections 1926.1208, 1926.1209, 1926.1210, and 1926.1211 of this final rule specify in detail the duties of authorized entrants, attendants, entry supervisors, and rescue service personnel. Paragraph (a) requires the training to impart the understanding, knowledge, and skills necessary for the safe performance of the duties assigned under those sections. OSHA believes that the training employers provide employees under this provision will enable the employees to understand their duties under this standard, as well as the hazards posed by permit spaces, and to properly use equipment and PPE in a PRCS. Therefore, this training will enable employees to safely perform their requisite PRCS duties.

In this paragraph, the Agency is requiring the employer to provide whatever training is necessary to achieve the goal of safe performance of an employee's duties. The performance language used in paragraph (a) will allow the employer to develop and implement the most effective confined space training program to meet the needs of the specific workplace. By requiring training of employees in § 1926.1207, and by specifying what those duties are in the relevant sections, the final rule sets forth requirements regarding whom employers train, as well as the content of the training.

This paragraph also incorporates a requirement found in proposed § 1926.1209(d)(1), which specifies that the training must result in an understanding of the hazards in the permit space(s), and the method(s) used to isolate, control, or in other ways protect employees from the hazards. For example, if an authorized entrant enters the space to isolate an identified hazard or to set up ventilation to control an atmospheric hazard, the employer must train the employee not only in accordance with the PRCS entry requirements, but also to perform the tasks necessary to isolate and control the specific hazards in accordance with other appropriate OSHA requirements applicable to construction. The employer also must train each employee who enters the space thereafter to understand how the employer isolated or controlled any hazards in the space. OSHA believes that the training employees receive under this provision will enable them to associate the signs, symptoms, and characteristic effects (discussed elsewhere in this preamble) to the failure of methods to control or isolate the hazards, and to alert them so that do not inadvertently disturb the isolation or control mechanisms. Therefore, this training will enable employees to safely perform their duties while working in the PRCS, and to respond appropriately if the hazard-protection methods fail.

Additionally, final § 1926.1207(a) includes the requirement, found in proposed § 1926.1209(d)(2), that, for employees not specifically authorized to perform entry rescue, their training must result in an understanding of the dangers of attempting entry rescue. This aspect of the training need not be extensive, as its purpose is to prevent exposure to permit-space hazards by simply keeping all employees who are not authorized to perform entry rescue out of such spaces. OSHA prohibits such entry precisely because it is likely to increase the risks of further injury to both the would-be rescuer and the employee requiring rescue. In final § 1926.1204(a) and (i), the Agency also requires entry employers to take action to prevent all unauthorized entry, but the training required by final paragraph (a) remains crucial to overcome the inclination of many employees to attempt to rescue a trapped colleague. If employees do not fully appreciate the dangers involved, their actions might also pose a danger to those employees designated to provide rescue.

Finally, some commenters asserted that the training requirements in this final rule should require employers to train entrants on the use of gas, propane, and diesel-powered equipment and chemical-cartridge respirators (ID–025, p. 3; ID–095, p. 3). Final § 1926.1207(a) requires employers to ensure that employees acquire the knowledge and skill to safely perform their duties, which includes training employees on how to use all equipment used in the PRCS.

Paragraph (b). Final § 1926.1207(b), which is substantively similar to § 1910.146(g)(2), requires the employer to provide training to each employee covered by this standard, as specified by paragraphs (b)(1)–(b)(5). One commenter requested that OSHA clarify that the employer must provide this training in a language understood by the employee (ID–140, p. 5). OSHA designed the training requirements in final § 1926.1207 to ensure that employees performing work regulated by this final rule understand the hazards so that they can take necessary precautions to perform their work safely. Therefore, the employer must provide this training in a language the employee understands, and ensure that the employee comprehends the training, to achieve the purpose of the training requirements. Final § 1926.1207(b)(1) incorporates the requirement that training be in both a language and vocabulary that the employee understands, which is consistent with OSHA's policy for all OSHA training requirements. See April 28, 2010, OSHA Training Standards Policy Statement, available at *www.osha.gov*. OSHA views this policy as applicable to all training requirements in all OSHA standards, but is adding the language in this standard for clarity.

Final § 1926.1207(b)(2)–(b)(4) require that the employer provide training before assigning the employee duties covered by this final standard, when there is any change in duties, and whenever there is a change in permit conditions that present a hazard for which the employee did not previously receive training. These requirements are substantively identical to § 1910.146(g)(2)(i)–(g)(2)(iii). OSHA believes the requirements in final § 1926.1207(b)(2)–(b)(3) are necessary to ensure that employers provide the training required by final § 1926.1207(a) at the appropriate times, that is, prior to exposure to confined space hazards.

Final § 1926.1207(b)(2), which is identical to § 1910.146(g)(2)(i), requires employers to initially train their employees before assigning them to perform duties under this standard. Accordingly, the employer must ensure that specified employees (that is, entry supervisors, attendants, authorized entrants, and rescue-service employees) receive the training required by final § 1926.1207(a) prior to performing assigned PRCS duties. This requirement ensures that employers train these specified employees regarding PRCS hazards before the employer exposes authorized entrants to these hazards.

Final § 1926.1207(b)(3) and (b)(4) are substantively identical to the general industry standard at § 1910.146(g)(2)(ii) and (g)(2)(iii). They address the issue of refresher training. Final paragraph (b)(3) requires training before there is a change in assigned duties. Such changes could be the result of new equipment or techniques introduced into the entry operations, promotions, or simple reassignments. If an employee previously received training in the new duties and the employer ensures that the employee is still familiar with the previous training, then the employer need not conduct additional training under this paragraph, provided the employer has no evidence that there are inadequacies in the employee's knowledge or use of the relevant permit-space procedures. If there is evidence that such inadequacies exist, the employer must retrain the employee under final paragraph (b)(5).

Paragraph (b)(4) similarly requires retraining if there is a change in permit-space entry operations that presents a hazard for which an employee did not previously receive training. This paragraph changes the phrase ''permit space operations,'' from the general industry standard at § 1910.146(g)(2)(iii), to ''permit space *entry* operations'' for the reasons explained in the introduction to the discussion of final § 1926.1204. One commenter was unsure whether minor revisions of procedures, such as an increase in the use of mechanical ventilation, would trigger the training requirements of final § 1926.1207(b)(3) (ID–099, p. 3). The relative significance of the change in procedures does not determine the need for additional training; employers must ensure that employees can perform their duties safely, so any change in PRCS entry procedures for which an employee did not receive previous training would necessitate training under this final rule to the extent it requires new knowledge or skill by the employee.

Final § 1926.1207(b)(5) provides that an employer must retrain an employee whenever the employer has any evidence that the employee has deviated from PRCS entry procedures or inadequacies in the employee's knowledge or use of these procedures. This provision is substantively identical to the general industry standard at § 1910.146(g)(2)(iv), but this final provision clarifies that retraining must occur when there is evidence of deviation, a change from the phrase ''reason to believe'' in the general industry standard. OSHA believes the term ''evidence'' will be clearer than the general industry language for both employers and OSHA inspectors. By making this revision, OSHA does not intend to make a substantive difference in the types of employee actions or other factors that would trigger the retraining requirement. Evidence of a need for retraining may come from a variety of sources, such as an employee's actions during, or prior to, an entry, statements made that indicate a lack of understanding of permit-space entry procedures, reports of other employees or third parties, or from other incidents.

One commenter asserted that requiring retraining after every deviation is overly burdensome. (ID–120, p. 3.) This commenter suggested that OSHA require the employer to establish a better line of communication and coordination when the deviation is not too severe. However, the commenter did not suggest a means of identifying the severity of a deviation. In light of the hazards associated with confined spaces, and the procedures implemented to address those hazards, the failure of even one employee to follow the correct procedure can adversely affect the safety of others. OSHA, therefore, concludes that it is necessary to retrain any employee who deviates from the approved entry procedures. This retraining must provide the employee with the knowledge and skills necessary for safe performance of his or her confined space duties in accordance with final § 1926.1207(a), although the employer may restrict retraining to the limited aspect of the employee's overall responsibility on which the employee made the deviation. For example, if employee failed to use a piece of equipment properly, the retraining could focus on the proper use of that equipment, and need not focus on areas unrelated to the deviation, such as the hazards associated with the atmosphere in the space.

Paragraph (c). Final § 1926.1207(c), which is identical to the general industry standard at § 1910.146(g)(3), requires an employer to establish that the employee is capable of performing his or her confined space duties proficiently, and to provide any supplemental training needed to make the employee proficient. This provision ensures that employees will not enter a PRCS without being able to apply the knowledge and procedures addressed in their training. In other words, the employer must determine that, for each employee, the training is effective and resulted in the employee being capable of performing the required duties proficiently.

Some commenters were unsure how an employer can demonstrate that an employee is proficient under final § 1926.1207(c) (ID–106, p. 2; –120, p. 3; –152, p. 3). Final § 1926.1207(c) is a performance-oriented measure that provides employers with flexibility by not requiring a particular way to demonstrate proficiency. Administration of a test or practical examination are some examples of how an employer may demonstrate an employee's proficiency.

Paragraph (d). Final § 1926.1207(d), which is substantively similar to the general industry standard at § 1910.146(g)(4), requires an employer to ''maintain training records,'' as opposed to the requirement in § 1910.146(g)(4) that employers ''certify'' training. This final paragraph also requires employers to document the names of employees trained, the trainer's name, and the dates of the training performed, and to make these records available for inspection by employees and their authorized representatives. Final § 1926.1207(d) differs from the general industry standard in that it provides more flexibility in the documentation of training, and it requires the retention of this documentation.

The training-documentation provision in final paragraph (d) requires only the name of the trainer, not the trainer's signature or initials as required in the general industry standard. Proposed § 1926.1209(d)(5) contained these more flexible requirements, and OSHA retained them in the final rule. This documentation can take any form that reasonably demonstrates the employee's completion of the training. Examples include a record of test scores, a photocopied card certifying completion of a class, or any other reasonable means. The employer may store these records electronically so long as they are readily accessible upon request. OSHA recognizes that the turnover rate for employees on construction sites is higher than in many other industries, and that employees also are likely to work at several different worksites based on the type of work required. For example, an employer could designate an employee to be an authorized entrant in several different confined spaces at the same worksite, which may require the employee to perform different assigned tasks under various planned conditions. In this situation, the documentation must be readily accessible to determine whether the employee received the training necessary to perform the various tasks under the planned conditions. Compliance with this provision will help ensure safe conditions within the PRCS by providing employers, and OSHA, with an administrative tool that they can use to confirm which employees will be able to perform the duties required by this standard. Section 1926.1207(d) requires, as the general industry standard does, that these training records must be available for inspection by employees and their authorized representatives. Permit-space employees rely on their fellow employees for safe entry operations, and this provision provides that the training records that document employees' training status be available to those employees and their representatives. This requirement can be especially important in the construction industry due to the high level of employee turnover and multiple employers present at construction sites, including different employers who conduct simultaneous entry where one employer's lack of training for its employees could jeopardize the fully trained employees of a different employer. Consequently, making these records available for inspection by employees and their representatives provides an additional level review to ensure that the employees received the proper training and are ready to engage in safe entry operations.

One commenter was unsure whether the final standard would require an employer to maintain the name of the person that provides general confined space training as well as ''for the specifics of this PCRS.'' (ID–098, p. 2). OSHA is uncertain of what training the commenter is referring to. To the extent that the commenter was referring to training required by this final rule, final § 1926.1207(d) requires the employer to record the name of the person who conducted the training. To the extent the commenter was referring to training required by a different rule, the comment is not applicable to this rulemaking.

As in this final rule, proposed § 1926.1219(c) required that employers retain these training records for the time the employee remains employed by them. The general industry confined spaces standard at § 1910.146(g)(4) does not specify how long an employer must retain the documentation. These training records are a valuable resource for tracking whether an employee received the necessary training. If these records are to serve as a tool to confirm employee training, the records must be available during the period the employee is working for the employer. Once the employee ceases to work for the employer, there is no longer a significant benefit in tracking this information. Therefore, OSHA is keeping in the final rule the proposed requirement that an employer must retain training documentation until the employee ceases to work for the employer.

One commenter had several concerns about the retention of training records. First, the commenter asserted that this retention requirement is an unnecessary burden on employers (ID–099, p. 4). OSHA's experience under the documentation requirements of other standards indicates that employers typically use existing training records to meet these documentation requirements and, as explained above, final § 1926.1207(d) allows significant flexibility in the form of the records and how an employer must store them. Next, the commenter was unsure whether final § 1926.1207(d) requires an employer to maintain training records when the employer lays off an employee and then rehires him or her (*id*). In the event an employee ceases to work for the employer, final § 1926.1207(d) does not necessarily require the employer to continue to maintain or store the training records; however, there is an incentive for the employer to retain these records if there is a possibility that the employer might re-hire the employee, as in the example offered by the commenter. The standard does require the employer to maintain a set of training records for all employees performing confined space work, regardless of when the employer hired the employee, so if the employee is rehired the employer would be required to produce that employee's training records or retrain the employee. This commenter also asserted that employers should be free to establish their own policy for retaining training records (*id*). Final § 1926.1207(d) leaves the employer with discretion in developing its training-documents retention policy, and requires retention only until the employee ceases to work for the employer.

Another commenter asserted that final § 1926.1207(d) should require employers to keep these training records on site (ID–031, p. 1). OSHA finds that such a requirement would be an unnecessary burden on employers. The purpose of the final requirement is to ensure that employers can document their employees' training in case an issue arises with respect to the training (*e.g.,* whether the employee received training, whether the training was adequate). Though the training records need to be readily available, it is not necessary for the employer to have immediate access to these records at the site. Requiring the employer to maintain the records and make them readily accessible for inspection, even offsite and/or in electronic form, is sufficient to accomplish the purpose of the provision.

Section 1926.1208—Duties of Authorized Entrants

An authorized entrant is an employee authorized by an entry supervisor to enter a permit space. As the Agency noted in the preamble to the general industry standard, ''[T]his is the person who faces the greatest risk of death or injury from exposure to the hazards contained within the space'' (58 FR 4515 (Jan. 14, 1993)). Because of the dangers associated with confined space work, employers must prepare the entrants properly to perform duties so as to assure their own safety and the safety of their fellow entrants. The employer accomplishes this purpose by means of training, communication of effective work rules, and internal administration.

Final § 1926.1208 is nearly identical to the general industry requirements in § 1910.146(h), except for minor editorial revisions and a revision in the introductory text to improve clarity. The introductory language in § 1910.146(h), which sets out requirements for authorized entrants, refers generally to the duties of ''the employer.'' OSHA changed the introductory language to refer to ''the entry employer'' to clarify how this rule applies on multi-employer worksites. This is a non-substantive change, however, because the provisions in § 1926.1208 apply to each employer establishing the permit program for a permit space or allowing its employees to enter under another employer's program.

The authorized entrant duties also are substantively the same as the duties specified by proposed § 1926.1211(g), except as noted in the discussion below. The Agency did not receive any comments specifically addressing that provision of the proposed rule.

Paragraph (a). Final § 1926.1208(a), which is substantively identical to the general industry standard at § 1910.146(h)(1), requires an employer to ensure that an authorized entrant is familiar with and understands the potential hazards associated with each particular confined space entry, including the mode, signs or symptoms, and the consequences of exposure to these hazards. The final rule uses ''familiar with and understands,'' rather than the ''knows'' used in the general industry standard, to emphasize the employee comprehension required by the rule. This knowledge and understanding affords authorized entrants with the information they need to protect themselves from these hazards, including recognition of the effects of these hazards should exposure occur.

Paragraph (b). Final § 1926.1208(b), which is substantively identical to the general industry standard at § 1910.146(h)(2), requires an employer to ensure that an authorized entrant uses required equipment properly. OSHA believes that proper use of such equipment is essential for working safely inside a PRCS and preventing any rescue operation from harming the incapacitated authorized entrant. Many employers can meet this requirement through implementation of safe work practices, training, and effective enforcement of those practices.

Paragraph (c). Final § 1926.1208(c), which is substantively identical to the general industry standard at § 1910.146(h)(3), requires an employer to ensure that an authorized entrant communicates effectively with the attendant to facilitate the attendant's adequate assessment of the entrant's status and timely evacuation (see also the discussion attendant-entrant communications in the explanation of § 1926.1206(m)). The authorized entrant's communication with the attendant provides the attendant with information regarding any problems the entrant is having, which the attendant can use to determine whether there is a need to evacuate the PRCS.

Paragraph (d). Final § 1926.1208(d), which is similar to the general industry standard at § 1910.146(h)(4), requires an employer to ensure that an authorized entrant alerts the attendant whenever one of the following circumstances arises: (1) There is a warning sign or symptom of exposure to a dangerous situation; or (2) the entrant recognizes a prohibited condition. In some instances, a properly trained authorized entrant may be able to recognize and report his or her own symptoms, such as headache, dizziness, or slurred speech, and take the required action. In other cases, the authorized entrant, once the effects begin, may be unable to recognize or report them. In these latter cases, this provision requires that other, unimpaired, authorized entrants in the PRCS, who employers must properly train to recognize signs, symptoms, and other hazard-exposure effects in other authorized entrants, report these effects to the attendant. Reporting these effects will ensure the safety of the authorized entrants by removing them from the hazardous conditions in a timely manner.

Paragraph (d)(1) differs slightly from the corresponding general industry provision at § 1910.146(h)(4)(i). The general industry provision requires an employer to ensure that an authorized entrant alerts the attendant when ''the entrant recognizes'' a dangerous situation. Final § 1926.1208(d)(1) requires an employer to ensure that an authorized entrant alerts the attendant whenever ''there is . . . a dangerous situation.'' OSHA made this change to make the requirement objective, and not contingent on the subjective belief of an authorized entrant about the level of danger. For example, if an entrant knocks over a container of sealant that was not scheduled to be opened until later, thereby releasing hazardous fumes into an inadequately ventilated permit space, the final rule makes it clear that the entrant has a duty to report the incident to the attendant immediately. The employer must ensure that the entrant is adequately prepared to identify such an incident as a dangerous situation, and the entrant's failure to do so would not excuse the entrant or employer from that duty.

By using language closer to that in the general industry, OSHA has deviated slightly from the equivalent requirement in the proposed rule, § 1926.1211(g)(3), which required the authorized entrant to alert the attendant of ''any sign, symptom, unusual behavior, or other effect of a hazard.'' OSHA retained the reference to a ''symptom'' from the proposed rule, but believes that the reference to the ''dangerous situation'' in the general industry standard provides slightly broader coverage than the proposed language. Under the general industry standard and this final rule, attendants would need to be aware, for example, of an entrant experiencing a heart attack or other condition unrelated to the conditions in the confined space, but which might nevertheless affect that entrant and/or other entrants in the space. However, the general industry language incorporated into the final rule provides sufficient specificity regarding the conditions covered by the provision, and employers and authorized entrants are familiar with the language, having used it for years in general industry work (and in construction work if they chose to voluntarily follow the general industry requirements). Other examples of exposure to a dangerous situation that an authorized entrant must report to the attendant under paragraph (d)(1) or (d)(2) include: Low measurements of supplied air in a closed-respirator system; fraying or snagging of a retrieval line; a leak allowing an unidentified substance to enter the confined space through the walls of the space or from a container brought into the space; sparks or other evidence of potential electrical malfunction (particularly in areas where flammable gases are present); and any changes identified by the entrant in his or her physical condition or the physical condition of another entrant (*e.g.,* dizziness, chest pains, vertigo, breathing difficulty, trembling, etc.).

Paragraph (e). The introductory language in final § 1926.1208(e), which is identical to the general industry standard at § 1910.146(h)(5), requires an employer to ensure that an authorized entrant exits from the confined space whenever one of circumstances identified in final § 1926.1208(e)(1)-(e)(4) arises.

Final § 1926.1208(e)(1), which is similar to the general industry standard at § 1910.146(h)(5)(i), requires an employer to ensure that an authorized entrant exits from the confined space whenever the attendant or entry supervisor orders an evacuation. It is essential that the authorized entrants quickly comply with the command to evacuate, particularly because the attendant or entry supervisor may be aware of a hazard that the authorized entrant has not detected. Even when there is disagreement between the entry supervisor and attendant as to whether to evacuate, this provision requires the employer to enforce orders to evacuate given by either the entry supervisor or the attendant. OSHA believes this provision is necessary because emergencies within a confined space are time sensitive, and the entry supervisor and attendant may have different information regarding the types or severity of the hazards in the PRCS.

Final § 1926.1208(e)(2), which is similar to the general industry standard at § 1910.146(h)(5)(ii), requires an employer to ensure that an authorized entrant exits from the confined space whenever there is a warning sign or symptom of a dangerous situation. The phrase ''warning sign or symptom of a dangerous situation'' has the same meaning as in final paragraph (d) of this section. As with final paragraph (d), and for the same reason, final paragraph (e)(2) differs slightly from the corresponding general industry provision at § 1910.146(h)(5)(ii) because final § 1926.1208(e)(2) requires an employer to ensure that an authorized entrant exits the space whenever ''there is . . . a dangerous situation,'' rather than whenever ''the entrant recognizes'' a dangerous situation. This provision requires authorized entrants to exit the PRCS as quickly as possible in such cases because the safety procedures delineated in the permit are designed to work in the context of clearly defined acceptable entry conditions, and deviations from the planned measures therefore require timely evacuation to ensure the health and safety of the entrants pending evaluation of the dangerous situation.

Final § 1926.1208(e)(3), which is identical to the general industry standard at § 1910.146(h)(5)(iii), requires an employer to ensure that an authorized entrant exits from the confined space whenever the entrant detects a prohibited condition, as defined in final § 1926.1201. This requirement ensures that employees exit the confined space if there is any prohibited condition, such as a hazardous atmosphere or uncontrolled physical hazard, in the space. Exiting the space upon detecting a prohibited condition will prevent serious injury or death to the entrants. Other examples of prohibited conditions include, but are not limited to, the emergence of a new hazard, a hazard level that exceeds acceptable entry conditions, or personal protective equipment that is not working as planned. In such circumstances, authorized entrants must exit the space to protect their health and safety.

Final § 1926.1208(e)(4), which is identical to the general industry standard at § 1910.146(h)(5)(iv), requires an employer to ensure that an authorized entrant exits the confined space whenever an evacuation alarm sounds. Examples of these alarms include, but are not limited to, atmospheric or engulfment-hazard monitor alarms or alarms activated by an authorized entrant or other employee. This provision ensures that entrants in a PRCS exit the space in a timely manner upon activation of an evacuation alarm warning them of an impending danger, thereby preventing serious injury or death to the entrants.

Section 1926.1209—Duties of Attendants

In final § 1926.1209, OSHA sets out the duties of the attendant required by final § 1926.1204(f) as part of every permit program. The general industry standard recognizes the need for an attendant outside permit spaces, and the preambles for final § 1926.1204(f) and the general industry standard at 58 FR 4517 (Jan. 14, 1993), explain the need for these attendants. One of the major problems in permit space entry operations is that, if an entrant within the space is injured or incapacitated in the space, he or she cannot normally be seen from outside the space, so the attendant is critical to recognizing quickly any injury or incapacitation so that the employer can initiate the applicable rescue operation as soon as possible. The attendant also plays a critical role in protecting employees inside the confined space from unauthorized entries and potentially hazardous conditions outside the confined space that could affect the workers inside the confined space.

The provisions in final § 1926.1209 are substantively identical to the provisions in the general industry confined spaces rule, except as noted below. The introductory language to § 1910.146(i) refers to ''the'' employer. As in the introductory language for many of the provisions in the final rule, OSHA refers to ''the entry employer'' in the introductory language of § 1926.1209 to clarify how this rule applies on multi-employer worksites.

The attendant duties are also similar to the duties specified in proposed §§ 1926.1210(f) and 1926.1211(f). The final rule does not include a paragraph found in proposed § 1926.1211(f)(9), which expressly prohibited attendants from entering a confined space to perform rescue. OSHA did not include this paragraph because the prohibition is clear from the general industry standard language incorporated into the final rule, *i.e.,* employers must ensure that attendants never enter a confined space, whether it is to perform rescue or for any other purpose, unless another person assumes the duties of the attendant, and the attendant is properly trained for rescue activity. See § 1926.1209(d) and its Note. In this way, the final rule provides more flexibility to employers than the proposal.

Paragraph (a). Final § 1926.1209(a), which is almost identical to the general industry standard at § 1910.146(i)(1) (except for non-substantive clarifications), requires an employer to ensure that each attendant is familiar with hazards that he or she may encounter during entry, as well as the signs and consequences of such exposures. Section 1910.146(i)(1) requires an employer to ensure that each attendant ''knows'' the hazards that he or she may encounter during entry. OSHA replaced ''knows'' with ''is familiar with and understands'' in the final rule to emphasize that the element of comprehension is critical to the attendant's ability to fulfill his or her duties. Attendants must be able to recognize when entry conditions in the PRCS are unacceptable—that the system of employee protection is malfunctioning. Because attendants would be able to easily communicate with entrants and entry supervisors, their recognition of deviations from acceptable entry conditions, and of the signs, symptoms, and characteristic effects that indicate exposure to a hazard, will enable a timely evacuation from the PRCS. For additional information concerning the signs and symptoms of exposure, see the discussion of § 1926.1208(d) in this preamble.

Paragraph (b). Final § 1926.1209(b), which is identical to the general industry standard at § 1910.146(i)(2), requires the attendant to be aware of the potential behavioral effects of hazard exposure to authorized entrants. While there is overlap between this requirement and the requirement to be familiar with and understand signs and symptoms of exposure, the same overlap exists in the general industry standard and OSHA is preserving the separate requirements for consistency with the general industry standard and to emphasize the importance of recognizing behavioral changes as possible evidence of hazard exposure. OSHA believes this requirement is necessary because the attendant is likely to be in a position to quickly recognize deteriorating conditions within the space and readily communicate the need for an immediate evacuation. For instance, subtle behavioral changes or effects detected in an entrant's speech, or deviations in established communication procedures, would alert the attendant that it is necessary to initiate the procedure to evacuate or rescue the entrant from the space.

Paragraph (c). Final § 1926.1209(c), which is identical to the general industry standard at § 1910.146(i)(3), requires the attendant to maintain an accurate count at all times of authorized entrants, and to ensure that the method used to identify entrants under final § 1926.1206 of this section is accurate. In emergency situations requiring evacuation, the count and identification of entrants is necessary to determine whether evacuation of all authorized entrants from the space occurred, and that no unauthorized entrants remain in the space. This information can then be relayed, if necessary, to rescue workers.

Paragraph (d). Final § 1926.1209(d), which is identical to the general industry standard at § 1910.146(i)(4), requires the attendant to stay outside of the permit space during entry operations until he or she is relieved by another attendant. One of the main duties of the attendant is to recognize hazardous conditions that are occurring inside the PRCS, and to communicate this information to rescue personnel in emergency situations. The attendant is also often the first (and sometimes only) person to recognize prohibited conditions or signs of hazardous conditions within the space. If the attendant was inside the space, the attendant could become incapacitated if an emergency occurred, or the entrants are exposed to prohibited conditions, and consequently rendered unable to perform the duties that are necessary to protect the other employees.

OSHA included a note to final § 1926.1209(d) that is substantively the same as the note in the general industry standard. OSHA reorganized the sentence structure of the note in the final rule to clarify that the attendant cannot attempt rescue until properly relieved, and then only if the attendant is permitted to do so under the permit program and adequately trained and equipped for entry rescue. However, the final rule permits the attendant to perform non-entry rescue so long as the attendant receives proper training to do so. If the attendant is performing his or her duties in multiple spaces, the attendant also must order the entrants in those other spaces to exit the spaces while the attendant is involved in the rescue, or ensure that another person assumes the attendant duties for the other spaces.

Paragraph (e). Final § 1926.1209(e), which is nearly identical to the general industry standard at § 1910.146(i)(5), requires the attendant to communicate with authorized entrants as necessary to keep track of the entrants' status and to notify entrants if evacuation under final § 1926.1209(f) of this section is necessary. OSHA believes that this communication provides information that the attendant needs to determine if the entry can continue. For example, subtle behavioral changes detected in the entrant's speech, or deviations from set communication procedures, could alert the attendant that it is necessary to evacuate or rescue the entrant. This requirement may assist the attendant in fulfilling the duties to identify signs and symptoms of exposure or behavioral changes (see paragraphs (a) and (b) of this section). In addition, if the need arises, the attendant must communicate to the entrants an order to evacuate because the entrants may not know that there is an emergency.

In the final rule, OSHA requires the attendant to stay in communication to ''assess'' the entrant's status, rather than to ''monitor'' it as required in the general industry standard. While there is no substantive difference between these terms, OSHA uses ''assess'' because ''monitor,'' as defined in the final standard, refers to the identification and evaluation of hazards in a confined space. Assessment connotes an interactive duty in which the attendant may ask questions of the entrant, or ask the entrant to perform a task so the attendant can evaluate the entrant's status.

As with the general industry standard, the attendant's ''communication'' with the entrant may take different forms depending on the limitations of the particular permit space. In most instances, the attendant could use voice communication, including communication by phone, walkie talkie, or other device that provides a clear and continuous means of communication with the entrant. In other cases, alternative methods, such as tapping on the walls of the space to allow for assessment through a pre-arranged code, may be sufficient to satisfy § 1926.1209(e). See, *e.g.,* July 30, 1993, letter to Julie Emmerich.

Paragraph (f). Final § 1926.1209(f), which is almost identical to the general industry standard at § 1910.146(i)(6), requires the attendant to assess the activities and conditions inside and outside the space to determine if it is safe for entrants to stay in the space. OSHA again uses ''assess'' instead of ''monitor'' for the same reason discussed above in final § 1926.1209(e). OSHA refers to ''activities and conditions'' in the final rule, as opposed to just ''activities'' in the general industry standard, for internal consistency within this provision. In the same paragraph, OSHA requires the attendant to evacuate the permit space under any of the four ''conditions'' listed in final § 1926.1209(f)(1) through (f)(4): (1) The attendant notices a prohibited condition, (2) the attendant identifies the behavioral effects of hazard exposure in an authorized entrant, (3) there is a condition outside the space that could endanger the authorized entrants, or (4) the attendant cannot effectively and safely perform the duties required under final § 1926.1209. Thus, it is necessary for the attendant to assess both the activities and conditions affecting the entrants.

In the general industry standard, OSHA requires the attendant to order evacuation ''if the attendant detects'' a prohibited condition, certain behavioral effects, or a condition outside the space that could endanger the entrants. See § 1910.146(i)(6)(i) through (i)(6)(iii). OSHA did not include the quoted language in the final rule because existing conditions, not detection by the attendant, trigger the duties in final § 1926.1209(f)(1) through (3). OSHA believes that each of these conditions represents potential precursors to serious safety hazards that threaten the health and well-being of employees working in and near the PRCS, and the employer has a duty to ensure that the attendant detects them.

One of the conditions that triggers evacuation is a situation that arises outside the permit space that could endanger the workers inside the space. See final § 1926.1209(f)(3). This requirement also is specified in the general industry standard. Under final § 1926.1203(h)(4) and § 1926.1204(k), the employer must develop and implement procedures to coordinate entry operations with other employers working outside the confined space when the activities of those employers could, either alone or in conjunction with the activities within a permit space, foreseeably result in a hazard within the confined space. In most cases, employers will perform such activities outside the space in close proximity to the permit space, and the attendant must be aware of the applicable coordination procedures to identify any deviation and evacuate the entrants if the deviation makes it unsafe for the entrants to remain in the permit space. While not required to do so, the attendant may take steps to stop activities that do not conform to those procedures, either directly or by notifying the entry supervisor and the controlling contractor, provided that doing so does not interfere with the attendant's ability to fulfill the duties required by § 1926.1209. However, if the employer does not address the potentially endangering activities immediately, the attendant must evacuate the entrants. Consider, for example, a situation in which employees are working inside a storm-sewer permit space that is not isolated from the general storm sewer system. If someone within the view of the attendant is setting up for an activity that will discharge water into the upstream portion of the storm sewer system, the attendant must alert the entry supervisor, and may call to the person setting up the discharge system to request that the person not discharge water into the storm sewer until the employees in the storm sewer have completed their work. If the potential pumpers refuse to wait, then the attendant must order the immediate evacuation of the permit space. See § 1926.1209(f)(3).

Other examples of conditions or activities outside a permit space that would require the attendant's attention include the placement of potentially hazardous items near a ventilation intake source (*e.g.,* an open container of epoxy or gasoline-powered equipment emitting exhaust), or physical conditions that could affect the permit space (*e.g.,* heavy rains outside a below-ground permit space).

One commenter asserted that requiring an attendant to evaluate confined space hazards inside and outside a ground storage tank exposes the attendant to both fall hazards and struck-by hazards (ID–210, Tr. p. 223). For example, a situation in which the tank does not have a ground level entrance, and the attendant must climb a vertical fixed ladder to gain access, exposes the attendant to a fall hazard. However, this comment fails to recognize that the standard would permit the attendant to use electronic monitoring and communications or other means to fulfill the duties in § 1926.1209. Thus, depending on the circumstances of the space, the attendant might only need to physically approach the entrance of the permit space to perform non-entry rescue if non-entry rescue is appropriate (the retrieval equipment would not increase the overall risk of entry and would contribute to the rescue of the entrant), and then only when assigned and trained to do so. In addition, if the attendant encounters a hazard not covered by the confined spaces standard (*e.g.,* a fall hazard), the employer must comply with the relevant OSHA requirements that address the hazard (*e.g.,* 29 CFR part 1926, subpart M, for fall hazards).

More importantly, it appears that the commenter also is challenging the general need for an attendant by asserting that an attendant is unnecessary when the employer is performing work inside an above-ground storage tank (ID–210, Tr. p. 223). In these situations, so long as the space meets the definition of a permit-required confined space, an attendant is necessary for safe entry operations. Although the person designated by the employer as attendant is not assigned the overall responsibility for employee safety and health assigned to the entry supervisor, the attendant is a crucial link in the communication chain between the entry supervisor, rescue operations, and the authorized entrants. For additional explanation of the importance of the attendant's role, see the introductory discussion of § 1926.1209.

It is extremely important that attendants understand their duties, stay in contact with the entrants, and remain alert to conditions inside and outside the PRCS. The attendant may be in the best position to warn the entrants of hazardous conditions developing outside the space and impending danger within the space, and to recognize physical and behavioral changes in the entrants that indicate that conditions within the space may be deteriorating. Should the entrant become incapacitated, the attendant often is an entrant's only contact with individuals outside the confined space. Therefore, the attendant is necessary to detect emergencies that develop in the space, and to summon emergency assistance before it is too late to prevent injury or death to the entrant.

Another commenter suggested that OSHA make it explicit that the attendant must remain outside the confined space when monitoring atmospheric conditions of the confined space (ID–132, p. 3). This additional language is unnecessary because final § 1926.1209(d) already requires attendants to remain outside the confined space while fulfilling all of their duties under this section, including the duties specified in § 1926.1209(f).

Paragraph (g). Final § 1926.1209(g), which is identical to § 1910.146(i)(7), requires the attendant to call upon rescue and other emergency services as soon as he or she decides that authorized entrants may need assistance to escape from permit space hazards. This provision is necessary to ensure that rescue of authorized entrants occurs as soon as possible to maximize their chance of survival and limiting their injuries, as well as minimizing risk of injury to the rescue-service employees. The Agency notes that in some situations, the attendant may be the person designated to perform non-entry rescue and, therefore, may simply commence that rescue. If other personnel are necessary for non-entry rescue, or if entry rescue is necessary, then the attendant must summon those personnel immediately.

One commenter noted that the parallel language in proposed paragraph § 1926.1211(f)(6) did not specifically require the attendant to ''summon'' the rescue service (only to ''inform'' them), and requested that OSHA insert language requiring that action (ID–210, Tr. p. 357). OSHA responded to this comment by adopting the language of the general industry standard in final § 1926.1209(g).

Paragraph (h). Final § 1926.1209(h), which is identical to the general industry standard at § 1910.146(i)(8), requires the attendant to take the actions specified in § 1926.1209(h)(1) through (h)(3) to prevent unauthorized persons from entering a permit space while entry is taking place. OSHA recognizes that there are individuals who may mistakenly believe that they are to work on a task in the space, or who may simply wander by or attempt to enter into the space unaware of the dangers of the PRCS. Final § 1926.1203(b) requires the employer to notify the controlling contractor and other specified employees, as well as the employees' authorized representatives, about the location of, and dangers posed by, the space. However, if someone other than an authorized entrant happens to approach the PRCS, § 1926.1209(h)(1) specifies that the attendant must make that individual aware that he/she must stay away from the PRCS. Some construction sites may be accessible to the public, so the attendant also would be responsible for warning members of the public who may attempt to enter a permit space at the site. Should an unauthorized person enter the PRCS, paragraph (h)(2) of § 1926.1209 requires the attendant to advise him/her to exit the space immediately. This provision protects employees who enter permit spaces without proper authorization, training, or equipment, from the hazards of the permit space, and prevents injury to the entrants already in the permit space from the actions of unauthorized entrants and the items they may carry into the space.

Because an attendant may not have supervisory authority, or because the errant individual may work for another employer at a multi-employer construction site, an attendant may not have the authority to stop unauthorized individuals from entering the PRCS, or to require them to exit once they are inside the space. Therefore, paragraph (h)(3) of § 1926.1209 requires the attendant to notify the entry supervisor, along with the authorized entrants, of this situation, and to evacuate if necessary, as unauthorized entry will typically create a prohibited condition under the permit. Accordingly, OSHA does not encourage or require attendants to expose themselves to potential harm by physically preventing entry to any person.

Paragraph (i). Final § 1926.1209(i), which is identical to the general industry standard at § 1910.146(i)(9), requires employers that designate attendants to perform non-entry rescues to ensure that the attendants perform these rescues in accordance with the employer's rescue procedure. When properly executed, the attendant's performance of non-entry rescue can be the fastest and most effective means of successfully rescuing an entrant, while preventing injuries and deaths that may result from improperly executed entry rescue operations. However, if the employer designates the attendant to perform non-entry rescue but does train the attendant to perform non-entry rescue, or if the attendant does not operate winching equipment or perform other components of the rescue in accordance with the proper procedures, then the result could render the rescue ineffective and endanger the attendant (*e.g.,* improper line retrieval could cause the attendant to lose balance and fall into the permit space), delay rescue (and, thereby, endanger the entrant in need of rescue), or endanger other entrants.

Paragraph (j). Final § 1926.1209(j), which is identical to the general industry standard at § 1910.146(i)(10), requires that the attendant not engage in other activities that could distract him or her from attending to the permit space. The attendant could endanger the authorized entrants if distracted from these duties. If an attendant performs a task that diverts his or her attention from the attendant duties, an emergency condition inside or outside the space could go undetected until it is too late to prevent injury or death to the attendant. However, OSHA also recognizes that the attendant can perform some additional tasks safely, particularly those tasks that enhance the attendant's knowledge of conditions in the permit space. For example, passing tools to authorized entrants and remote monitoring of the atmosphere of the PRCS are among the types of duties permitted, provided the attendant does not enter the PRCS. Activities requiring close or prolonged concentration, or those activities requiring that the attendant be away from a location in which he can observe the PRCS, would likely interfere with attendant duties. Employers must not assign such activities to an attendant and must ensure that an attendant not engage in such activities. The Agency notes that, although the employer may assign attendants to more than one permit space at the same time under § 1926.1204(f), the employer must still properly train and equip the attendant so that the attendant's role with respect to one space does not interfere with his or her duties with respect to other permit spaces. See also § 1926.1204(f)(1). In other words, the attendant's duty under § 1926.1209(j) applies separately with respect to each individual permit space.

Section 1926.1210—Duties of entry supervisors

The duties of the entry supervisor are critical to the safety of entrants working in a permit space. The employer must assign an entry supervisor who has the responsibility to supervise testing the atmosphere and identifying hazards both before and during entry, terminating entry when necessary, removing unauthorized entrants, and generally ensuring that the work performed in the permit space conforms to the permit program and the acceptable conditions specified on the permit. As noted in the preamble to the general industry standard, the entry supervisor has ''overall accountability for confined space entry'' (58 FR 4523). OSHA enumerated specific responsibilities in § 1926.1210 of the final rule, which is almost identical to § 1910.146(j) of the general industry standard. The final rule also is consistent with the entry supervisor requirements in the proposed rule, which were at proposed § 1926.1210(e)(2) and § 1926.1211(d)(1) and (d)(2).[24]

The introductory language to § 1910.146(j) refers to ''the employer.'' In this final rule, OSHA instead refers to ''the entry employer'' to clarify how this rule applies on multi-employer worksites. This revision is non-substantive; in both cases, the requirements apply to each employer establishing the permit program for a permit space.

One commenter suggested that OSHA use ''competent person'' in place of ''entry supervisor'' to ''be more consistent with other construction standards'' (ID–124, p. 8). Although some employers in the construction industry may not be as familiar with the term ''entry supervisor,'' OSHA is retaining the language of the general industry standard because the term is clear and intuitive, and the majority of commenters seemed familiar with that terminology.

Paragraph (a). Final § 1926.1210(a), which is identical to the general industry standard at § 1910.146(j)(1), except for a non-substantive clarification, requires the employer to ensure that each entry supervisor is familiar with, and understands, the hazards that entrants may encounter during entry, including information on the mode, signs or symptoms, and the consequences of exposure to these hazards. Consistent with its approach in other provisions noted earlier, OSHA changed the use of the term ''know,'' found in corresponding § 1910.146(j)(1), to ''is familiar with and understands'' in this final rule to clarify that the entry supervisor must comprehend the hazards that entrants may encounter.

In the discussion of the duties of the entry supervisor in the preamble to the general industry standard, OSHA explained that, in light of the overarching responsibility of the entry supervisor for the safety of all entrants, it is ''only reasonable that he or she be expected to know at least as much, if not more, than authorized entrants and attendants'' (58 FR 4523). That knowledge is particularly important in the context of construction, where high turnover of employees and changes to the work site may be more frequent than for general industry. As an individual with the authority to terminate entry and cancel the entry permit, it is essential that the entry supervisor recognize hazardous conditions and telltale indications (signs, symptoms, and characteristic effects) that a hazard from within or outside the permit space is affecting employees engaged in the PRCS operations. By meeting the knowledge requirements of final § 1926.1210(a), the entry supervisor will be able to effectively identify emergency situations by observing employees involved in entry operations.

Paragraph (b). Final § 1926.1210(b), which is identical to the general industry standard at § 1910.146(j)(2), requires the entry supervisor to verify that the employer performed all tests specified by the entry permit, and that all procedures and equipment so specified are in place before he or she may sign the permit and allow entry. The paragraph also specifies that the entry supervisor must verify this information by checking the corresponding entries on the permit. These preliminary checks are necessary to ensure that the conditions in the space are within the acceptable entry conditions—hazard levels are as planned, and protective measures are in place, working properly, and are effective—before entry operations commence.

Paragraph (c). Final § 1926.1210(c) requires the employer, through the entry supervisor, to stop the entry and cancel (or suspend) the permit, as set forth by final § 1926.1205(e), when certain conditions change inside the permit space. By requiring the entry supervisor to terminate the entry permit under the specified conditions, the final rule ensures that the employees will exit the space if there is a deviation from acceptable entry conditions and, therefore, avoid encountering harm arising from prohibited conditions within the PRCS. Final § 1926.1210(c) is nearly identical to the general industry standard at § 1910.146(j)(3), except that the new final provision allows for the suspension of a permit, rather than a cancellation, as permitted in final § 1926.1205(e). For additional explanation of the suspension of the permit, see the explanation above of § 1926.1205(e).

To perform this duty effectively, an entry supervisor must be knowledgeable of the hazardous conditions and the tests and procedures used to monitor these conditions so the entry supervisor can respond in a timely manner to a developing hazard. While the entry supervisor need not personally perform the testing or monitoring (but may choose to do so if properly trained), the entry supervisor must possess the expertise necessary to oversee the testing and identify the hazards in the permit space, and is ultimately responsible for identifying deviations from acceptable entry conditions and other unsafe conditions. In the proposed rule, this requirement differed slightly from the requirements in the general industry standard and this final rule, but the result is the same: The entry supervisor must have all the information regarding the conditions and monitoring results required to know when it is necessary to terminate entry. This requirement remains in effect even if the entry supervisor assumes other duties, such as the duties of an entrant or attendant.

Paragraph (d). Final § 1926.1210(d), which is nearly identical to the general industry standard at § 1910.146(j)(4), requires the entry supervisor to verify that rescue services are available, and that the means for obtaining such services are operable. Because the employer must assign authority for safe permit entry operations to the entry supervisor, it is reasonable and consistent with the rescue provisions to specify that the entry supervisor verify that the rescue service is available, and that the means of summoning it in a

[24] OSHA specified in the proposed rule that the entry supervisor is responsible for evacuating employees from the permit space under specified conditions, and for terminating entry and canceling the permit. OSHA included similar requirements in final § 1926.1205(e) (permitting process), which is a more appropriate location than § 1926.1210 of the final rule because the requirements in § 1926.1205(e) address the process of terminating and canceling the permit.

timely manner is functioning properly. The only difference between this final provision and the general industry standard is that OSHA clarified in this final provision that, as part of the contact with the rescue service, the entry supervisor must verify that the rescue service will notify the supervisor if that service becomes unavailable during the entry process. This clarification corresponds to the employer's duty to confirm the continued availability of the rescue service in final § 1926.1211(a)(3), and is consistent with the proposed rule, which focused overall coordination of the permit entry operations on the entry supervisor (see 72 FR 67368 (Nov. 28, 2007)). Under both the proposed and final rules, the overall coordination duties include managing communications with the rescue service.

Paragraph (e). Final § 1926.1210(e), which is identical to the general industry standard at § 1910.146(j)(5) and consistent with the proposed rule at § 1926.1211(d)(2), requires the entry supervisor to remove unauthorized individuals who enter, or attempt to enter, the permit space during entry operations. Unauthorized entrants lack the safety training necessary to work in the PRCS, and the entry permit does not account for them. Their presence in a permit space not only poses a danger to them, but may also endanger the authorized entrants in the space.

In the final rule, OSHA requires attendants to warn persons near a permit space not to enter the permit space unless they have authorization to do so, but the attendant is not required to physically prevent unauthorized entry or to remove an unauthorized entrant (final § 1926.1209(h)). Under the final rule, as with the general industry standard, the entry supervisor has ultimate responsibility for preventing unauthorized entry and, if that fails, for removing the unauthorized person as quickly as possible from the permit space.

Paragraph (f). Final § 1926.1210(f) is identical to the general industry standard at § 1910.146(j)(6) and consistent with the proposed rule at § 1926.1211(e)(2). While paragraphs (a) and (b) of this section of the final rule set out the entry supervisor's responsibility to ensure that the permit space will be safe prior to entry, and paragraph (c) of this section makes it clear when the employer must cancel or suspend the permit, paragraph (f) requires the entry supervisor to ensure the maintenance of safe working conditions during the entry. In final § 1926.1210(f), OSHA sets out the entry supervisor's duty to assess the space when first assigned entry supervisor duties for the permit space, and at regular intervals thereafter.

OSHA recognizes that employers will need to replace entry supervisors occasionally for various reasons (for example, shift changes, lunch breaks, and regular rotations to other tasks at the job site). This final provision requires that, whenever there is a transfer of supervisory responsibility for a permit-space entry operation, the entry supervisor must assess the space and its hazards to maintain entry operations that are consistent with the entry permit and other requirements of the standard pertaining to the maintenance of acceptable entry conditions. This requirement ensures that the new entry supervisor reviews the permit and entry conditions and, consequently, has the information necessary for performing the duties enumerated in final § 1926.1210.

Final § 1926.1210(f) also requires that the entry supervisor assess the space and its hazards at intervals dictated by the hazards and operations performed therein. This requirement addresses the fact that conditions often change over time within a permit space, while providing the employer some flexibility to monitor different hazards at different intervals of time (see 58 FR 4524). Some hazards may develop rapidly and require more frequent assessments, such as when employees are in a space with a combustible gas already at 9 percent of its LEL, and the employer expects the operations to generate additional gas that will be controlled through ventilation. Other hazards, such as a slow leak of water from a pipe into a permit space, are likely to develop at a more predictable pace that would allow for less frequent monitoring. The type of operation and location or characteristics of the space may also require more frequent assessments by the entry supervisor, such as demolishing an underground wall near water pipes or performing construction work in a sewer system where even a small leak of an unidentified substance or other small change in the sewer space could potentially place the lives of the employees in danger.

One commenter asserted that it is not feasible for an employer to have only one entry supervisor because employees could perform no work in the permit space if the entry supervisor is absent (ID–107, p. 4). This commenter misunderstands the entry supervisor requirements. Final § 1926.1210(f) permits an employer to transfer the duties of the entry supervisor between employees, so long as each such entry supervisor has the proper qualifications to perform these duties and receives the appropriate information about the space from the previous supervisor.

Another commenter also was unsure whether the final rule requires the entry supervisor to be on the construction site at all times (ID–124, p. 7). The entry supervisor is responsible for crucial duties, including monitoring the space, physically removing unauthorized entrants, and terminating entry if necessary. Therefore, it is highly unlikely that the entry supervisor will be able to fulfill the required duties from a distance. However, the standard does not foreclose the potential for technology advances that may allow an entry supervisor to perform the required functions while located away from the permit space. If the entry supervisor is unable to perform his or her duties, either because he or she is not present on the site or for another reason, then the employer must terminate the entry or replace that entry supervisor with a supervisor properly qualified under this final section, and who makes the determinations required by final § 1926.1210(f), or the employer will not be in compliance with this final rule.

Section 1211 — Rescue and Emergency Services

An employer conducting a permit-space entry must include procedures for providing rescue and emergency service as part of its permit-space program (final § 1926.1204(i)). Final § 1926.1211 specifies requirements for that rescue and emergency service. The requirements in final § 1926.1211 are substantively similar to the corresponding provisions in the general industry confined spaces standard at § 1910.146(k). In general, the substance of the rescue provisions in the proposed rule was similar to that of the rescue provisions in the general industry rule, but the language of the general industry rule is more performance-oriented and includes fewer detailed requirements than the proposed rule.

Final § 1926.1211 uses the term ''rescue and emergency services.'' There are two types of rescue services addressed by this provision: Non-entry rescue and entry rescue, and the employer must determine which is appropriate. Emergency services are distinct: They are the services that must be used to retrieve the entrant when the employer's non-entry or entry rescue fails.

OSHA notes that during the rulemaking for the general industry confined spaces standard, a commenter raised a question as to whether an entry rescue service involved only off-site rescue teams (58 FR 4525). The Agency made clear in that rulemaking that an employer could use an on-site team as long as the employer met all the criteria outlined in the standard. That rationale is equally applicable to this final rule. Consequently, the term ''rescue service'' in this standard does not exclude the use of an on-site entry rescue service. Indeed, as OSHA noted in the preamble to final § 1910.146, the need to respond as quickly as possible to an emergency within a permit space indicates a preference for on-site rescue teams wherever it is practical.

Some employers may prefer to establish an on-site rescue service. Other employers may prefer to rely on off-site rescue services, perhaps because they believe that they do not have the resources to train employees to perform rescue or because the ready availability of an adequate off-site rescue service makes an on-site capability unnecessary. The final rule allows employers to make arrangements for either on-site or off-site services.

Also, the final rule's phrase ''rescue service'' refers to all rescue personnel provided to remove entrants from permit spaces. It includes situations in which one person will be responsible for the rescue of authorized entrants (*e.g.,* when the employer uses non-entry rescue systems). In such situations, the evaluation and selection requirements of final § 1926.1211(a) will apply. The training and practice requirements of final § 1926.1211(b) also apply in these situations. Thus, OSHA is treating all rescue services alike, whether the service is on-site or off-site, whether the service is entry rescue or non-entry rescue, or whether the service consists of a multiple-person team or a single person.

One commenter asserted that the rescue requirements should differ based on the type of hazard that is present in or near the confined space (ID–077, p. 1). This standard does set different requirements based on the type of hazard in a PRCS, although the requirements in § 1926.1211(a)(1) and (a)(3)(i) establish performance-oriented criteria that vary based on the hazards in the permit spaces. Final § 1926.1203(e) allows an employer to use alternative entry procedures different than those required by the rest of this standard under certain circumstances. Final § 1926.1203(g) allows an employer to reclassify a PRCS as a non-permit confined space when the employer meets the requirements of that paragraph. The rescue requirements in this final standard do not apply when an employer is using the procedures in final §§ 1926.1203(e) or 1926.1203(g). When an employer is working within a PRCS that does not meet the criteria in one of those paragraphs, however, the rescue requirements are the same for all hazards severe enough to trigger the PRCS program required by final § 1926.1204.

Paragraph (a). The introductory text in final § 1926.1211(a), which is identical to the general industry standard at § 1910.146(k)(1), introduces the requirements for designating rescue services. This paragraph emphasizes the evaluation that an employer must perform of available rescue and emergency service resources before designating a rescue provider for the purposes of this standard as required at § 1926.1204(i) of this final rule. The requirements of this paragraph apply equally to both on-site (employees of the entry employer or controlling contractor) and third-party rescue services.

One commenter asserted that some third-party rescue services, such as fire departments, are unwilling to be the designated rescue service due to liability concerns (ID–075, p. 8). Another commenter asserted that relying on local fire departments to provide third-party recue services can be problematic because the rescue service is not designed specifically to provide confined space rescue at a particular worksite (ID–210, Tr. p. 192). These comments imply that OSHA requires employers to designate the local fire department as the rescue service, which is not the case. In the final rule, OSHA provides employers with much flexibility in choosing its third-party rescue service if the employer elects to rely on a third-party rescue service.

Contrary to the assertion of one commenter (ID–107 p. 4), both the proposed rule and the general industry standard require employers to provide a rescue service for entries, even if a third-party rescue service is not available. (See proposed § 1926.1211(h) and 72 FR 67377–78; 29 CFR 1910.146(d)(9); 58 FR 4524–27; and 63 FR 66018, 66023 (Dec. 1, 1998).) If one third-party rescue service will not assume the responsibility of providing rescue under this final rule, or is not adequately prepared to meet these rescue requirements, then the employer must either find a different third-party rescue service that is capable of performing this service, or train and equip its own employees to provide adequate rescue service.

Paragraph (a)(1). Final § 1926.1211(a)(1), which is identical to the general industry standard at § 1910.146(k)(1)(i), requires an employer to assess a prospective rescue service's ability to respond to a rescue summons in a timely manner. Final § 1926.1211(a)(1) provides that the hazards identified in the permit space determine timeliness. This provision defines ''timeliness'' in terms of how quickly an entry rescue service needs to reach an entrant to prevent further serious physical damage that may result from hazards in the PRCS while the entrant is awaiting rescue. For example, as stated in the note to paragraph (a)(1), OSHA's respiratory protection standard at 29 CFR 1910.134, made applicable to construction by 29 CFR 1926.103, requires standby rescue personnel equipped with respiratory protection when employees are working in atmospheres that require respiratory protection because the atmospheres are immediately dangerous to life or health (IDLH). Consistent with that requirement, the timeliness requirement in this final rule also means that employers must ensure that an appropriate rescue service is on site for IDLH permit entries. An atmosphere in a permit space where an exposed entrant could suffer irreversible impairment within four to six minutes would meet the definition of an IDLH atmosphere. However, because not all permit spaces pose the same immediate dangers as those spaces with IDLH atmospheres, employers may use a less resource-intensive and more measured response capability for situations in which the need for a nearly instant response is not present. For example, in appendix F to § 1910.146, OSHA explained that if the danger to entrants is restricted to mechanical hazards that would cause injuries (*e.g.,* broken bones, abrasions) a response time of 10 or 15 minutes might be adequate.

At least one commenter was unsure what constitutes a response in a ''timely manner'' (ID–121, p. 5). Another commenter suggested that OSHA identify the factors in § 1910.146(k)(1)(i) of the general industry confined spaces standard that it would use to analyze whether a rescue response is ''timely,'' and apply them in the construction standard (ID–129, p. 3). The factors that apply in general industry are relevant in evaluating timeliness in this final rule.

When the Agency added the parallel rescue selection requirements to paragraph (k) of § 1910.146, it included a substantive discussion of ''timely'' rescue in the preamble, and concluded that the determination of timeliness ''will be based on the particular circumstances and hazards of each confined space, circumstances and hazards which the employer must take into account in developing a rescue plan'' (63 FR 66023). As the note to new § 1926.1211(a)(1) makes clear, the same approach applies in this final rule. Employers must consider the known hazards of in the space, the time it takes to reach the permit space, as well as the time it will take to enter the space and retrieve employees from inside the space, when determining what is a ''timely'' response. Several commenters acknowledged that so many factors could affect whether a response is ''timely'' that it is not practical for OSHA to adopt a bright-line timeframe that would work in all scenarios (ID–090, p. 1; ID–108, p. 3; ID–116, p. 4). As noted in the discussion above, OSHA identified some of the factors that determine whether an employer's response to an emergency is ''timely,'' but these factors are not exclusive. The standard as a whole will prevent employee exposure to hazards, but employers must develop rescue plans that anticipate and minimize potential harm to employees in the event an employee becomes trapped or exposed to an atmospheric hazard. For example, if a permit space contains a potential IDLH atmosphere that the employer will control through ventilation, the employer has a duty to ensure that the ventilation is effective, but also has a separate duty to plan for rescue in the event that the ventilation fails and an employee becomes trapped in the increasingly hazardous atmosphere.

The deaths of two workers during a sewer entry illustrate the potential consequences of inadequate rescue planning: Not only did the two employees enter the space without a permit, rescue plan, or retrieval lines, but the employer also did not assess a potential rescue service. See *S. J. Louis Construction,* OSHRC Docket No. 12–1045 (2013) (Welsh, ALJ). The first worker was overcome quickly by a hazardous atmosphere in the sewer manhole, and the second worker was also overcome after he entered the sewer manhole to attempt rescue. The firemen who responded first were not trained or equipped for permit-space entry and had to summon a different rescue service. The first worker was washed down the sewer line before the second rescue service arrived and was trapped underwater so that it took nearly a day to retrieve his body.

One commenter asserted that, when using a third-party rescue service, it is infeasible for the third-party rescue service to maintain constant contact with construction sites, and not reasonable for outside services to track frequent changes in a confined space's configuration (ID–116, p. 4). Another commenter asserted that it is too costly to require rescue services on site, and that OSHA should allow an employer to merely establish a rescue plan to address accidents (ID–108, p. 5). Neither final § 1926.1211(a)(1), nor any other paragraph in final § 1926.1211, requires an employer's rescue service to be on the construction site at all times, absent an IDLH atmosphere or other hazard that would require immediate rescue, or to be in constant contact with the construction site.

In general, final § 1926.1211(a) only requires an employer to determine that the rescue service is capable of responding to an emergency in a timely manner. However, compliance may require the employer to communicate with an off-site rescue service immediately prior to each permit-space entry unless the employer has been assured that personnel are always available and able to respond in a timely manner. Section 1910.146 addresses the scenario in which the designated rescue service is a local fire department that cannot guarantee that the rescue team will available during the employer's entire permit-space entry operations; in such a case, the employer must ensure close communication with the rescue service during entry operations so that, if the rescue service becomes unavailable while an entry is underway, the employer can abort the entry immediately. May 23, 2008, letter to Jonathan Pennington. To facilitate this communication, OSHA requires in final paragraph (a)(3)(iii) that the entry employer select a rescue provider that agrees to notify the entry employer in the event the rescue service is unavailable. Entry operations must not resume until the entry supervisor verifies that rescue services are available (final § 1926.1210(d)).

One commenter asserted that OSHA should focus on the capability of the rescue service to provide life support, and not whether the rescue response is ''timely'' (ID–017, p. 2). For example, the provision should focus on requiring someone trained in space-specific rescue techniques, first aid and cardiopulmonary resuscitation, who can gain safe access to the patient, stop the bleeding, administer CPR, and perhaps effect rescue. Final § 1926.1211(a)(2) specifies the requirement to assess whether a rescue service is capable of providing adequate and effective rescue service. Final § 1926.1211(a)(1) requires the employer to assess whether the rescue service is capable of applying such skills in a timely manner.

Paragraph (a)(2). Final § 1926.1211(a)(2), which is identical to the general industry standard at § 1910.146(k)(1)(ii), requires an employer to assess a prospective rescue service's ability to provide adequate and effective rescue services. This requirement is necessary to ensure that the rescue service can perform rescue safely and effectively.

Many third-party emergency responders may be able to provide proper permit-space rescue functions for spaces that do not require immediate, stand-by rescue capability, but not all responders have this ability. Each employer relying on these services must verify that the emergency responder has the training, equipment, ability, and willingness to perform rescue for confined spaces in its facility.

In evaluating a prospective rescue provider's abilities, the employer also must consider the willingness of the service to become familiar with the particular hazards and circumstances faced during its permit-space entries. Paragraphs (a)(4) and (a)(5) of final § 1926.1211 require the employer to provide its designated rescuers with information about its confined spaces and access to those spaces to allow the rescuers to develop appropriate rescue plans and to perform rescue drills. A rescue service's receptiveness to this information is directly relevant to its ability to function appropriately during actual rescue operations.

Two commenters suggested that OSHA provide additional guidance about how employers that use a third-party rescue service are to verify that they meet the requirements in final § 1926.1211(a) (ID–099, p. 3; ID–132, p. 3). OSHA has provided performance-based requirements that are closely aligned with the general industry standard. Therefore, OSHA does not believe that it will be difficult for an employer to determine whether the rescue service meets these requirements. However, OSHA is willing to provide additional guidance as necessary.

Paragraph (a)(3). Final § 1926.1211(a)(3), which is identical to § 1910.146(k)(1)(iii) except for the addition of § 1211(a)(3)(iii), introduces the requirements that a designated rescue service must meet. Final § 1926.1211(a)(3) requires the employer, after performing the evaluations required by paragraphs (a)(1) and (a)(2) of this section, to select a rescue provider that meets the requirements of this paragraph. Therefore, it is not sufficient for an employer simply to perform the evaluations required. The employer also must use the results of those evaluations to select a rescue service that will meet the requirements of this standard.

Final § 1926.1211(a)(3)(i), which is identical to the general industry standard at § 1910.146(k)(1)(iii)(A), requires an employer to designate a rescue team that is capable of reaching a victim in an appropriate amount of time. This requirement is an important element of a preplanned rescue because it eliminates further risk of injury and death resulting from an unnecessary lapse of time between an emergency and when the rescue service affects the rescue. Delays may occur for reasons such as: The travel distance from an off-site location is too far away from the permit space; time needed to gather rescue equipment from storage; lack of training needed to use the rescue equipment properly; or the rescue service is off-duty at the time of the emergency. As discussed above, the time required to respond to a rescue summons varies with the hazards posed by the permit space, and the entry employer must consider the hazards involved in its permit-space work and select an appropriate rescue service.

Final § 1926.1211(a)(3)(ii), which is identical to the general industry standard at § 1910.146(k)(1)(iii)(B), requires an employer to designate a rescue team that is capable of providing proficient rescue service. This requirement is an important element of a preplanned rescue because it eliminates further risk of injury and death resulting from improperly equipped or untrained rescuers. At a minimum, the designated service must comply with final § 1926.1211(b).

Final § 1926.1211(a)(3)(iii) requires an employer to designate a rescue service that agrees to notify the entry employer immediately if it becomes unavailable during an entry operation. There is no corresponding provision explicitly required in § 1910.146, although § 1910.146(k)(1)(iii)(A) implies such a duty. For a rescue service to be effective, it must be available when the entry employer is conducting permit-space entry operations. This provision will promote employee safety by ensuring that entry employers know when their designated rescue services are unavailable.

Final § 1926.1211(a)(3)(iii) enhances an employer's knowledge about the availability of a rescue service during entry operations. This final provision, in combination with other provisions of this final standard, ensures that entry employers know that the rescue service is available. Final § 1926.1210(d), and § 1910.146(j)(4), both require the entry supervisor to verify that the rescue service is available.

Final § 1926.1211(a), and § 1910.146(k)(1), address the employer with a designated third-party rescue service that cannot guarantee that its rescue team will be available during the employer's permit-space entry operations. In such a case, the employer must maintain close communication with the rescue service during entry operations so that, if the rescue service becomes unavailable while an entry is underway, the employer can instruct the attendant to abort the entry immediately. May 23, 2008, letter to Jonathan Pennington. Consistent with these two provisions, the rescue service needs only to communicate its unavailability when the entry employer informs it that entry operations are underway. Although the employer is less likely to know exactly when a third-party service is responding to another call that would make the service unavailable to perform rescue from the PRCS, this requirement also applies to on-site rescue services if, for example, the on-site service members become involved in other work activities that prevent them from responding in a timely fashion to a rescue summons.

Paragraph (a)(4). Final § 1926.1211(a)(4), which is identical to the general industry standard at § 1910.146(k)(1)(iv), requires an employer to inform the designated rescue service of the known hazards associated with the permit space in the event rescue becomes necessary. This provision provides the rescue service with information about hazards and conditions in the permit space that will protect the rescue-service employees who enter the permit space for rescue operations, training, or any other purpose.[25] Compliance with this paragraph, as well as with paragraphs (a)(1) and (a)(2) of this section, would require the employer to provide this information to the rescue service prior to permit-space entry. Similarly, if an entry involves hazards not usually encountered by the rescue service, or hazards or a configuration that would require the rescue service to use equipment that it does not always have available, the employer would have to notify the rescue service of these hazards and conditions prior to beginning the entry operation. In most cases, this information exchange can be accomplished during a single conversation, but additional conversations would be necessary in the event of changes in the conditions or configuration of the space after the initial conversation.

Paragraph (a)(5). Final § 1926.1211(a)(5), which is identical to the general industry standard at § 1910.146(k)(1)(v), requires an employer to provide the designated rescue service with access to all permit spaces from which the rescue service may need to perform a rescue. The purpose of the provision is to provide the rescue service with an opportunity to develop appropriate rescue plans and to practice rescue operations. OSHA believes that this provision will allow the rescue service to become familiar with the configuration and features of the permit space to which the employer may summon it to perform rescue operations, and thereby develop appropriate rescue plans and practice rescue operations.

Access to the permit space or a simulated permit space for the purpose of planning and practicing rescue operations increases the probability that rescue operations will proceed more efficiently and effectively, thereby reducing the probability of serious injury or death to authorized entrants and rescuers during an actual entry-rescue operation. Note that this provision does not require the third-party rescue service to use the permit spaces for practice; final paragraph (a)(5) simply requires that the entry employer provide access to the space. In performing practice rescues, the third-party service may use any representative permit spaces that replicate the permit spaces from which it may perform a rescue in accordance with final § 1926.1211(b)(4).

Paragraph (b). Final § 1926.1211(b) sets forth four requirements for an employer that has employees designated to provide rescue service. Paragraph (b) is identical to the general industry standard at § 1910.146(k)(2), except that OSHA replaced references to employers' responsibilities for "employees" collectively with references to employers' responsibilities to "each employee"; this revision emphasizes that an employer's responsibility in this area is to each employee individually.

Final § 1926.1211(b) applies to the employer of the rescue service (including non-entry rescue personnel) when that employer also is the entry employer or other employer performing work integral to construction. When the employer is a third-party rescue service that does not perform work integral to construction, then the work performed by the rescue service is covered under the corresponding general industry standard at § 1910.146(k)(2). OSHA believes that it is important to protect employees who enter permit spaces to perform rescue duties regardless of the

[25] To meet the requirements of this provision, the employer would have to inform the rescue service that the employer selected the service to rescue its employees during entry operations, and that the employer is relying on the rescue services to perform these rescues when necessary.

employer responsible for the rescue team. By making this final paragraph substantively identical to § 1910.146(k)(2), there are no differences in the requirements for rescue-team employers under the general industry or construction confined space standards. The Agency determined that this requirement is necessary to provide protection for employees in on-site rescue teams, while employees of third-party rescue services will be protected under identical general industry requirements. This is consistent with the intent of the Agency to protect both on-site rescue teams and third-party rescue services in the general industry confined spaces standard (58 FR 4527).

One commenter, representing a company involved in sewer work, asserted that it is neither practical nor feasible for employers performing construction to employ their own rescue personnel (ID–107, p. 4). However, neither proposed § 1926.1213(c) nor final § 1926.1211(b) specify that entry employers must hire additional, rescue-specific, personnel. Rather, employers that train and equip current employees as required by this standard may designate their own employees to provide permit-space rescue, just as under the general industry standard. Also, the commenter referred to a ''typical sewer construction/maintenance project,'' implying that the company it represents engages in maintenance projects that would be subject to the same requirement in the general industry standard. However, the commenter did not indicate that this company, or any other company, found it infeasible to comply with the general industry standard. The commenter did not provide any explanation for why compliance with the requirement in this final standard would be more burdensome than compliance with the general industry work.

Other commenters incorrectly asserted that OSHA would require construction employers to become experts in rescue service (ID–126, pp. 2–3; ID–075, pp. 8–9). Final § 1926.1211(b) does not prohibit employers from using a third-party rescue service; it merely permits employers to use their own employees to provide rescue service. The general industry confined spaces standard at § 1910.146(k) also provides the option of using an employer's own employees to provide rescue services. At least one commenter supported the provision permitting construction employers to use their own employees to provide rescue service, noting that the use of a third-party rescue service is not always effective because of the location of the site or the competency of the third-party rescuers (ID–143, p. 2).

Paragraph (b)(1). Final § 1926.1211(b)(1), which is nearly identical to the general industry standard at § 1910.146(k)(2)(i), requires an employer with employees designated to provide rescue service to equip each affected employee with PPE and to train the employees, at no cost to those employees, how to use the PPE safely. The provisions in this paragraph will help the employer prevent injuries and deaths that could occur without the appropriate PPE, or because the employees did not receive proper training in use of such equipment. Employers still must select and use PPE in accordance with subpart E of part 1926 and all other applicable requirements. These requirements, which include proper selection and use of respirators in accordance with the requirements of the respiratory protection standard at § 1926.103, continue to apply when workers are working in a permit space.

Paragraph (b)(2). Final § 1926.1211(b)(2), which is nearly identical to the general industry standard at § 1910.146(k)(2)(ii), requires an employer with employees designated to provide rescue service to train each employee performing the rescue service, and to ensure that these employees successfully complete the training required for authorized entrants.

This provision would ensure that rescue-service employees can perform their assigned duties proficiently and safely under hazardous permit-space conditions. Lack of such training would endanger the rescue-service employees, those in need of rescue, and others affected by the permit-space rescue operations. Training in the proper use of rescue equipment will help the employer eliminate injuries and deaths caused by the improper use of such equipment. Rescue-equipment training must include training on all equipment that may be used in conducting a rescue in the PRCS, such as the care and inspection of breathing and ventilation gear and emergency-evacuation equipment, and the use of two-way radios and fire-fighting equipment. Training in the requirements for authorized entrants also will protect the rescue-service employee, those in need of rescue, and others affected by the rescue operations because rescue-service employees will be familiar with the hazards of permit spaces and the modes of communicating with attendants. The rescue service may need to use the same modes of communication to communicate with a trapped entrant.

One commenter suggested that OSHA require an employer to train all of its employees, not just entry rescue-service employees, on how to perform rescue duties (ID–150, p. 3). OSHA disagrees with this commenter because, under final § 1926.1211, training for employees not authorized to perform rescue is not necessary for an employer to be ready to provide effective and timely rescue service.

Paragraph (b)(3). Final § 1926.1211(b)(3), which is nearly identical to the general industry standard at § 1910.146(k)(2)(iii), requires an employer with employees designated to provide rescue service to train the employees performing both non-entry and entry rescue services in basic first aid and cardiopulmonary resuscitation (CPR). The Agency believes this requirement is necessary because of the hazards and resultant injuries that may occur in permit spaces. This requirement also will improve the probability that the injured employees survive until higher levels of medical treatment become available.

Paragraph (b)(4). Final § 1926.1211(b)(4), which, apart from an addition discussed below, is identical to the general industry standard at § 1910.146(k)(2)(iv), requires an employer to ensure that the designated rescue service practices rescue operations at least once every 12 months. OSHA believes this training requirement for entry-rescue service employees is necessary to maintain proficiency in entry-rescue procedures and the use of rescue equipment. This training also will ensure that the employer trains the entry rescue-service employees on all revisions to entry-rescue procedures, and that the employees are cognizant of any other new information regarding entry rescue. Practicing rescues in a permit space or a representative permit space also highlights deficiencies in rescue procedures, and allows for revisions of those procedures before they can adversely affect the safety of rescue-service employees or employees in need of rescue during an actual rescue operation.

One commenter read the proposed rule as prohibiting rescue services from conducting practice rescues in the actual permit space (ID–107, p. 4). There was no such prohibition in the proposed rule, and by adopting the language of the general industry standard in this final rule, OSHA makes it clear that rescuers may practice by removing dummies or real persons ''from the actual permit spaces or from representative permit spaces.'' If the employer does not use actual permit spaces for practice, representative permit spaces must simulate the types of permit spaces from which the rescuers may perform rescues with respect to opening size, configuration, and accessibility.

Proposed § 1926.1213(d) provided that this practice is not necessary when the affected employees properly performed rescue in the same, or similar, permit space during the last 12 months. This proposed language made explicit the existing rule under the general industry standard, which, in its original preamble, stated that satisfactory performance of one or more actual rescues in the same, or similar, space during the 12-month period prior to the training anniversary date could substitute for a practice rescue (58 FR 4528). OSHA previously recognized in other standards (such as in § 1910.120—Hazardous waste operations and emergency response) that actual experience at a particular task can be at least as valuable as a practice session or other type of training. However, just as the rescue service must practice in the same spaces or spaces similar to the ones in which it is to provide rescue, for an actual rescue to take the place of a practice rescue, it must be in the same or similar space. Also note that unsatisfactory performance of a rescue indicates the need for further training and, therefore, cannot substitute for a practice rescue. This exception applies when the rescuers perform a rescue operation in a satisfactory manner and the entrants, through factors beyond the rescuers' control, do not survive. Therefore, this final rule incorporates the exception from the proposed rule by adopting the performance-based language of the general industry standard.

One commenter asserted that the requirement to perform a simulated rescue is infeasible in situations where the rescue service is a small local fire department (ID–090, p. 2). Nevertheless, the commenter volunteered that performing the simulated rescue is the safest approach. When a third-party rescue service does not have the resources to perform this simulated rescue, the employer must either train its own employees to provide rescue or designate a third-party rescue service that is capable of complying with all of the rescue requirements in final § 1926.1211(b).

Another commenter asserted that OSHA wrote proposed § 1213(c)(6) in a manner that allowed an entry employer's employees to enter a confined space even when the initial practice rescue occurred 15 years before the entry takes place (ID–013, p. 5). This commenter misread the requirement. Final § 1926.1211(b)(4), as in the proposed rule, requires an employer to conduct a practice rescue at least once every 12 months after the initial practice rescue. Therefore, 12 months minus one day is the longest period allowed between a practice rescue and the moment the employer begins entry operations.

Another commenter asked how employers who designate a third-party rescue service can verify that the service practices rescue every 12 months (ID–099, p. 3). The duties in paragraph (b) apply to the ''employer whose employees have been designated to provide permit space rescue.'' Therefore, if an entry employer hires a third party to provide rescue services, the final standard does not require the entry employer to verify the practice of the third party. However, paragraph (a), which applies to all employers that designate rescue and emergency services, requires those employers to evaluate the rescue proficiency of the rescue team, even a third-party rescue team, and select a team that is proficient. This commenter also asserted that it is too burdensome to fulfill the requirement to practice rescue operations, but did not provide a specific reason why compliance is infeasible (*id.*). Both the general industry confined spaces standard at § 1910.146(k)(2)(iv) and NFPA 1670, sec. 7.1.3.4 (2009 ed.) also specify a requirement to practice rescue operations found in final § 1926.1211(b)(4). Without a specific reason to depart from this established procedure, OSHA finalized this provision to be similar to proposed rule § 1926.1213(c)(6) and the corresponding provision for general industry confined spaces at § 1910.146(k)(2)(iv).

Paragraph (c). Final § 1926.1211(c), which is substantively similar to the general industry standard at § 1910.146(k)(3), requires that an employer use non-entry rescue, instead of entry rescue, unless non-entry rescue is more dangerous or ineffective than entry rescue. The major difference between this final provision and § 1910.146(k)(3) is that OSHA revised this final requirement to clarify the employer's obligation.

If the employer determines that it will use non-entry rescue, final § 1926.1211(c) also requires the employer to use a retrieval system or method. Accordingly, in general authorized entrants must wear retrieval devices and employers must use a retrieval system, in addition to confirming that emergency assistance is available in the event the non-entry retrieval fails.

Retrieval lines can be highly effective in assisting in the rescue of an unconscious or otherwise incapacitated employee from a confined space. The other major advantage of using retrieval lines for rescue is that it is not necessary to expose a rescuer to the hazards of entering the permit space to help remove an injured entrant. The effectiveness of retrieval lines in rescue was recognized by employers using this equipment for confined space entries during the general industry standard rulemaking (see 58 FR 4530), and mandatory use of retrieval lines is included in both ANSI Z117.1 and the general industry standard. However, the Agency recognizes that many spaces do not readily or safely accommodate the use of retrieval lines. For example, obstructions can snag the retrieval line, and the air lines and electric cords within the space can pose entanglement hazards. In addition, depending on the number of entrants and how much they move around in the space, the retrieval lines themselves could pose an entanglement hazard (see final § 1926.1211(c)(3)).

To allow for the greatest degree of safety in addressing these problems, the final standard requires the use of retrieval systems or methods whenever an authorized entrant enters a permit space, except in situations for which the employer can demonstrate that the retrieval equipment would increase the overall risk of entry or would not contribute to the rescue. This is the approach taken in ANSI Z117.1 and the general industry standard, and OSHA believes that adopting this approach will provide the most effective protection for employees, with appropriate allowance for situations in which employers should not use retrieval systems.

When enforcing this provision, OSHA may inspect the permit space to determine whether a retrieval system would contribute to a rescue without increasing the overall risk of entry. Although some spaces may have configurations or hazards that warrant a slightly different approach, in general, the Agency intends to use the following factors in determining that a permit space does not require an employer to use a retrieval system: (1) The permit space has obstructions or turns that prevent transmitting pulls on the retrieval line to the entrant; (2) the permit space has projections that would cause injury to an employee making forceful contact with the projections during rescue; and (3) when an entry employee enters the permit space using an air-supplied respirator and the non-entry rescuers cannot control the retrieval line so as to prevent entanglement of the retrieval line with the respirator's air line.

Section 1926.1211(h) of the proposed rule specified that employers must provide both entry and non-entry rescue, while proposed paragraph (h)(2)(i) specified that employers must summon an entry-rescue service whenever they initiate a non-entry rescue. One commenter was unsure whether employers must prepare to provide both entry and non-entry rescue (ID–098, p. 2). Another commenter asserted that it was too burdensome to require employers to prepare for both entry and non-entry rescue when working within or near a PRCS. (ID–120, p. 3). To address these concerns, OSHA based the final rule on the general industry confined space standard, but drafted the final rule to be more performance-oriented than the general industry standard.

The final rule provides for a ''back-up'' to non-entry rescue, much as the proposed rule did, but in a manner that is less burdensome for employers. Consequently, final § 1926.1211(c) requires that, if an entry employer determines that it will use non-entry rescue, it must confirm, prior to entry, that emergency assistance *will be available* in the event that non-entry rescue fails. OSHA expects this confirmation will typically involve a quick phone call or other communication to establish availability before making the first entry. The employer need not repeat such confirmation when there are several entries planned as part of the same project, provided the employer discusses during the initial contact with the rescue service the availability of emergency assistance for the expected duration of the project. This confirmation is especially important if the employer uses a 911 service or other third-party service that is small and has few teams on call because the service must be available to provide emergency assistance quickly when needed if the assistance is to be effective. In the event emergency assistance is summoned, OSHA anticipates that the emergency assistance provider will assume direction of the rescue and would request any other information it deems essential to effectively provide assistance, and notes that employers may be required by other laws to comply with the emergency assistance requests for information. OSHA is not requiring the employer to provide other specific information at the site out of concern that such a requirement might slow the rescue process if it compels the employer to provide information not needed by the emergency assistance provider. Note that arranging for emergency assistance is not the same as providing for entry rescue; emergency assistance is intended as the backup for the employer's rescue plan, whether the employer relied on entry or non-entry rescue. Entry rescue requires personnel trained to recognize the hazards associated with entry rescue and perform entry rescue duties. These personnel must be trained in performing entry rescues and must have practiced such a rescue within the past year. Employers must designate entry rescuers when non-entry rescue is not an appropriate option. Emergency assistance is intended to supplement employer rescue efforts and provide emergency care to employees injured on site and/or rescued from a confined space. Emergency assistance is required if there is a problem with a non-entry rescue or with an entry rescue.

The non-entry rescue requirements are based on the general industry standard, but provide additional guidance. While there is no corresponding provision stated explicitly in the general industry standard at § 1910.146, § 1910.146(d)(9) requires employers to develop plans to summon emergency services and for rescuing personnel. In final § 1926.1204(i), OSHA clarified that, if the entry employer uses non-entry rescue as the designated method of rescue, the employer must develop a procedure for summoning emergency assistance in case the non-entry rescue is not able to retrieve the entrant. Emergency assistance, such as a 911 emergency-responder service or an on-site or off-site entry-rescue team, may prevent such a situation from resulting in injury or death, so it is critical that emergency assistance be available to respond to the emergency.

In final § 1926.1211(c), OSHA also clarifies that, if the employer determines that it will use entry rescue, it must designate a rescue service that is capable of providing entry rescue. Additionally, it sets requirements for non-entry rescue systems; these requirements do not differ substantively from the corresponding general industry provision.[26]

[26] As with the general industry standard, the construction standard relies on existing fall-protection requirements to ensure the proper use of fall-protection equipment. Final § 1926.1211(c) does not address the issue of fall protection for entry into, and exit from, vertical type permit spaces; 29 CFR part 1926, subpart M, and the General Duty Clause, 29 U.S.C. 654(a)(1), govern fall protection in construction.

Paragraph (c)(1). Final § 1926.1211(c)(1), which is similar to the general industry standard at § 1910.146(k)(3)(i), requires an employer to provide each employee with a chest harness or full body harness for most non-entry rescue, but permits use of wristlets or anklets if the employer can demonstrate that the chest or full body harness is infeasible or creates a greater hazard. A chest or full-body harness prevents further injury should an employee become suspended during a rescue; without a chest or full-body harness, injuries can result from the unequal distribution of force on the body during suspension (see the preamble to OSHA's final rule on fall protection for construction at 59 FR 40672, 40702–40704 (Aug. 9, 1994), for a detailed discussion of this issue.)

One commenter asserted that OSHA should require the use of a full-body harness to perform rescue in every instance because it is the most effective means of rescue (ID–210, Tr. p. 68). OSHA disagrees with this commenter. Permit spaces come in many different sizes and configurations, which may make a chest harness more appropriate than a full-body harness in some circumstances.

This provision also provides that the employer must place the retrieval line attached to the harness on the entrant's back near shoulder level, over the entrant's head, or at another point that will establish a small enough profile for successful removal of the entrant from the permit space. One commenter agreed that it was safer to attach the line to the entrant's back, rather than the chest (ID–095).

Final § 1926.1211(c)(1) differs from the general industry standard at § 1910.146(k)(3)(i) in that it includes both anklets and wristlets as acceptable means of retrieval in lieu of a harness in limited circumstances. Employers can use wristlets or anklets in lieu of a harness only if the employer can demonstrate that the use of a harness is infeasible or creates a greater hazard to the employee, and that the use of the wristlets or anklets is the most effective alternative available. Proposed § 1926.1213(a)(4)(iii) permitted employers to use ankle straps, along with wristlets, for non-entry rescue under limited conditions. One commenter supported this proposed minor change from the general industry standard, asserting that anklets may be the safest alternative in horizontal entries (ID–094). However, because of the potential safety advantages of the chest and full-body harnesses, the Agency believes that it is necessary to limit the circumstances when employers can use either wristlets or anklets to those in which the employer can demonstrate that use of a harness is infeasible or a greater hazard than wristlets or anklets because of the increased risk of employee injury during a rescue.

Paragraph (c)(2). Final § 1926.1211(c)(2), which is identical to the general industry standard at § 1910.146(k)(3)(ii), requires an employer to use a retrieval line attached to a mechanical retrieval device or fixed point outside the permit space so that non-entry rescue can begin as soon as needed. It also requires an employer to use a mechanical device to retrieve personnel from spaces more than five feet deep. This provision reduces the elapsed time between an attendant determining that a rescue is necessary and commencing the PRCS rescue operation by requiring the essential parts of the retrieval system to already be in place and attached to the mechanical device or fixed point. This requirement will eliminate further injury or death due to the delay resulting from locating and attaching retrieval-system parts and equipment.

The requirement to use a mechanical device for spaces more than five feet deep is consistent with the general industry standard and ANSI Z117.1. Securing the line to an anchor point or using an un-mechanized pulley for retrievals over five feet could endanger the authorized entrant because designated non-entry rescuers may not have sufficient strength and stamina to lift a disabled entrant over a vertical distance of more than five feet.

One commenter asserted that OSHA should require a mechanical retrieval device for all heights when the employer conducts non-entry rescue (ID–211, Tr. pp. 43–44). Another commenter asserted that OSHA should recognize that mechanical winches and pulleys are sometimes necessary based on job conditions (ID–108, p. 2). Neither commenter provided any evidence that attendants encountered difficulty retrieving entrants from distances of less than five feet, or pointed to any problems that arose in the context of the general industry standard or ANSI Z117.1, both of which include the same five-foot threshold. Without additional support for imposing this requirement, OSHA decided to retain the language from the general industry standard. Nothing in this standard, however, precludes use of mechanical retrieval devices for retrievals from heights of less than five feet.

Proposed § 1926.1213(a)(2)(iv)(B) also provided that movable equipment (for example, earth-moving equipment) that is ‘‘sufficiently heavy to serve as an anchor point,’’ may be used for that purpose only if effectively locked out or tagged out. Two commenters expressed concern about movable equipment as an anchor point. One commenter stated that many accidents occurred in the past when using a pick-up truck as a fixed point without notifying the driver of the truck, who then unexpectedly moved the truck. This commenter urged that this provision include ‘‘proper protocols’’ to ensure that such a situation did not recur (ID–025, p. 4). Another commenter noted that OSHA's construction standards do not include an equivalent to the Lockout/Tagout standard for general industry. The commenter, therefore, urged OSHA to include a more protective requirement, asserting that a requirement to ‘‘lock out’’ or ‘‘tag out’’ equipment, without additional detail, would ‘‘be subject to various interpretations,’’ and could result in unexpected activation of the equipment (ID–143, p. 2).

OSHA recognizes that on a construction site, a piece of moveable equipment may sometimes be the most accessible fixed point, but acknowledges the commenter's concern that such equipment is moveable, even if it has sufficient weight. Thus, under this final rule, an employer must ensure that any movable equipment used as a fixed point is ‘‘fixed,’’ meaning that it is sufficiently heavy (such as earth-moving equipment) to prevent movement, and that it is subject to additional precautions to prevent unexpected movement. Accordingly, as in the proposed requirement, to determine whether a retrieval line that is attached to moveable equipment is ‘‘attached to a . . . fixed point’’ under final § 1926.1211(c)(2), OSHA will evaluate whether the moveable equipment is effectively locked out or tagged out. In particular, OSHA will use the final rule's definitions of ‘‘lockout’’ and ‘‘tagout’’ in making that determination, which partially address the commenter's concern by bringing the lockout/tagout process closer to the protection offered by the general industry standard. For example, as part of the tagout process, an employer must ensure that tagout provides ‘‘equivalent protection’’ to lockout or that lockout is infeasible. Consequently, the employer must take whatever measures are necessary to prevent unexpected energization or movement of the equipment. Placing a ‘‘do not move’’ tag in the truck or other equipment would not be sufficient by itself. Typically, such measures include activating an emergency brake or similar device, removing the key from the equipment after ensuring that duplicates are not readily available on the site, placing a tag on the equipment to warn others not to start it, and informing any potential operator(s) not to move the equipment while it is serving as a fixed point for rescue. If the equipment is capable of activation by remote control, then the employer must secure the remote control or disable that capability to prevent unexpected movement.

Final § 1926.1211(c)(2) is performance oriented, and allows flexibility in the design specifications of the retrieval equipment, subject to the requirements of § 1925.1211(c)(3) (equipment must be suitable). One commenter asserted that there are many instances when the use of a tripod assembly with a three-way retrieval system is effective (ID–060, p. 1). Final § 1926.1211(c)(2) does not prohibit the use of such a device if it meets the requirements of this subparagraph. A different commenter asserted that final § 1926.1211(c)(2) should be performance based because of ongoing advancements in confined-space retrieval equipment, and suggested incorrectly that the proposed rule limited retrieval by specifying the use of anchor points or simple pulleys (ID–116, p. 3). The definition of ‘‘retrieval system’’ in final § 1926.1202 is performance based, and allows for technological advancements in retrieval equipment. This definition does not limit retrieval to the use of anchor points or simple pulleys.

One commenter asserted that final § 1926.1211(c)(2) should require an employer to have the retrieval system located at the confined space opening (ID–025, p. 4). Final § 1926.1211(c)(2) requires the employer to have the retrieval system available as soon as needed, which ensures that rescue can begin immediately. Another commenter asserted that the proposed language ‘‘available as soon as needed’’ was too vague, and that a retrieval device could satisfy this provision even if kept elsewhere on the worksite and not installed (ID–095, p. 4). Final § 1926.1211(c)(2) addresses this commenter's concern by requiring attachment of the retrieval line to the appropriate retrieval mechanism (a mechanical device if the depth exceeds five feet, or a fixed anchor point for shallower entries) ‘‘in such a manner that retrieval can begin as soon as the rescuer becomes aware that rescue is necessary,’’ thus ensuring that the line will be available and ready for use when needed. If the retrieval device is not at the opening of the permit space, then the employer is responsible for demonstrating that it could initiate retrieval immediately as soon as the rescuer becomes aware that rescue is necessary.

Paragraph (c)(3). Final § 1926.1211(c)(3) prohibits an employer from using equipment that is unsuitable for retrieval, such as retrieval lines likely to become entangled or that are ineffective due to the configuration of the PRCS. Final § 1926.1211(c)(3) is similar to proposed § 1926.1213(a)(4). There is no corresponding provision in § 1910.146.

A retrieval device, for example, would not be suitable unless it is designed and rated for human use. The provision does not require certification of the retrieval system, but OSHA will accept certifications by manufacturers, as well as listing by a Nationally Recognized Testing Laboratory, as evidence of the proper design and rating. If the employer fabricates its own retrieval device, OSHA will look for evidence that the employer designed, manufactured, tested, and certified the retrieval device in accordance with generally accepted industry practices (for example, by a registered professional engineer).

This final provision prohibits the use of retrieval lines that have a reasonable probability of becoming entangled with the retrieval lines used by other authorized entrants, or due to the internal configuration of the PRCS. The Agency believes that there are situations in which the retrieval lines of two or more employees can become entangled, such as when the employees' work requires that they move around each other. There are also a variety of situations in which the configuration of the PRCS would interfere with a non-entry rescue and cause further serious injury to authorized entrants in need of rescue. For example, the permit space may have objects or equipment protruding from its walls, or sharp corners that may damage rescue equipment or prevent the use of certain types of non-entry rescue equipment.

Final § 1926.1211(c)(3) also prohibits the use of other unsuitable equipment, such as equipment that increases the overall risk of entry or impedes rescue of an authorized entrant. Under final § 1926.1211(c)(3), the mechanical retrieval device used must be appropriate for rescue service. This requirement follows the general industry standard, which was based on the record in that rulemaking indicating that incapacitated entrants could easily be bounced around, torn apart, or impaled if too much torque was applied to the retrieval line or the retraction of the line was not precisely controlled (see the general industry preamble discussion at 58 FR 4531). Accordingly, the employer must not use any mechanical device, such as a fork lift or backhoe, that could injure the entrant during rescue. Using a material hoist to both haul material and to serve as a rescue retrieval system during an entry operation also is not acceptable. In such a situation, the material hoist would not be available for rescue when it is hauling materials; further delay would result when, during a rescue operation, the attendant would have to detach the retrieval line from the materials and attach it to the employee requiring rescue. See Oct. 6, 1995, letter to Mr. Joseph Bouchard. The employer also must not use powered winches without a stop clutch or other power-limiting device. Such winches can cause injuries to an entrant if the entrant becomes entangled on an object inside the permit space, but the winch continues to pull the entrant (58 FR 4462, 4531 (Jan. 14, 1993)).

Prohibiting such unsuitable equipment will reduce the injuries and deaths that would result from the use of unsuitable retrieval equipment during rescue operations. The Agency did not receive any comments objecting to the propriety of this approach and, therefore, finalized this proposed prohibition of unsuitable rescue equipment.

Paragraph (d). Final § 1926.1211(d), which is identical to § 1910.146(k)(4), requires an employer to provide relevant information about a hazardous substance to a medical facility treating an entrant exposed to the hazardous substance if the substance is one for which the employer must keep a safety data sheet (SDS) or other similar information at the worksite. The Agency recognizes that such information may already be available to medical facilities from other sources (such as state emergency-planning commissions), and that SDS or similar written information may not be available in some instances. However, because the timely provision of this information may be critical to the proper medical treatment of an injured employee, and this final standard limits the requirement to SDS or other similar written information that the employer already must keep at the worksite, OSHA concludes that the potential significance of this information to the health of the employee outweighs any minimal burden on the employer associated with providing this information. Such information would aid emergency medical services and medical facilities in correctly diagnosing and treating the employee rescued from the permit space.[27]

Section 1926.1212—Employee Participation

This section provides for employee participation in confined space programs. The provisions in final § 1926.1212 are nearly identical to the provisions in the general industry confined spaces rule at § 1910.146(l). Final § 1926.1212 differs from § 1910.146(1) in that it refers to ''each affected employee'' rather than ''affected employees,'' to emphasize that an employer's responsibility in this area flows separately to each employee, but the employer's obligation remains unchanged. In the proposed rule, employee participation was limited to the requirement in proposed rule § 1926.1204(e) that employers offer entry employees the opportunity to observe the evaluation and monitoring of the permit space. One commenter suggested that OSHA restore the employee participation requirement from the general industry rule for the reasons OSHA added paragraph (l) to the general industry rule in 1998, and also noted that no commenters who favored using the general industry format raised any objections to its employee participation requirements (ID–0220 p. 26–28). OSHA agrees, and notes that the use of the general industry language is particularly warranted because the final rule requires a written permit-space program in final § 1926.1203(d), which was not required in the proposed rule, so final § 1926.1212(a) would ensure that employees bring their experience to bear regarding that program.

Paragraph (a). Final § 1926.1212(a), which is nearly identical to the general industry standard at § 1910.146(l)(1), requires employers to consult with affected employees and their authorized representatives in the development and implementation of the permit-space program required by final § 1926.1204. Allowing employees and their authorized representatives to participate in this manner will contribute to confined space safety. Commenters on the 1998 amendments to the confined space standard that added § 1910.146(l) noted that employees who work in confined spaces and their representatives are particularly well qualified to contribute to the task analysis that is a necessary step in developing a confined space program

[27] The employer must provide this information if other applicable Federal regulations (such as § 1910.1200—Hazard communication) or state regulations already require the employer to keep the SDS or other written information at the worksite.

(63 FR 66018 (Dec. 1, 1998)). One commenter provided an example of when he, as an employee representative, was able to identify dangerous adhesive fumes in a confined space that could have otherwise harmed the two employees in that space who did not identify the danger (ID–010). These employees are most familiar with the practices used during confined space entries. If those practices differ significantly from the practices planned by the employer, the employer needs to know of the differences and take appropriate steps to remedy any deficiencies in the permit-entry procedures. Likewise, employees may know of hazards within the space that non-entrants are not taking into consideration. This provision leaves the final contents of the confined space program up to the employer, but, by doing so, this provision should promote safety and avoid the need to develop a cumbersome procedure to resolve conflicts between employers and employees regarding confined space entries.

Final § 1926.1212(a) also is consistent with Section 2(13) of the OSH Act, 29 U.S.C. 652(13), which emphasizes employer-employee cooperation by stating that one of the purposes of the Act is to ''encourage joint labor-management efforts to reduce injuries and disease arising out of employment.'' Congress reiterated this purpose in a directive to OSHA to promulgate a Process Safety Management (PSM) standard; this directive explicitly provides for employee involvement in the development of the process safety management programs mandated by that standard (see Chemical Process Safety Management, Pub. L. 101–549, Title III, sec. 304(c)(3) (1990), reprinted at 29 U.S.C.A. 655 note (Supp. 1991)). OSHA also has a longstanding practice of encouraging and promoting employer-employee cooperation as exemplified in its 1989 Safety and Health Program Management Guidelines (54 FR 3904); these guidelines recognize the importance of involving employees in safety and health programs at the workplace. OSHA's experience in enforcing the employee-participation requirements under the PSM standard and the general industry confined spaces standard convinced the Agency of both the value and the utility of the provision in paragraph (a).

Paragraph (b). Final § 1926.1212(b), which is nearly identical to § 1910.146(l)(2), requires that affected employees and their authorized representatives have access to all information developed under this standard, with the clarification that this obligation applies to each employee. Other sections of this standard, such as final § 1926.1203(d), already require that employers make some information available to employees and their representatives. OSHA is adding this provision for purposes of emphasis and clarification. This provision emphasizes that employees and their representatives have a right to all information developed under the rule affecting their health and safety. Final § 1926.1212(b) does not require employees or their authorized representatives to request or review this information; however, it provides them with the option of requesting and reviewing the information should they choose to do so. Employers need not provide separate copies of the information to each employee; employers have flexibility in determining how to distribute the information so long as each employee can access it.

Section 1926.1213—Provision of Documents to Secretary

Final § 1926.1213 requires each employer who must retain documentation under this final rule to make that documentation available to the Secretary of Labor, or a designee, upon request. Final § 1926.1213 is similar to proposed rule § 1925.1219(e). There is no corresponding provision in § 1910.146. OSHA added this provision to enable the Agency to more accurately identify potential safety hazards at a worksite and to monitor compliance with the requirements of this standard.

The request from the Secretary or the Secretary's designee (for example, OSHA) may be either oral or written. Unless another provision of this standard requires employers to maintain a document at the worksite, the employer may maintain these documents off site as long as the employer can produce them readily to the requesting official, such as through electronic transmission to the worksite where OSHA is conducting an inspection. These documents pertain to the determinations made, and actions taken, regarding hazards. They provide valuable information to use when inspecting the worksite, including evaluating any potential safety hazards.

At least one commenter objected to this requirement, asserting that OSHA should have to demonstrate a need for a specific document and obtain a subpoena, and that this requirement is a paperwork burden and will not increase safety (ID–075, p. 11). Requesting such documentation is already part of OSHA's standard inspection practice under the general industry standard, as it is under many other standards. *See* CPL–02–00–100, CPL–02–00–150. This provision creates no new retention requirement—it merely confirms that when employers are already required to maintain records, they must make those records available to the Secretary. The provision provides employers with flexibility in where and how such records are maintained. Though there is a small cost to this provision, OSHA believes the safety benefit of identifying any potential safety hazards supports the inclusion of this provision.

IV. Agency Determinations

A. Legal Authority

The purpose of the OSH Act, 29 U.S.C. 651 *et seq.,* is ''to assure so far as possible every working man and woman in the Nation safe and healthful working conditions and to preserve our human resources.'' 29 U.S.C. 651(b). To achieve this goal, Congress authorized the Secretary of Labor to promulgate and enforce occupational safety and health standards. 29 U.S.C. 654, 655(b), 658.

A safety or health standard ''requires conditions, or the adoption or use of one or more practices, means, methods, operations, or processes, reasonably necessary or appropriate to provide safe or healthful employment and places of employment.'' 29 U.S.C. 652(8). A safety standard is reasonably necessary or appropriate within the meaning of 29 U.S.C. 652(8) if:

- It substantially reduces a significant risk of material harm in the workplace;
- It is technologically and economically feasible;
- It uses the most cost-effective protective measures;
- It is consistent with, or is a justified departure from, prior Agency action;
- It is supported by substantial evidence; and
- It is better able to effectuate the purposes of the OSH Act than any relevant national consensus standard.

See United Auto Workers v. *OSHA,* 37 F.3d 665, 668 (D.C. Cir. 1994) (Lockout/Tagout II). In addition, safety standards must be highly protective. See *id.* at 669.

A standard is technologically feasible if the protective measures it requires already exist, available technology can bring these measures into existence, or there is a reasonable expectation for developing the technology that can produce these measures. See, for example, *American Iron and Steel Inst.* v. *OSHA* (*Lead II*), 939 F.2d 975, 980 (D.C. Cir. 1991) *(per curiam*). A standard is economically feasible when industry can absorb or pass on the costs of compliance without threatening industry's long-term profitability or competitive structure. See *American Textile Mfrs. Inst.* v. *Donovan,* 452 U.S. 490, 530 n. 55 (1981); *Lead II,* 939 F.2d at 980. A standard is cost effective if the protective measures it requires are the least costly of the available alternatives that achieve the same level of protection. See, for example, *Lockout/Tagout II,* 37 F.3d at 668.

Section 6(b)(7) of the OSH Act authorizes OSHA to include among a standard's requirements labeling, monitoring, medical testing, and other information-gathering and information-transmittal provisions. 29 U.S.C. 655(b)(7). Finally, the OSH Act requires that when promulgating a rule that differs substantially from a national consensus standard, OSHA must explain why the promulgated rule is a better method for effectuating the purposes of the Act. 29 U.S.C. 655(b)(8). OSHA explains deviations from relevant consensus standards elsewhere in this preamble.

B. Final Economic Analysis and Final Regulatory Flexibility Analysis

1. Introduction

The Occupational Safety and Health Administration (OSHA) finalized its safety standard for confined spaces in construction work. When appropriate, this final standard aligns with the confined-spaces standard for general industry (29 CFR 1910.146), although it also has distinctive characteristics for construction worksites. The pre-existing rule on confined spaces in construction, 29 CFR 1926.21(b)(6), which this final rule replaces, is merely a general training requirement that lacks the specificity and protections that the general industry rule—and this final standard—provide.

The final standard differs from the earlier proposed standard. OSHA revised the proposal in response to numerous stakeholder comments, including those from the Office of Advocacy of the Small Business Administration (ID–119), which indicated that employers in construction in large part followed the general industry standard and, therefore, preferred that this final rule not depart substantially from general industry standard. However, this final rule includes important requirements (also present in the proposed rule) to address communication, worksite evaluation, and training, which are absent from, or not as clearly specified in, the general industry standard.

The final standard establishes practices and procedures that apply to employers that have workers who enter confined spaces during construction work, including major renovation projects. The final standard does not apply to routine maintenance activities, which the general industry standard covers instead.

Work in confined spaces involves a significant risk of death or serious injury, which compliance with this rule will reduce substantially. OSHA estimates that full compliance with this final rule will prevent an average of approximately 5.2 fatalities and 780 lost workday injuries each year. In particular, the Agency believes that compliance with this final rule will avert injuries and fatalities from causes such as asphyxiation, chemical burns, scalds, and poisonings.

Not all confined spaces pose occupational hazards. However, there are spaces that employees can enter only after employers follow specific procedures to ensure safety. Pursuant to the final rule, employers must develop and implement permit programs or use specified alternative procedures when employees work in such spaces. The standard sets forth the requirements for evaluating hazards, identifying and classifying confined spaces, and issuing permits or implementing alternative procedures. When the standard requires a permit to enter a confined space, the employer must maintain a written program and review it annually, and prepare and post a permit for the space. Employers also must adopt a variety of safety measures, including isolation procedures, atmospheric testing, ventilation, monitoring, and arrangements for rescue and emergency assistance.

As shown in Table IV–1 below, OSHA estimates that the final rule will result in yearly compliance costs of $60.3 million (using a discount rate of 7 percent), and yearly safety benefits, based on lives saved and injuries prevented, of $93.6 million. Therefore, the benefits of this final standard outweigh the costs of complying with its provisions, yielding net benefits of $33.3 million a year. Compliance with the final standard will result in approximately $1.55 of benefits for every dollar of costs.

Based on the analysis presented in this FEA, OSHA concludes that this final standard is technologically and economically feasible for all affected industries.

This FEA includes numerous analyses OSHA is required to perform, including the findings of technological and economic feasibility and their supporting materials required by the OSH Act as interpreted by the courts (in sections 5, and 7, which depend on results derived in sections 3 and 6); the analyses required by E.O. 12866 and E.O. 13563 (primarily in sections 2, 4, 6, and 9, though these depend on material in section 3); and those required by the Regulatory Flexibility Act (the final regulatory flexibility analysis is presented in section 8, but depends on or refers to results in section 3, 6 and 7 which in turn depend, in part, on materials presented in other chapters). Terminology and analytic methods and standards appearing in a particular chapter correspond to the source(s) of that chapter's requirements; for example, the legal concept of ''economic feasibility,'' which is a key subject of section 7, is not recognized in E.O.s 12866 or 13563 or their associated guidance document, OMB Circular A–4.

TABLE IV–1—NET BENEFITS

[Millions of 2009 dollars]

	7% Discount rate	3% Discount rate
Annualized Costs		
Evaluation, Classification, Information Exchange and Notification	$12.4	$12.2
Written Program, Issue Permits, Verify Safety, Review Procedures	$4.2	$4.2
Provide Ventilation and Isolate Hazards	$2.8	$2.7
Atmospheric Monitoring	$11.4	$11.3
Attendant	$3.6	$3.6
Rescue Capability	$8.2	$7.6
Training	$11.3	$11.3

TABLE IV–1—NET BENEFITS—Continued

[Millions of 2009 dollars]

	7% Discount rate	3% Discount rate
Other Requirements	$6.4	$6.3
Total Annual Costs	$60.3	$59.2
Annual Benefits		
Number of Injuries Prevented		780
Number of Fatalities Prevented		5.2
Monetized Benefits		$93.6
Net Annual Monetized Benefits (Benefits Less Costs)		
	$33.3	$34.4

The remainder of this FEA contains the following chapters:

2. The Need for Regulation
3. Profile of Affected Industries
4. Benefits and Net Benefits
5. Technological Feasibility
6. Costs of Compliance
7. Economic Feasibility Analysis and Regulatory Flexibility Determination
8. Final Regulatory Flexibility Analysis
9. Sensitivity Analysis
10. References

2. The Need for Regulation

OSHA previously considered non-regulatory alternatives and established the need for regulation of work in confined spaces when it promulgated the general industry standard (58 FR 4548). The Agency asserts that the same need for regulation applies when employers are entering these spaces to perform construction work. Confined spaces in construction expose employees to a variety of significant hazards, including engulfment, electric shock, burn, and atmospheric hazards that cause serious injury and death. Although better compliance with existing safety standards may prevent some of these incidents, research and analyses conducted by OSHA found that many preventable injuries and fatalities would continue to occur even if employers fully complied with the existing standards. Relative to full compliance with the existing standards, OSHA estimates, in Chapter 4 of this FEA, that full compliance with the final standard would prevent an estimated additional 780 injuries and 5.2 fatalities annually.

Executive Order 12866 provides that ''[e]ach agency shall identify the problem that it intends to address [via regulation] . . . including, where applicable, the failures of private markets.'' Executive Order 13563 reiterates that requirement. In the absence of this regulation, many construction employees would not know about or recognize the hazards that confined spaces, or the procedures to follow to protect against such hazards. Even those employees with years of experience in construction work may lack training on confined spaces, information about specific onsite confined-space hazards, equipment needed to monitor and ventilate confined spaces, or rescue procedures and equipment.

The final standard for confined spaces in construction addresses these problems. The benefits analysis presented in Chapter 4 of this FEA shows that many accidents are potentially preventable with better information on confined spaces and worksite conditions and the proper confined-space procedures and equipment. When employers provide confined-spaces training, that training may be incomplete or ineffective in the absence of a specific set of construction requirements addressing training for confined spaces.

To better understand the market failures that make this final rule necessary, OSHA examined the economic incentives that underlie employer decisions with respect to workplace safety and health. An employee typically accepts the risks associated with a particular job in return for two forms of compensation: (1) A wage premium for assuming that risk; and (2) expected compensation for damages in the event of occupational injury or illness. The rational profit-maximizing employer will make investments in workplace safety to reduce the level of risk to employees only if such expenditures result in at least an offsetting reduction in the employer's payouts of wage premiums for risk and compensation for damages. To the extent that the sum of the costs of wage premiums and compensation for damages accurately represent the total damages associated with workplace accidents, the rational employer will accordingly arrive at the socially optimal level of accident prevention from an economic efficiency viewpoint.

Consequently, the major possible sources of market failure, resulting in an ''under-provision'' of health and safety, would be either: (1) The existence of occupational accident costs borne neither by the employee nor by the employer, or (2) the wage premiums or compensation for damages are not fully responsive to changes in employer-specific workplace risk. Both cases apply here.

In the first case, there are some non-fatal occupational injury and illness costs incurred by neither the employer nor the employee. For instance, neither employers nor employees have a vested interest in Federal and State taxes that go unpaid as a result of an employee injury. Such taxes typically represent 15 percent (for Social Security alone) to 26 percent of the total value of the income loss to the employee (IRS, 2013; Urban Institute/Brookings, 2012).[28] Workers' compensation payments are not subject to Federal income or Social Security taxes (IRS, 2012), and many studies find that income losses not compensated by workers' compensation are significant (NASI, 2012).

In the second case, as discussed below, the costs employers pay in compensation for damages or wage premiums are not fully responsive to changes in employer-specific workplace risk. Accordingly, most employers cover compensation for injured employees

[28] The average Federal tax rate for 2009 for the middle quintile of household income was 11.1 percent (Urban Institute/Brookings, 2012).

through workers' compensation insurance. (Some very large employers may self-insure in some states.) States highly regulate premiums for workers'-compensation insurance and, generally, employ a combination of a class rating and an experience rating in deriving premiums (NCCI, 2013; Ashford, 2006). States base the class rating on the average risk for employees in the same occupations as those working for the employer. The basis of the experience rating is the employer's actual workers'-compensation claims over the past several years. States use class rating for almost all very small firms and some medium-sized firms. Very large firms use either experience rating, but it takes several years before their insurance premiums account fully for changes in their workplace safety performance. States assign many firms a combination of class and experience ratings.[29] As a result, most employers will not receive full or prompt reductions in their workers' reduced premiums for the expenditures they made to prevent workplace injuries, illnesses, and fatalities. From a societal perspective, the result is an insufficient level of worker protection.

Furthermore, workers' compensation covers only a small fraction of most estimates of the willingness to pay to prevent a fatality.[30] Additionally, workers' compensation payments do not fully compensate injuries in that workers' compensation provides no payments for pain and suffering, or losses other than lost wages or medical expenses associated with injuries. There is extensive evidence that workers' compensation does not even fully restore wages lost as a result of long-term disability (Ashford, 2006).

Having to pay wage premiums for risk is another economic incentive for employers to mitigate occupational risk. However, wage premiums do not respond strongly to variations in risk level due to information asymmetries. For an employer to have an adequate incentive to implement measures that will prevent workplace incidents, it is not sufficient that employees simply know that their work is dangerous, or even know quantitatively that their occupation has a specific risk. Employees must know the exact types, and the likely quantitative effects, of safety measures and systems used by their employers; have a reasonable expectation that their employer will continue to provide existing safety measures in the future; and be able to act on their knowledge of risk by readily changing workplaces or wage demands in response to differences in levels of risk.[31] OSHA believes that even skilled construction workers (including some workers injured in accidents preventable by the final rule who fall into that category) lack such detailed employer-specific knowledge, or the ability to act on it. Further, construction employees who typically work at a variety of different sites, including sites controlled by multiple employers, will find it particularly challenging to determine future risk levels, as these levels will vary from site to site.

In summary, OSHA believes that: (1) Neither employers nor employees absorb the full costs of occupational injuries and fatalities; and (2) wage premiums and workers'-compensation insurance are not sufficiently responsive to variations in risk to assure that employers will reduce risk to the socially optimal level. This final rule, therefore, is necessary to address market failures and insufficient levels of worker safety that result from externalities and information asymmetries.

OMB's Circular A–4 (OMB, 2003) states that ''a demonstration of compelling social purpose and the likelihood of effective action'' may provide the basis for a Federal regulation. The OSH Act provides a Congressional finding as to the compelling social need for assuring occupational safety. Congress declared that the purpose of the OSH Act is ''to assure so far as possible every working man and woman in the Nation safe and healthful working conditions.'' 29 U.S.C. 651(b). Further, by emphasizing ''every working man and woman,'' Congress expressed an interest in preventing unsafe workplaces to the extent feasible, not simply in assuring that, on average, workplaces are safe. Thus, while some employers are excessively cautious about risk, while others are insufficiently cautious, OSHA's concern needs to be with the insufficiently cautious employers.

3. Profile of Affected Industries

This chapter presents a profile of the industries affected by the final standard for confined spaces in construction. It includes, for each affected industry, estimates of the number of firms, establishments, and employees, as well as the estimated number of establishments affected annually by the final standard. It also includes the number and characteristics of entries into confined spaces covered by the final standard.

A preliminary profile of industries appeared in OSHA's Preliminary Economic Analysis (PEA) that accompanied the proposed standard (ID–002). For this final analysis, OSHA updated the profile to reflect the latest available data from the Bureau of Labor Statistics, the Bureau of the Census, the Internal Revenue Service, and other authoritative sources and to address public comments. In addition, the Agency organized the industries in this final analysis according to the North American Industry Classification System (NAICS) rather than the Standard Industry Classification (SIC) system used in the PEA. This was necessary because OSHA wished to update the analysis using more recent economic data and the more recent economic data uses the NAICS rather than the SIC system.

An analysis conducted by CONSAD Research Corporation under contract with OSHA served as the basis for the PEA (ID–003). The CONSAD report relied on a variety of sources, including information provided by a panel of construction industry safety experts in 1995 regarding characteristics of, and entries into, confined spaces for 25 categories of construction projects, as well as compliance rates for provisions of the proposed standard. CONSAD used F.W. Dodge data to estimate the number of construction-project starts for each project category, by size of project

One commenter, the Associated General Contractors of America (AGCA), presented an alternative economic analysis of the proposed rule, prepared by Dr. N. Mike Helvacian, based in part on a survey of AGCA's members (ID–222). That economic analysis suggested that the PEA omitted five affected industries, including, by NAICS code: 238210 (Electrical Contractors); 221119 (Utilities—Other Electric Power Generation); 221310 (Utilities—Water Supply Irrigation); 236118 (General Contractors in Residential Modeling); and 238220 (Plumbing, Heating and Air Conditioning Contractors). OSHA included these five industries, other than NAICS 221119 (Utilities—Other

[29] Premiums due to class rating, by definition, do not vary with an individual employer's injury experience. There is some empirical evidence, using a difference in differences methodology, showing that (small) firms that move from class rating to experience rating decrease their total claims by 8 to 12 percent (Neuhauser et al., 2013).

[30] While workers' compensation varies by state, Leigh and Marcin (2012) estimate that the average indemnity benefit for a fatality is $225,919, far less than willingness-to-pay estimates. For example, as explained in Chapter 4 of this FEA, OSHA uses a willingness-to-pay measure of $8.7 million per life saved in 2009 dollars. Other agencies use different estimates, but all the values are in the millions of dollars.

[31] Furthermore, bargaining power differences or external constraints must not interfere in the wage setting process as these factors do in circumstances such as monopsony or multiemployer collective-bargaining agreement.

Electric Power Generation), in the industry profile, and in the estimation of compliance costs, for the final standard.

For electric power-generation industries (NAICS 221111, NAICS 221112, and NAICS 221113, in addition to NAICS 221119, in the 2007 version of NAICS), OSHA believes that most of the confined-space entries performed are for maintenance and repair subject to General Industry requirements under §§ 1910.146 and 1910.269. When the size and scope of a project involving entry into confined spaces is large or complex enough that the work is construction work as defined in § 1910.12(b), electric utilities typically hire contractors in industries that are already included in this FEA to perform the work and confined-space entry. Consequently, OSHA concluded that employers in NAICS 221119 will themselves rarely, if ever, perform work covered by this final rule and, thus, will incur no direct costs or negligible direct costs to comply with the final standard. By the same reasoning, OSHA did not in the PEA, and did not in this FEA, include any other electric power-generation industries in its industry profile or in its estimation of compliance costs for the final standard.

Other commenters, including SBA Advocacy, pointed out that OSHA did not include single-family housing projects in the analysis of compliance costs in the PEA (see ID–119 and ID–219). In its original analysis, the Agency excluded single-family housing projects, in part because the previously mentioned panel of industry experts found that such projects did not have entries into confined spaces covered by the standard (see ID–003, p. 3.54). Comments in the record generally indicate that there are a limited number of confined-space entries in these projects. For example, the National Association of Home Builders (NAHB) noted that ''there is very limited exposure to confined space hazards in residential construction'' (ID–117). In a post-hearing brief, NAHB explained that ''although it will happen only occasionally, permit spaces may arise in residential home construction, perhaps when a subcontractor brings certain chemicals . . . into a confined space, such as into a crawl space, attic, or a basement before steps are installed'' (ID–219). OSHA agrees that, although entry into confined spaces to conduct work on home-building construction sites is rare, it cannot rule out some potential for exposure to confined-space hazards for this sector of the construction industry. Therefore, OSHA included single-family home construction projects in this analysis by adding NAICS code 236115, New Single-Family Housing Construction (except Operative Builders), to the scope of this FEA.

In addition, OSHA believes that some residential remodeling projects, such as an expansion of an apartment building or upgrading HVAC systems, plumbing, or electrical systems in multi-family housing, may constitute construction activity. Therefore, for this FEA, OSHA added costs for employers with confined spaces in residential remodeling projects to comply with the final standard.

Another commenter stated that the CONSAD report ''specifically excludes gas, water, sewer and municipal work from their analysis. It is erroneous for . . . the entire sewer construction industry to be excluded from the economic analysis'' (ID–091). OSHA points out that the PEA did not exclude the entire sewer-construction industry. Rather, the PEA excluded new water- and sewer-line construction projects because such work typically involves smaller lines and, therefore, does not typically involve entries covered by the rule. However, OSHA included entries into existing storm sewers, sanitary sewers, and sewer manholes for construction work, including entries involved in storm sewer and flood-control projects and sewer-, water-, and waste-treatment plants, both in the PEA and in this FEA. OSHA also discusses in the economic feasibility analysis the possibility that establishments in industries that seldom have confined space entries might occasionally have one.

OSHA concludes that the final standard will affect establishments in 15 six-digit NAICS codes. In particular, the standard will affect firms that perform construction work involving buildings, highways, bridges, tunnels, utility lines, and other types of projects. Also potentially affected by the final rule are general contractors, as well as specialty-trade construction contractors and property owners.

Table IV–2 provides information on the estimated number of projects for each type of construction activity, as well as the estimated number of entrants per entry, number of entries, and worker-entry hours in confined spaces. OSHA based this information on the estimates originally provided in the CONSAD report.

Table IV–3 presents profile data on the number of establishments, the number of employees, and revenues and profits for each affected industry sector. The Agency updated this table from the PEA using the more recent data from the 2007 Statistics of U.S. Businesses from the Census Bureau adjusted to 2009 dollars using the GDP deflator. This is the same source of data used in the PEA. These industries contain an estimated combined total of over 500,000 establishments and nearly 5 million employees. The annual combined revenues of these industries in 2007 came to nearly $1.3 trillion (in 2009 dollars). Commercial and Institutional Building Construction (NAICS 236220), the largest of these industries in terms of annual revenue, accounted for about $393 billion of this total. However, due to the type of the activity addressed by this rule, OSHA modeled only a small fraction of establishments in the affected industries as performing construction activities in confined spaces and bearing the associated compliance costs in a given year.[32]

OSHA updated the PEA estimates of before-tax profit rates in Table IV–3 using more recent corporate balance-sheet data from the Internal Revenue Service's *Corporation Source Book* (IRS, 2013). This is a more recent edition of the same source of data used in the PEA. For each of the years 2003 through 2007, the Agency calculated profit rates as the ratio of total receipts to net income by NAICS group, and averaged profit rates across the five-year period (2003–2007). Since some data provided by the IRS were not available at disaggregated levels for all industries and profit rates, OSHA used data at more highly aggregated levels as a proxy for such industries—that is, where data were not available for each six-digit NAICS code, OSHA used corresponding four- and five-digit NAICS codes, as appropriate.

Table IV–4 presents profile data for firms defined as small entities by the Small Business Administration (SBA),[33] and Table IV–5 presents profile data for very small entities, defined as firms with fewer than 20 employees. Table IV–6 presents OSHA's estimated compliance rates for key provisions of the final standard, which it discusses in Chapter 6 of this FEA. Table IV–7 presents the wage rates, in 2009 dollars, for the labor categories used in OSHA's cost analysis, while Table IV–14 in Chapter 6 of this FEA presents other unit-cost data used in the analysis.

[32] Only some construction projects involve entry into confined spaces.

[33] OSHA converted revenue cutoffs for small business designation to the closest employee number cutoffs so that it could apply available business census employment numbers.

TABLE IV–2—SUMMARY STATISTICS ON MODELED WORKER ENTRIES INTO CONFINED SPACES, BY TYPE OF CONSTRUCTION ACTIVITY AND PROJECT SIZE

Project category	Total number of projects	Total number of projects with confined spaces	Average number of confined spaces per project			Total number of confined spaces	Average number of workers in an entry team	Number of entries into confined spaces per project	Total entries into confined spaces, all projects	Number of worker entries into confined spaces per project	Total worker entries into confined spaces, all projects	Number of worker-hours in confined spaces per project	Total worker hours all projects [a]
			Existing	New	All								
Commercial and Public Buildings:													
Small Project	13,931	3,483	2	2	4	13,931	2	8	27,862	16	55,724	32	111,448
Medium Project	4,328	3,246	5	10	15	48,690	2	57	185,022	134	434,964	605	1,962,207
Large Project	852	724	5	10	15	10,863	2	57	41,279	134	97,043	605	437,779
Warehouses:													
Small Project	2,609	130	2	0	2	261	2	12	1,565	18	2,348	72	9,392
Medium Project	4,409	220	0	2	2	441	2	4	882	7	1,543	25	5,511
Large Project	462	23	0	2	2	46	2	4	92	7	162	25	578
Health Facilities and Laboratories:													
Small Project	2,332	117	5	0	5	583	2	29	3,381	77	8,978	294	34,310
Medium Project	4,419	442	4	4	8	3,535	2	13	5,745	22	9,722	65	28,724
Large Project	643	129	4	4	8	1,029	2	13	1,672	22	2,829	65	8,359
Detention Facilities:													
New Construction	163	147	1	14	15	2,201	2	43	6,308	90	13,203	87	12,763
Athletic and Entertainment Facilities:													
All Projects	1,378	69	1	6	7	482	2	24	1,654	46	3,169	66	4,547
Airline Terminals:													
New Construction	59	53	1	14	15	797	2	43	2,283	90	4,779	87	4,620
Aircraft Service:													
All Projects	295	30	0	5	5	148	2	36	1,062	72	2,124	19	551
Auto, Bus, and Truck Service:													
Small Renovation	10	2	0	2	2	4	1	2	4	2	4	3	6
Major Renovation	20	12	0	8	8	96	1	16	192	22	264	92	1,104
New Construction	87	87	0	18	18	1,566	1	46	4,002	77	6,699	362	31,494
Residential Housing:													
Small Project	1,004,721	25,118	0	1	1	25,118	1	3	612	3	612	3	612
Medium Project	3,204	801	0	2	2	1,602	2	6	4,806	10	8,010	14	11,214
Large Project	2,204	882	0	10	10	8,816	2	150	132,240	280	246,848	913	805,195
Apartments, Hotels, and Dormitories:													
All Projects	4,258	426	3	12	15	6,387	2	44	18,735	74	31,509	140	59,612
Streets and Highways:													
Repair Storm Drain/Sewer Local Street	11,893	1,784	4	5	9	16,056	2	17	30,327	29	51,735	113	202,181
Install New Storm Drain/Sewer System	8,325	2,914	10	7	17	49,534	2	321	935,314	544	1,585,080	2,764	8,053,119
Lane Expansion on Major Interstate	3,568	1,784	15	13	28	49,952	2	721	1,286,264	1,463	2,609,992	6,765	12,068,165
Bridges:													
Small Project	952	952	0	46	46	43,792	3	442	420,784	1,324	1,260,448	1,988	1,892,576
Medium Project	2,011	1,006	0	96	96	96,528	3	742	746,081	2,524	2,537,882	2,388	2,401,134
Large Project	808	404	0	196	196	79,184	3	1,342	542,168	4,924	1,989,296	3,188	1,287,952
Dams and Reservoirs:													
Small Project	208	10	1	1	1	10	2	2	21	4	42	32	333
Medium Project	468	164	2	0	2	328	4	40	6,552	160	26,208	640	104,832
Large Project	48	24	0	3	3	72	17	810	19,440	15,300	367,200	46,800	1,123,200
Storm Sewers and Flood Control:													
Small Project	2,489	2,489	21	2	23	57,247	1	26	64,714	26	64,714	80	198,290
Medium Project	350	350	0	59	59	20,650	1	437	152,950	460	161,000	598	209,300
Large Project	59	59	0	193	193	11,387	1	446	26,314	478	28,202	666	39,294
Sewer, Water, and Waste Treatment Plants:													
Small Renovation	2,310	578	4	20	24	13,860	1	69	39,848	88	50,820	280	161,411
Major Renovation	1,012	708	0	34	34	24,086	1	94	66,590	126	89,258	395	279,641
New Construction	1,179	1,179	0	58	58	68,382	2	163	192,177	229	269,991	743	875,408
Tanks:													
Minor Installation/Renovation (Small Contractor)	540	216	0	6	6	1,296	1	9	1,944	9	1,944	5	1,116
Minor Installation/Renovation (Medium Contractor)	294	176	0	9	9	1,588	1	139	24,520	163	28,753	340	59,888
New Construction/Major Renovation (Large Contractor)	147	118	0	11	11	1,294	4	389	45,746	1,421	167,110	5,364	630,748
Hydro-Electric Power Plants:													
Small Project	7	1	5	0	5	5	1	84	88	164	172	656	689
Medium Project	10	8	6	0	6	48	2	48	384	96	768	384	3,072
Large Project	1	1	18	0	18	16	3	433	390	1,012	911	4,048	3,643
Other Power Plants:													
Small Project	49	0	0	0	0	0	0	0	0	0	0	0	0
Medium Project	119	95	11	0	11	1,047	5	252	23,990	1,304	124,141	4,035	384,132
Large Project	92	87	7	0	7	612	18	604	52,790	3,590	313,766	15,880	1,387,912
Electric Substations:													
Small Project	34	31	2	1	3	92	2	22	673	44	1,346	176	5,386
Medium Project	107	102	4	3	7	712	2	138	14,028	276	28,055	1,104	112,222
Large Project	13	12	4	3	7	86	2	138	1,704	276	3,409	1,104	13,634

TABLE IV–2—SUMMARY STATISTICS ON MODELED WORKER ENTRIES INTO CONFINED SPACES, BY TYPE OF CONSTRUCTION ACTIVITY AND PROJECT SIZE—Continued

Project category	Total number of projects	Total number of projects with confined spaces	Average number of confined spaces per project			Total number of confined spaces	Average number of workers in an entry team	Number of entries into confined spaces per project	Total entries into confined spaces, all projects	Number of worker entries into confined spaces per project	Total worker entries into confined spaces, all projects	Number of worker-hours in confined spaces per project	Total worker hours all projects[a]
			Existing	New	All								
Natural Gas Plants:													
Small Upgrade	4	3	0	2	2	7	1	2	7	2	7	4	13
Major Renovation	4	3	0	8	8	27	12	64	218	768	2,611	4,608	15,667
New Construction	8	7	8	28	36	265	12	728	5,358	8,728	64,238	24,135	177,631
Space Facilities:													
Small Project	37	37	0	15	15	555	1	43	1,591	54	1,998	196	7,252
Medium Project	1	1	0	27	27	27	1	78	78	95	95	342	342
Large Project	1	1	0	44	44	44	1	126	126	152	152	572	572
Manufacturing Facilities:													
Major Renovation	1,204	0	0	0	0	0	0	0	n/a	0	n/a	0	n/a
New Construction	1,067	107	0	2	2	213	11	51	5,442	1,001	106,807	24,000	2,560,818

[a] Data in this column rounded to the nearest whole hour.
n/a = not applicable (no confined spaces in this category).
Source: U.S. Department of Labor, OSHA, Directorate of Standards and Guidance, Office of Regulatory Analysis-Safety.

TABLE IV–3—PROFILE OF INDUSTRIES AFFECTED BY THE FINAL STANDARD ON CONFINED SPACES IN CONSTRUCTION

NAICS	Industry	Total number of firms in industry	Total number of establishments in industry	Total employment in industry	Estimated annual number of projects with confined spaces	Estimated number of establishments affected annually
221310	Water Supply and Irrigation Systems	3,579	4,068	33,017	66	65
236115	New Single-Family Housing Construction (except Operative Builders).	61,262	61,613	282,851	1,340	1,321
236116	New Multifamily Housing Construction (except Operative Builders).	4,319	4,373	46,634	1,482	883
236118	Residential Remodelers	99,592	99,791	355,134	13,542	9,602
236210	Industrial Building Construction	3,858	3,963	96,918	107	106
236220	Commercial and Institutional Building Construction.	41,282	42,369	670,043	9,021	6,408
237110	Water and Sewer Line and Related Structures Construction.	13,679	13,872	206,899	3,980	2,765
237130	Power and Communication Line and Related Structures Construction.	5,099	5,750	196,223	341	341
237310	Highway, Street, and Bridge Construction	10,953	11,746	323,289	8,843	4,275
237990	Other Heavy and Civil Engineering Construction.	5,200	5,392	91,545	1,598	965
238190	Other Foundation, Structure, and Building Exterior Contractors.	5,701	5,720	45,035	2,680	1,182
238210	Electrical Contractors and Other Wiring Installation Contractors.	79,011	80,172	825,169	2,680	2,680
238220	Plumbing, Heating, and Air-Conditioning Contractors.	99,374	100,806	1,012,541	2,935	2,934
238310	Drywall and Insulation Contractors	21,785	22,458	320,238	2,680	2,284
238910	Site Preparation Contractors	41,251	41,517	331,237	255	255
	Total	495,945	503,610	4,836,773	51,551	36,066

NAICS	Industry	Revenues ($ thousand)	Average revenues per firm ($ thousand)	Profit rate (percent)	Estimated profits ($ thousand)	Average profit per firm ($ thousand)
221310	Water Supply and Irrigation Systems	$7,999,900	$2,235	5.89	$471,431	$132
236115	New Single-Family Housing Construction (except Operative Builders).	103,600,723	1,691	4.53	4,692,648	77
236116	New Multifamily Housing Construction (except Operative Builders).	24,939,736	5,774	4.53	1,129,658	262
236118	Residential Remodelers	75,344,805	757	4.53	3,412,781	34
236210	Industrial Building Construction	26,486,027	6,865	4.53	1,199,698	311
236220	Commercial and Institutional Building Construction.	392,958,284	9,519	4.53	17,799,246	431
237110	Water and Sewer Line and Related Structures Construction.	51,808,802	3,787	5.98	3,099,719	227
237130	Power and Communication Line and Related Structures Construction.	35,528,777	6,968	5.98	2,125,685	417
237310	Highway, Street, and Bridge Construction	112,052,152	10,230	5.98	6,704,076	612
237990	Other Heavy and Civil Engineering Construction.	24,090,901	4,633	5.98	1,441,358	277
238190	Other Foundation, Structure, and Building Exterior Contractors.	7,085,701	1,243	4.58	324,258	57
238210	Electrical Contractors and Other Wiring Installation Contractors.	129,184,454	1,635	4.54	5,864,637	74
238220	Plumbing, Heating, and Air-Conditioning Contractors.	167,754,151	1,688	3.86	6,470,472	65
238310	Drywall and Insulation Projects	42,281,365	1,941	4.58	1,934,891	89
238910	Site Preparation Contractors	67,939,838	1,647	4.77	3,243,144	79
	Total	1,269,055,615	2,559	4.72	59,913,701	121

Source: U.S. Department of Labor, OSHA, Directorate of Standards and Guidance, Office of Regulatory Analysis-Safety.

TABLE IV–4—PROFILE OF SBA-DEFINED SMALL ENTITIES WITHIN INDUSTRIES AFFECTED BY THE FINAL STANDARD ON CONFINED SPACES IN CONSTRUCTION

NAICS	Industry	Total number of firms in industry-size grouping	Total number of establishments in industry-size grouping	Total employment in industry-size grouping	Estimated annual number of projects with confined spaces	Estimated number of establishments affected annually
221310	Water Supply and Irrigation Systems	3,579	4,068	33,017	66	18
236115	New Single-Family Housing Construction (except Operative Builders).	61,065	61,125	241,095	953	953
236116	New Multifamily Housing Construction (except Operative Builders).	4,208	4,218	31,694	828	728
236118	Residential Remodelers	99,571	99,657	347,579	12,848	9,468
236210	Industrial Building Construction	3,687	3,699	33,998	24	24
236220	Commercial and Institutional Building Construction.	40,279	40,424	415,362	4,463	4,463
237110	Water and Sewer Line and Related Structures Construction.	13,348	13,379	140,854	2,272	2,272
237130	Power and Communication Line and Related Structures Construction.	5,012	5,121	84,488	112	112
237310	Highway, Street, and Bridge Construction	10,205	10,255	134,875	2,784	2,784
237990	Other Heavy and Civil Engineering Construction.	5,001	5,011	45,364	584	584
238190	Other Foundation, Structure, and Building Exterior Contractors.	5,638	5,650	35,003	1,763	1,112
238210	Electrical Contractors and Other Wiring Installation Contractors.	77,933	78,115	558,977	1,446	1,446
238220	Plumbing, Heating, and Air-Conditioning Contractors.	98,267	98,468	727,726	1,722	1,722
238310	Drywall and Insulation Projects	21,264	21,304	176,689	1,130	1,130
238910	Site Preparation Contractors	40,840	40,900	257,517	169	169
	Total	489,841	496,340	3,247,574	31,116	26,985

NAICS	Industry	Revenues ($ Thousand)	Average revenues per firm ($ Thousand)	Profit rate (%)	Estimated profits ($ Thousand)	Average profit per firm ($ Thousand)
221310	Water Supply and Irrigation Systems	$2,510,882	$713	5.89	$147,965	$ 42
236115	New Single-Family Housing Construction (except Operative Builders).	76,651,638	1,255	4.53	3,471,975	57
236116	New Multifamily Housing Construction (except Operative Builders).	15,147,671	3,600	4.53	686,122	163
236118	Residential Remodelers	73,283,645	736	4.53	3,319,420	33
236210	Industrial Building Construction	10,421,351	2,827	4.53	472,040	128
236220	Commercial and Institutional Building Construction.	199,388,653	4,950	4.53	9,031,411	224
237110	Water and Sewer Line and Related Structures Construction.	32,860,609	2,462	5.98	1,966,049	147
237130	Power and Communication Line and Related Structures Construction.	15,098,169	3,012	5.98	903,323	180
237310	Highway, Street, and Bridge Construction	43,921,533	4,304	5.98	2,627,824	258
237990	Other Heavy and Civil Engineering Construction.	10,427,684	2,085	5.98	623,888	125
238190	Other Foundation, Structure, and Building Exterior Contractors.	5,277,635	936	4.58	241,517	43
238210	Electrical Contractors and Other Wiring Installation Contractors.	80,826,690	1,037	4.54	3,669,320	47
238220	Plumbing, Heating, and Air-Conditioning Contractors.	111,089,247	1,130	3.86	4,284,841	44
238310	Drywall and Insulation Contractors	23,969,602	1,127	4.58	1,096,903	52
238910	Site Preparation Contractors	49,943,011	1,223	4.77	2,384,056	58
	Total	750,818,022	1,533	4.74	35,447,057	72

Source: U.S. Department of Labor, OSHA, Directorate of Standards and Guidance, Office of Regulatory Analysis-Safety.

TABLE IV–5—PROFILE OF VERY SMALL ENTITIES (FEWER THAN 20 EMPLOYEES) WITHIN INDUSTRIES AFFECTED BY THE FINAL STANDARD ON CONFINED SPACES IN CONSTRUCTION

NAICS	Industry	Total number of firms in industry-size grouping	Total number of establishments in industry-size grouping	Total employment in industry-size grouping	Estimated annual number of projects with confined spaces	Estimated number of establishments affected annually
221310	Water Supply and Irrigation Systems	3,413	3,428	12,676	11	11
236115	New Single-Family Housing Construction (except Operative Builders).	59,376	59,385	185,153	580	580
236116	New Multifamily Housing Construction (except Operative Builders).	3,760	3,761	15,035	271	271
236118	Residential Remodelers	97,291	97,294	258,012	7,105	7,105
236210	Industrial Building Construction	3,225	3,227	16,136	8	8
236220	Commercial and Institutional Building Construction.	33,977	33,992	174,975	1,329	1,329
237110	Water and Sewer Line and Related Structures Construction.	11,242	11,242	57,685	642	642
237130	Power and Communication Line and Related Structures Construction.	3,973	3,976	21,403	17	17
237310	Highway, Street, and Bridge Construction	8,011	8,014	42,634	601	601
237990	Other Heavy and Civil Engineering Construction.	4,321	4,323	18,871	166	166
238190	Other Foundation, Structure, and Building Exterior Contractors.	5,244	5,244	19,607	706	706
238210	Electrical Contractors and Other Wiring Installation Contractors.	71,144	71,156	297,375	544	544
238220	Plumbing, Heating, and Air-Conditioning Contractors.	89,245	89,255	388,409	655	655
238310	Drywall and Insulation Projects	18,832	18,837	77,284	336	336
238910	Site Preparation Contractors	37,690	37,691	139,196	64	64
	Total	450,744	450,825	1,724,451	13,035	13,032
NAICS	Industry	Revenues ($ Thousand)	Average revenues per firm ($ Thousand)	Profit rate (percent)	Estimated profits ($ Thousand)	Average profit per firm ($ Thousand)
221310	Water Supply and Irrigation Systems	$1,814,859	$532	5.89	$106,949	$31
236115	New Single-Family Housing Construction (except Operative Builders).	58,016,827	977	4.53	2,627,902	44
236116	New Multifamily Housing Construction (except Operative Builders).	6,202,571	1,650	4.53	280,949	75
236118	Residential Remodelers	53,069,089	545	4.53	2,403,792	25
236210	Industrial Building Construction	4,744,855	1,471	4.53	214,921	67
236220	Commercial and Institutional Building Construction.	77,231,171	2,273	4.53	3,498,225	103
237110	Water and Sewer Line and Related Structures Construction.	12,423,307	1,105	5.98	743,286	66
237130	Power and Communication Line and Related Structures Construction.	3,755,169	945	5.98	224,672	57
237310	Highway, Street, and Bridge Construction	14,530,558	1,814	5.98	869,363	109
237990	Other Heavy and Civil Engineering Construction.	4,349,517	1,007	5.98	260,231	60
238190	Other Foundation, Structure, and Building Exterior Contractors.	2,892,942	552	4.58	132,388	25
238210	Electrical Contractors and Other Wiring Installation Contractors.	40,914,727	575	4.54	1,857,422	26
238220	Plumbing, Heating, and Air-Conditioning Contractors.	55,526,805	622	3.86	2,141,733	24
238310	Drywall and Insulation Projects	11,280,100	599	4.58	516,203	27
238910	Site Preparation Contractors	25,679,366	681	4.77	1,225,818	33
	Total	372,431,864	826	4.72	17,582,974	39

Source: U.S. Department of Labor, OSHA, Directorate of Standards and Guidance, Office of Regulatory Analysis-Safety.

TABLE IV–6—ESTIMATED COMPLIANCE RATES FOR CONSTRUCTION PROJECTS AFFECTED BY OSHA'S FINAL STANDARD FOR CONFINED SPACES IN CONSTRUCTION

[By project category]

Project category	Entrant training (a) (percent)	Information exchange (percent)	Written programs (and formal annual review) (percent)	Classify spaces and issue permits (percent)	Lockout/ tagout (percent)	Mechanical ventilation (percent)	Attendants (percent)	Rescue capability (percent)
Commercial and Public Buildings:								
Small Project	65	75	50	83	83	86	83	N/A
Medium Project	83	75	70	93	86	90	86	79
Large Project	86	80	80	97	93	93	93	86
Warehouses:								
Small Project	62	50	50	69	65	48	100	N/A
Medium Project	62	50	50	69	86	48	100	N/A
Large Project	62	50	50	69	86	48	100	N/A
Health Facilities and Laboratories:								
Small Project	58	65	25	58	58	58	100	N/A
Medium Project	58	65	25	58	58	58	100	N/A
Large Project	58	65	25	58	58	58	100	N/A
Detention Facilities:								
New Construction	100	20	0	45	N/A	93	65	86
Athletic and Entertainment Facilities:								
All Projects	33	75	20	47	37	47	N/A	N/A
Airline Terminals:								
New Construction	100	20	0	45	N/A	93	65	86
Aircraft Service:								
All Projects	34	75	20	48	N/A	48	N/A	N/A
Auto, Bus, and Truck Service:								
Small Renovation	38	20	10	65	N/A	31	N/A	72
Major Renovation	38	20	10	65	N/A	31	N/A	72
New Construction	100	80	80	65	N/A	100	N/A	N/A
Residential Housing:								
Small Project	38	0	0	31	45	83	93	N/A
Medium Project	45	5	0	45	58	83	93	N/A
Large Project	65	30	10	72	83	83	93	N/A
Apartments, Hotels, and Dormitories:								
All Projects	38	75	20	51	41	51	N/A	N/A
Streets and Highways:								
Repair Storm Drain/Sewer-Local Street	82	80	75	96	96	94	97	97
Install New Storm Drain/Sewer System	89	85	85	96	98	96	98	98
Lane Expansion on Major Interstate	93	90	90	96	99	96	99	99
Bridges:								
Small Project	82	0	5	100	N/A	100	100	100
Medium Project	82	0	80	100	N/A	100	100	100
Large Project	82	5	5	100	N/A	100	100	100
Dams and Reservoirs:								
Small Project	52	50	60	72	68	52	100	100
Medium Project	72	50	70	84	76	60	100	N/A
Large Project	88	95	100	100	N/A	100	100	N/A
Storm Sewers and Flood Control:								
Small Project	63	50	50	100	N/A	56	N/A	N/A
Medium Project	93	80	80	100	N/A	100	N/A	N/A
Large Project	93	80	80	100	N/A	100	N/A	N/A
Sewer, Water, and Waste Treatment Plants:								
Small Renovation	63	50	30	93	N/A	63	N/A	85
Major Renovation	63	50	30	93	N/A	63	N/A	85
New Construction	63	50	30	93	N/A	63	N/A	85
Tanks:								
Minor Installation/Renovation (Small Contractor)	60	45	40	85	64	71	67	71
Minor Installation/Renovation (Medium Contractor)	71	60	60	93	71	78	82	78
New Construction/Major Renovation (Large Contractor)	85	80	80	96	82	85	89	85
Hydroelectric Power Plants:								
Small Project	64	90	95	96	100	71	86	N/A
Medium Project	82	95	100	100	N/A	78	100	N/A
Large Project	89	95	100	100	N/A	86	100	N/A
Other Power Plants:								
Medium Project	70	95	80	85	N/A	78	78	74
Large Project	96	95	95	100	N/A	96	100	96
Electric Substations:								
Small Project	96	95	95	96	N/A	96	96	96
Medium Project	96	95	95	96	N/A	96	96	96
Large Project	96	95	95	96	N/A	96	96	96
Natural Gas Plants:								
Small Upgrade	55	40	40	93	100	78	55	55
Major Renovation	70	60	50	100	100	93	N/A	N/A
New Construction	93	90	90	100	N/A	93	100	100
Space Facilities:								
Small Project	93	90	90	100	N/A	93	N/A	N/A

TABLE IV–6—ESTIMATED COMPLIANCE RATES FOR CONSTRUCTION PROJECTS AFFECTED BY OSHA'S FINAL STANDARD FOR CONFINED SPACES IN CONSTRUCTION—Continued

[By project category]

Project category	Entrant training (a) (percent)	Information exchange (percent)	Written programs (and formal annual review) (percent)	Classify spaces and issue permits (percent)	Lockout/ tagout (percent)	Mechanical ventilation (percent)	Attendants (percent)	Rescue capability (percent)
Medium Project	93	90	90	100	N/A	93	N/A	N/A
Large Project	93	90	90	100	N/A	93	N/A	N/A
Manufacturing Facilities:								
New Construction	43	50	50	86	N/A	65	43	43

(a) Current compliance rates for attendant training are nearly identical to the rates for entry training, but may be somewhat lower for some project categories based on estimates provided by CONSAD's 1995 industry expert panel. See CONSAD report (2005) for details.

N/A = Not Applicable (treated as "0%" in calculations).

Source: U.S. Department of Labor, OSHA, Directorate of Standards and Guidance, Office of Regulatory Analysis-Safety.

TABLE IV–7—LOADED HOURLY LABOR RATES APPLIED IN OSHA'S COST ANALYSIS OF THE FINAL STANDARD FOR CONFINED SPACES IN CONSTRUCTION

[2009 dollars]

Labor category	Wage rate
Construction supervisor	$42.16
Skilled worker	29.60
General construction employee	24.93
Clerical employee	22.53
Unskilled worker	22.67

Source: Department of Labor, OSHA, Directorate of Standards and Guidance, Office of Regulatory Analysis-Safety, based on data from Bureau of Labor Statistics 2009 Occupational Employment Statistics (OES) Survey.

4. Benefits and Net Benefits

Introduction

The final standard will improve the safety of workers who encounter confined spaces in construction. Confined spaces represent special safety problems because it can be difficult to exit them and it may be difficult to provide aid if an incident occurs in a confined space. There are also certain types of hazards, such as low oxygen levels, accumulations of dangerous gases, and engulfment by water that are particularly likely to be found in confined spaces. As a result, OSHA developed a programmatic approach to assure the safety of workers who must work in the vicinity of confined spaces. This programmatic approach includes provisions for identifying confined spaces and the hazards they may contain; removing the hazards if possible; restricting entry through a permit system where employers cannot remove the hazard; providing appropriate testing and equipment when employees must enter a space; providing for attendants; and arranging for rescue services when emergencies occur in a confined space.

Independent researchers found that a similar system in general industry significantly reduced confined-spaces incidents (Seong and Mendeloff, Assessing the Accuracy of OSHA's Projections of the benefits of New Safety Standards, 2004). The Seong and Mendeloff paper estimates at least a fifty percent reduction in total deaths in two BLS fatality categories: "inhalation in enclosed, restricted, or confined spaces," and "depletion of oxygen in enclosed, restricted, or confined spaces," following the implementation of the general industry rule. These two categories would include a number of kinds of events not covered by the general industry confined space standard, such as inhalation of toxic substances in a room (for example, there are some fatalities every year from using paint or paint strippers in ordinary rooms not adequately ventilated for the purposes of heavy chemical use that nevertheless would not be confined spaces). These kinds of events would be included in the denominator of Seong and Mendeloff analysis but would not be affected by the general industry confined space rule. The Seong and Mendeloff analysis does not attempt to determine if the incidents included in its analysis occurred in a confined space, much less whether the confined spaces rule was being followed. OSHA believes that most of the remaining confined space incidents in general industry are the result of failure to follow that standard. Compliance with the provisions of this standard will reduce accidents, injuries, and fatalities in confined spaces in construction. In particular, the number of injuries and fatalities from causes such as asphyxiation, lethal gas, chemical burns, explosions, drowning, and failed rescue attempts will decline.

For the Preliminary Economic Analysis (PEA), OSHA developed estimates of the benefits associated with the proposed standard by estimating the numbers of fatalities and injuries likely prevented by full compliance, and then applied monetary values to them. Table IV–8 shows the Agency's estimate of the annualized monetary benefits associated with the final standard. The remainder of this section details OSHA's methodology for estimating those benefits.

TABLE IV–8—ESTIMATED VALUE OF ANNUALIZED BENEFITS *

Benefits	Number	Monetized value
Fatalities Avoided.	5.2	$45.2 million. [a]
Injuries Avoided	780	$48.4 million. [b]
Total	....	$93.6 million.

* In 2009 dollars.

[a] Based on an estimated value of $8.7 million per fatality avoided.

[b] Based on an estimated value of $62,000 per injury avoided.

Estimation of Prevented Fatalities

In the analysis CONSAD Research Corporation (CONSAD) submitted to OSHA and which OSHA reviewed and approved for use in the PEA, the CONSAD researchers used OSHA's Integrated Management Information System (IMIS) and the Bureau of Labor Statistics (BLS) Census of Fatal Occupational Injuries (CFOI) to develop the estimated safety benefits or the number of fatalities and injuries potentially avoided as a result of this standard. Using these sources, CONSAD gathered data on the number of fatal and non-fatal construction-related accidents involving the entry of a confined space by applying a search criterion relevant to both confined spaces and construction work. For data collected from the IMIS database, CONSAD searched for accident reports with construction industry SIC codes of 15, 16, and 17, and then manually reviewed those reports and the narratives of the accidents for factors indicative of an enclosed or confined space-related injury. Such factors included specific types of environmental hazards, certain events and human errors, as well as the type and source of an injury (see Section 4.1.1 of the CONSAD Report for a detailed list of the factors; Docket ID: OSHA–2007–0026–0003). Outside of the search criteria, CONSAD also reviewed incident reports where the Agency cited employers for violations of other OSHA standards involving constructions hazards similar to those hazards found in confined spaces; however, OSHA assured that the analysis excluded any cases involving a confined-space entry or cases largely involving work activity covered by OSHA standards—subpart P, subpart S, subpart V or any General Industry standard.

For data collected from CFOI, BLS provided CONSAD with a research data file, procured under a confidentiality agreement, which contained detailed information about work-related fatalities such as employee occupation, industry, worker activity, the type and source of the injury, the event, the location of the accident, as well as a narrative description as to how the injury occurred. CONSAD used the BLS *Confined Space Fatality Study—1992* (BLS, 1992b) as a reference guide for developing the screening criteria used to identify fatal confined-space accidents in the CFOI file since the BLS study also used CFOI data and defined a confined space similar to OSHA's General Industry confined-spaces standard. Figure 4.1 of the CONSAD Report shows a detailed list of the factors used to screen the CFOI data file for confined-space accidents. Like the data used from the IMIS database, CONSAD manually reviewed each CFOI record and eliminated any accident that did not involve a confined space or that involved work activity covered by another OSHA standard.

From the IMIS database, CONSAD reviewed fatality and injury cases that occurred during the period of April 1984 to October 2001, and identified a total of 102 accidents related to confined spaces in construction. These accidents resulted in 84 fatalities and 88 injuries. The complete list of these accidents, along with their narratives, is available in Appendix C.1 of the CONSAD Report. Since the CFOI program did not begin collecting work-related fatality data from all 50 states and the District of Columbia until 1992, any data prior to 1992 was incomplete and, therefore, eliminated from further analysis. As a result, CONSAD only reviewed cases from the CFOI research data file that occurred during the period of 1992 to 2000, identifying a total of 21 accidents related to confined spaces in construction that resulted in a total of 24 fatalities. Due to the confidentiality agreement made between CONSAD and BLS, the details of these cases were not made available for public viewing. In an effort to be consistent with the data-collection process used with the CFOI data, CONSAD limited its analysis of the IMIS fatality and injury data to the period of 1992 to 2000. Using this constraint, the IMIS data yielded a total of 44 accidents related to confined spaces in construction that resulted in 34 fatalities and 39 injuries. Collectively from these two data sources, CONSAD was able to identify a total of 65 accidents related to confined spaces in construction during the period of 1992 to 2000 in which 58 fatalities and 39 injuries occurred.[34]

For the PEA, OSHA used the 58 selected fatalities from the 9-year period of 1992 to 2000 as a baseline to develop an estimate of the number of fatalities and injuries that this standard would potentially prevent. At that time, OSHA estimated that there was an average of 6.44 [35] confined-spaces-in-construction fatalities per year. In Section 4.3 of the CONSAD Report, CONSAD, with the assistance of its safety professional, did a further analysis of the fatality data used to estimate the safety benefits in the PEA and developed a methodology for determining the likelihood of preventing an accident with full compliance with the provisions of this standard. Using the expertise of CONSAD's safety engineer, CONSAD assigned each accident used in the analysis a ranking of 1 to 4, with 1 meaning that it was highly unlikely that the standard would prevent the victim's fatality or injury, and 4 meaning that is was highly likely that the standard would prevent the victim's fatality or injury. CONSAD then translated these rankings into probabilities that the standard would prevent each fatality or injury, using percentages of 5 percent for a ranking of 1, 35 percent for a ranking of 2, 65 percent for a ranking of 3, and 95 percent for a ranking of 4.[36] CONSAD subsequently aggregated the data and drew the conclusion that full compliance with the standard would prevent, on average, 91 percent of the fatalities and injuries.[37] OSHA reviewed and approved the CONSAD analysis and applied this probability prevention rate to the fatality estimate of 6.44 fatalities per year, and estimated in the PEA that full compliance with the provisions of this standard would prevent an estimated 5.9 (rounded to 6) confined-spaces-in-construction fatalities per year.

One commenter, Associated General Contractors of America (AGCA), commissioned a report by Dr. N. Mike Helvacian (ID–222) that made several criticisms of the methodology for estimating prevented fatalities and injuries in the PEA. The report characterized the approach to assigning prevention probabilities to accidents as ''a subjective assessment that cannot be reproduced by other safety professionals'' (p. 57). Another commenter stated that there was no basis for the estimate that full compliance with the final standard would eliminate 90 percent of fatalities and injuries (ID–100).

In light of such comments, as well as other comments received on the proposed rule and the PEA, OSHA reevaluated the original fatalities used to develop the benefits estimates and revised its values accordingly, as shown in Table IV–8. Based on the IMIS data, the CONSAD analysis showed 44 accidents during the period of 1992 to 2000 (listed in Appendix C.1 of the CONSAD Report, beginning at CONSAD Accident Number 57 and ending with CONSAD Accident Number 100), of which 34 fatalities and 39 injuries were reported.[38] Of those 44 accidents, 27 of them included fatalities listed, along with their narratives, in Table IV–9 below.[39]

Due to a confidentiality agreement made with the Bureau of Labor Statistics, OSHA did not include details

[34] While there is overlap between fatalities and injuries reported in OSHA IMIS and BLS CFOI, using information such as date, time, place, and names of affected individuals and firms allowed the contractor to find the unique incidents reported in each database.

[35] A commenter stated that ''it is unknown and not reported how OSHA has determined these figures. Practically, it is unknown how there could be a .44 fatality'' (ID–0100). OSHA notes that the estimated number of preventable fatalities can take on decimal values since it is an average value.

[36] CONSAD estimated a maximum effectiveness in preventing fatalities of 95 percent because the researchers believed that even a reasonable effort at compliance would not result in perfect compliance. OSHA believes that this percentage is very conservative as the standard has multiple layers of protection that assure that even fail to comply with some requirements, there are further protections to preventing fatalities and for reducing fatalities to injuries. The standard is unlikely to prevent any fatalities only when the employer completely fails to identify a space as a confined space and, thus, fails to take any of the appropriate measures. However, if there is a complete failure to identify a confined space, the employer will incur no costs.

[37] Thus, the vast majority of the accidents had a rating of 4 and a 95 percent probability of prevention.

[38] Note that an accident could involve several workers, with some injured and some killed.

[39] Table IV–9 only provides the narratives of the fatalities (with injuries omitted) shown in Appendix C.1 of the CONSAD Report; the CONSAD accident number listed for each accident in the table refers to the location of the narrative for that accident in the report.

of the accidents gathered from the CFOI database in the PEA or this FEA. However, the CONSAD report provides a detailed description of the methodology used to collect construction-related accidents involving confined-space entries from the CFOI database; OSHA made this description available for public viewing and commenting in the docket under Docket ID: OSHA–2007–0026–003.

OSHA still believes that CONSAD's analysis of the number of accidents that would be prevented by the standard given full compliance is reasonable. First, no existing standard provides a comprehensive approach to confined spaces in construction. There is an existing construction standard requiring employers to train employees in confined-space hazards. However, this existing standard does not specify what constitutes a confined space, nor does it specify the contents of the training that would serve to prevent fatalities or injuries due to confined-space hazards. There are also rules governing specific hazards, such as immediately dangerous to life and health (IDLH) atmospheres and hazardous gases, but OSHA did not adapt these rules to the specific circumstances of confined spaces; therefore, these rules are unlikely to provide adequate protection to workers when they encounter the hazards within a confined space. As demonstrated by the number of fatalities and injuries between 1992 and 2000, and confirmed by the supplemental data indicating that the fatalities and injuries continued to mount in more recent years, the existing rules have not been effective in preventing confined-space fatalities in construction. OSHA shares the belief of the ACCSH, as well as the other industry representatives who recommended that OSHA conduct this rulemaking, that a rule specific to confined spaces in construction could prevent these fatalities in a way that existing rules do not.

Table IV–9 shows fatalities occurring as a result largely of atmospheric hazards—either insufficient oxygen or the presence of lethal gases, particularly carbon monoxide or hydrogen sulfide—all of which this standard would prevent. This standard also could prevent fatalities that resulted from construction-related explosions or fires. In addition, a number of the fatalities were the result of would-be rescuers entering a confined space to assist another employee and succumbing to the same hazard, a result this standard would prevent.

Perfect compliance with the final standard would prevent all of these fatalities in several ways. First, identification of confined spaces would trigger the need for analysis and testing for possible hazards, as well as restrictions to prevent unauthorized entry. To the extent employers find hazards but cannot remove them, a system of controls would go into place. This system would prevent casual entry into confined spaces, such as occurred in CONSAD accident number 76 and entry by an employee working alone as occurred in the accidents with CONSAD accident numbers 72 and 84.[40] When entry was necessary, there would need to be appropriate and continuous testing, and employers would have to install ventilation to remove the atmospheric, or explosion and fire, hazards, or provide appropriate PPE. Better data sharing also may prevent some accidents, such as accident number 92. These factors would prevent most fatalities resulting from to atmospheric or explosion hazards.

To the extent these measures failed, the final standard also includes provisions for rescue, and prohibitions against unauthorized rescue entries. Rescue provisions may not prevent all fatalities that result from hazards such as explosions, but they can be crucial when atmospheric hazards are present. Adequate rescue might prevent fatalities that do not result in instant death. For example, quick withdrawal of workers from an explosive atmosphere or workers suffering from asphyxiation (followed by adequate first-aid measures) could prevent many fatalities. The rescue provisions would also prevent fatalities due to entry of inadequately equipped rescuers, either by removing the need for entry (providing non-entry rescue capability) or by assuring that the rescuers have adequate equipment for entry. Such rescue-related fatalities occurred in accidents 72, 84, and 97, and nearly occurred in several other accidents such as accident number 92.

In addition to atmospheric hazards, Table IV–9 shows a few other types of hazards. These include drowning and physical hazards such as dislodged plugs. The provisions for upstream-warning systems might prevent some of these drownings. Several of the accidents involved physical hazards posed by pipe plugs (or exposure to the physical hazards only temporarily restrained by the pipe plug); the requirements in the final standard to remove or isolate physical hazards through physical barriers or other means, rather than temporarily controlling the physical hazards, would eliminate employee exposure to such hazards during a confined-space entry and prevent some of these drownings. For example, having water bypass an area, rather than relying on a plug to hold the water, would prevent some of these accidents. The ability to quickly remove an injured employee with a retrieval line would also prevent a fatal accident in some cases. In many cases, better hazard awareness, compliance with permit-program requirements that prohibit entry when hazards are present, and the use of retrieval lines and other rescue procedures would make a difference.

Based on this review, OSHA believes that CONSAD's estimate that the standard would prevent 91 percent of the confined-space fatalities in their database seems reasonable. In almost all cases, multiple provisions would, if fully followed, completely prevent the fatalities. However, this estimate is in some senses a maximum estimate of the effectiveness of the standard. The estimate assumes full compliance, and OSHA's experience in general industry shows that perfect compliance with a similar standard was not achieved.[41] It is also possible, though none of the accidents examined illustrate this phenomenon, that an employer might have confined space incident even when in compliance with the standard due to an unanticipated equipment failure (such as an air hose developing leaks) or gross human error (such as an attendant falling asleep). However, not a single incident OSHA has examined occurred in a situation in which an employer was in compliance with the provisions of the standard.

In this Final Economic Analysis (FEA), OSHA revised its estimates with the same methodology used in the PEA, but also added supplementary data (*i.e.,* Table IV–10, described later in this section) whereby the Agency used new data to address a commenter's point and to confirm the continuing validity of the original data.

Several commenters questioned generally whether OSHA properly included the accidents used to estimate benefits in the PEA, but did not point

[40] Hereafter, this discussion will refer to all incidents by their CONSAD accident numbers.

[41] Seong and Mendeloff (2004) have found that past OSHA safety regulations' effectiveness at reducing occupational hazard-related mortality has been substantially lower than estimated by OSHA. It should be noted that (1) OSHA is forecasting effectiveness with full compliance and Seong and Mendeloff measured effectiveness given actual compliance, and (2) OSHA uses a fundamentally different approach to estimating benefits to this (and most other) safety standards than was used in the analyses the Seong and Mendeloff study reviewed. Nevertheless, this study potentially provides empirical support for the characterization of 91 percent as an upper bound in terms of the benefits that will actually be realized.

to any specific accidents that they would remove from the list of IMIS fatalities provided in the public record for this rulemaking. One of these commenters, the Associated General Contractors of Texas—Highway, Heavy, Utilities and Industrial Branch (AGCT), stated that OSHA did not specify the industry sectors in which the fatalities and injuries occurred (ID–0124).

AGCT also asserted that ''most potential exposures to confined space hazards in the construction industry occur in connection with excavation operations,'' and that other standards adequately address these hazards (ID–124). Another commenter stated that the PEA included accidents in trenches, while the proposed standard excluded trenching work (ID–035). In response, OSHA notes that the proposed standard did not apply to non-sewer construction work regulated by 29 CFR part 1926, subpart P—Excavations. However, the proposed standard applied to sewer work that fell under subpart P and, therefore, the inclusion of some accidents in trenches was consistent with the scope of the proposed rule. Final § 1926.1201(b) eliminates the distinction between non-sewer construction work and other construction work; the final standard clearly states that it does not apply to work regulated by 29 CFR part 1926, subpart P. As a result, the FEA does not include the costs and benefits associated with accidents occurring in trench-related activities unless they also involve confined spaces other than the trench (*e.g.,* a pipe placed inside the trench).

In addition, AGCT asserted, without support, ''Most sewer related fatalities involve municipal workers who are not covered by OSHA standards'' and expressed concern that it would be unfair and improper for OSHA to include benefits to municipal workers not covered by OSHA standards (ID–124). AGCT did not, however, point to any examples in the IMIS fatality data on the record that involved municipal workers. OSHA reexamined the 1992–2000 IMIS data and did not find any indication that these examples involved fatalities of municipal workers. Moreover, while AGCT's assertion may hold true with respect to the normal maintenance activities in sewers typically performed by municipal workers, AGCT did not distinguish in its comments between municipal-worker fatalities resulting from sewer work performed as part of construction and normal maintenance activities. To the contrary, it is OSHA's understanding that private contractors perform most sewer-construction activities.

Another commenter, Edison Electric Institute, stated that the analysis did not explain the basis for determining how the included accidents involved construction work, and that the analysis should exclude ''public sector'' work (ID–210, Tr. pp. 98–100). OSHA limited the accidents that served as the basis of the benefits analysis in the PEA to construction work based on the industry code of the employer of the worker involved in the accident. The final standard covers employers subject to OSHA enforcement authority and engaged in construction activity not covered by 29 CFR part 1926, subparts Y—Commercial Driving Operations, P—Excavations, or S—Underground Construction, Caissons, Cofferdams, and Compressed Air, so the final standard covers ''public sector'' work only to the extent that such work is within OSHA's enforcement authority. To the extent that ''public sector'' work means work conducted by municipal employees, OSHA refers to its response in the previous paragraph.

In response to these criticisms, OSHA reviewed the fatalities in the CONSAD IMIS database with respect to the issue of whether a construction standard would cover those accidents. First, the standard would cover municipal workers in state-plan states. However, there is not a single instance in Table IV–9 that identifies a municipal worker as a fatality. As CONSAD reported, all fatalities were for firms in a construction SIC code, and not for firms in a local government SIC code. Some commenters may believe, incorrectly, that contracted construction work funded by a municipality in a non-state plan state is not subject to OSHA standards; if the work involves an employee of a private-sector employer, that employer is subject to OSHA standards regardless of whether or not a local government funds the work.

OSHA then examined whether the general industry standard or any other OSHA standards covered the fatalities. It is difficult to determine coverage from the IMIS descriptions alone, so OSHA examined what standards it cited at the time of the fatality investigation. Even this approach may be unreliable because there may be a citation for a violation associated with a fatality inspection that did not involve a violation that directly contributed to the fatality. OSHA found that only two fatality accidents (89 and 99) had any citations under general industry standards. Absent a clear indication of a causal link between the general industry work cited and the fatality, OSHA is reluctant to remove these accidents. Moreover, even if these fatalities were the result of general industry activity, OSHA believes that it should include these two fatalities as prevented by the construction standard because it is possible that the employer believed the activities constituted construction work and, therefore, not covered by the general industry standard. With the promulgation of this final rule, it will now be clear that all confined spaces are subject to an OSHA standard, and that similar precautions apply to these spaces.

With respect to excavations, OSHA found only three accidents in which it cited the excavation standard (66, 80, and 86). However, OSHA believes that in all three cases, the fatality occurred in a confined space. The accident investigator identified the worksite in Accident 66 as a confined space. Accident 80 describes an entry into a manhole, which normally means a confined space. Accident 86 describes the activities as ''finish up work,'' implying the excavation phase of the project was complete when the accident occurred.

Several of the accidents involved underground activities, so OSHA examined the accidents for citations to subpart S, OSHA's underground construction standards. OSHA did not find any such citations and, therefore, did not exclude any accidents on that basis.

As a result of the decision, discussed in the cost analysis in this FEA, to exclude costs in state-plan states that adopted some provisions of a confined-spaces standard for construction, OSHA examined whether any of the fatalities involved citations to a state confined-spaces-in-construction standard. OSHA found two such cases—Accidents 67 and 82. Accident 67 occurred in Alaska, which has a comprehensive confined-space-in-construction standard that included almost all of the provisions in this final confined-space standard. OSHA decided not to include this fatality in the list of fatalities that this standard would prevent given full compliance with the rule. Accident 82, however, occurred in a state that required only mechanical ventilation of confined spaces, and no other provisions of this OSHA standard. OSHA believes that a full confined-space program compliant with this standard would prevent this accident, while a simple ventilation requirement would not.

TABLE IV–9—CONFINED SPACES IN THE CONSTRUCTION INDUSTRY FATAL ACCIDENTS AND INJURIES—1992–2000

[As listed in the Consad report]

Consad accident No.	Year	Industry SIC code	Type of confined space	Number of reported fatalities	Inspection/ activity No.
57	1992	1623	sewer/pipe/manhole	1	109472456

Description of Accident:
At approximately 11:30 a.m. on April 16, 1992, Employee #1 entered a 15 ft. 9 in. deep manhole that was part of a new sewer line installation project in order to plug two sewer lines with wing nut plugs. Employee #2 and a third employee were at the top of the manhole watching as Employee #1 entered the hole and inserted one plug near the top, then proceeded down the ladder to the bottom to install the second plug, which took approximately 4 minutes to install. Employee #1 then stated he was hot, started up the ladder, and fell unconscious to the floor. Employee #2 entered the manhole and attempted to sit Employee #1 upright. Employee #2 then began feeling faint and started up the ladder to exit. A little more than halfway up he passed out and was left hanging from the ladder. The third employee then ran for help. A superintendent tied a rope around himself, held his breath, and rescued Employee #2, who was transported to the hospital, where, after undergoing a blood gas test, he was treated for carbon monoxide exposure. Employee # 1 died from acute carbon monoxide poisoning before he was retrieved from the manhole. The company had no confined space entry procedure in place for this particular job site because they did not consider new manholes to reasonably pose a risk to workers. No measuring equipment was used to detect toxic or combustible gases and oxygen levels. No mechanical ventilation was used. No rescue equipment was available.

61	1992	1799	Other	1	115562290

Description of Accident:
At approximately 7:45 a.m. on October 27, 1992, Employee #1 was preparing to fiberglass the interior surface of a swimming pool that measured 30 ft long and 16 ft wide with a depth of 4 ft at the shallow end and 9 ft at the deep end. Overnight, a water faucet adjacent to the pool had leaked water into the pool. Employee #1 was removing the standing water in the bowl of the deep end. Initially, he used a sponge and bucket to remove the water. Later, he used about 2 gal of acetone to help accelerate evaporation of the remaining water. He then used a non-explosion-proof shop vacuum to vacuum the remaining water-acetone mixture. Switching on the vacuum created a spark that ignited the acetone vapor in the bowl of the pool. The resulting explosion and fire caused second- and third-degree burns on 70 percent of his body. Employee #1 was hospitalized until November 12, 1992, when he died of complications.

64	1993	1623	sewer/pipe/manhole	1	114834930

Description of Accident:
On September 17, 1993, Employee #1, of Dan's Excavating Inc., a laborer on a sewer construction crew, entered a 26 ft deep manhole to check the line sight glass for water levels. After he had climbed to the bottom of the manhole, Employee #1 made a noise as if he were clearing his throat and then started climbing back out. When Employee #1 was 6 to 8 ft from the top he looked up, let go of the ladder, and fell backward to the bottom of the manhole. Employee #1 died of asphyxia. The atmosphere had not been tested before he entered the manhole. When it was later tested at the manhole level from which Employee #1 fell, an oxygen deficiency was found. Citations were issued for serious violations of R408.40121(1), R408.40121(2), and R408.41115(8).

65	1994	1771	sewer/pipe/manhole	1	124771049

Description of Accident:
Employee #1 was applying grout in a manhole. There had been a 20 to 36 in. rubber plug installed into a 36 in. sewer line that entered the manhole in which Employee #1 was working. For some unexplained reason, the rubber plug exploded, hitting Employee #1 and forcing him down the downflow side of the sewer line. Employee #1 died at the scene of severe head injuries.

66	1994	1629	Undetermined	1	107232167

Description of Accident:
Employee #1 entered a confined space with a lighted torch. The atmosphere was not tested and contained an explosive concentration of propane gas. The propane gas exploded, sending the employee approximately 20 feet in the air, and igniting his clothing. Employee #1 sustained 2nd- and 3rd-degree burns over 70 percent of his body. He died of respiratory arrest two days later. A propane torch had been left on in the space overnight and the flame had gone out, allowing propane to accumulate. Citations were issued.

67	1994	1623	Undetermined	1	124078163

Description of Accident:
Employee #1 died of asphyxia when he was directed to enter a confined space without full compliance with confined space standards and associated procedures.

68	1994	1623	sewer/pipe/manhole	1	109054866

Description of Accident:
Employees #1, #2, and #3 were in a dry well modifying sewer mains. Fluids left in the pipe for three months flowed into the work area. The fermenting fluids released hydrogen sulfide gas. Employees #1 and #2 were hospitalized. Employee #1 died of asphyxiation. Employee #2 is in a long term health care facility in Westchester, NY. Employee #3 was treated and released.

TABLE IV–9—CONFINED SPACES IN THE CONSTRUCTION INDUSTRY—Continued
FATAL ACCIDENTS AND INJURIES—1992–2000
[As listed in the Consad report]

Consad accident No.	Year	Industry SIC code	Type of confined space	Number of reported fatalities	Inspection/activity No.
69	1994	1794	sewer/pipe/manhole	1	110465739

Description of Accident:
At approximately 7:00 a.m. on November 21, 1994, Employee #1 and a coworker, laborers, began removing the rubber bladder plugs from a 48 inch storm sewer drain system to allow the construction site to drain off standing water captured by the blocked line. They climbed into the 10 foot deep manhole D–2, and placed two jointed pieces of 2 by 4s against the end of the metal portion on the rubber bladder plug and the manhole wall to prevent the plug from being swept downstream in the 48 inch storm sewer drain pipe. They then climbed out of manhole D–2. Air pressure was released from the plug installed in the storm sewer drain pipe in manhole D–2 to allow the stored water to pass. Employee #1 told his coworker to release the air pressure from the plug in manhole mixing box D–3, located approximately 71 feet away and upstream adjacent to the flightline. When the coworker arrived at mixing box D–3, it was under water. The employees conversed and the coworker was told to take the air release valve assembly out of the air vent hose to completely deflate the upstream plug. The employees knew this plug was secured by a rope attached to mixing box D–3. They stood around the opening to manhole D–2, and conversed when they noticed the 2 by 4 brace holding the rubber bladder plug in manhole D–2 in the inflow pipe was coming loose. Employee #1 entered manhole D–2 without an access ladder and attempted to shore up the brace by stomping it back into a horizontal position while standing on the lip of the outbound pipe. He was washed down the storm drain and drowned.

Consad accident No.	Year	Industry SIC code	Type of confined space	Number of reported fatalities	Inspection/activity No.
70	1995	1623	sewer/pipe/manhole	1	116508169

Description of Accident:
Employee #1 was standing on a ladder while removing the rubber plug of an 8 inch sewer line in a manhole. He fell from the ladder into the bottom of the manhole, which contained waste product. Employee #1 attempted to climb out, but fell backward into the manhole. Employee #1 drowned in the bio-residue that was at the bottom of the manhole.

Consad accident No.	Year	Industry SIC code	Type of confined space	Number of reported fatalities	Inspection/activity No.
72	1995	1542	Pit	2	108724915

Description of Accident:
At approximately 7:45 a.m. on November 9, 1995, Employees #1 and #2 were dismantling a scaffold that was approximately 12 ft above an open 45 ft by 60 ft excavation. Employee #1 allegedly fell into the pit on the west side. Employee #2 ran to the ladder on the east side of the pit to help. He collapsed at the bottom of the pit by the ladder. Employees #3 and #4 also went into the pit by the east side ladder. Employee #3 collapsed behind the ladder on a dirt mound about 3 to 5 ft above the bottom of the pit. While descending the ladder, Employee #4 began to feel lightheaded and weak in the knees, and was pulled out of the pit by two Reynolds employees. Two coworkers, who were fire brigade members, also responded to the emergency. One descended the ladder without SCBA and collapsed at the bottom of the pit on top of Employee #2. The other coworker also started down the ladder without SCBA, began to feel lightheaded and weak in the knees, and was pulled out by Reynolds employees. Employees #1 through #3 died of asphyxia and Employee #4 was hospitalized for approximately one month. Argon gas had been used instead of compressed air to operate a pump that removed water from the pit.

Consad accident No.	Year	Industry SIC code	Type of confined space	Number of reported fatalities	Inspection/activity No.
76	1996	1623	sewer/pipe/manhole	1	300602943

Description of Accident:
Employee #1 and a coworker were assigned to search for a missing plug in one of several manholes in an active sewer system. They opened three manholes, climbed down 12 ft, and used a flashlight to look in the 15 in. pipes. Employee #1 then went into a fourth manhole, where he was overcome by toxic gases. He died several hours later.

Consad accident No.	Year	Industry SIC code	Type of confined space	Number of reported fatalities	Inspection/activity No.
77	1996	1629	sewer/pipe/manhole	1	300947256

Description of Accident:
Employee #1, a laborer, and his foreman arrived at a manhole to open a mechanical valve at the bottom of the manhole. While Employee #1 was removing the manhole cover, the foreman was 5 ft away at his truck getting the air tester. When the foreman turned around to go back to the manhole, he saw the top of Employee #1's head disappear into it. The foreman then looked down into the manhole and saw that Employee #1 was unconscious. The foreman tested the air in the manhole and obtained a reading of 14% oxygen. He immediately called 911, and Employee #1's body was retrieved by the local fire department with the use of SCBAs. OSHA's testing of the manhole showed oxygen levels of between 12 and 14 percent. Tests for carbon monoxide, hydrogen sulfide, and flammable vapors were negative. Tests for carbon dioxide were positive, with a reading of 35,000 ppm.

Consad accident No.	Year	Industry SIC code	Type of confined space	Number of reported fatalities	Inspection/activity No.
78	1997	1711	Pit	1	116308453

Description of Accident:
Employee #1 was working at the bottom of a 10 ft deep pit when he passed out. A coworker who went down to rescue him started to feel sick, so he emerged from the pit and called for help. He then reentered the pit with a second coworker, who passed out before Employee #1 could be rescued. The first coworker was again able to escape. Emergency Services arrived and extricated Employee #1 and the second coworker from the pit. Employee #1 died of asphyxia from inhalation of argon gas.

TABLE IV–9—CONFINED SPACES IN THE CONSTRUCTION INDUSTRY—Continued
FATAL ACCIDENTS AND INJURIES—1992–2000
[As listed in the Consad report]

Consad accident No.	Year	Industry SIC code	Type of confined space	Number of reported fatalities	Inspection/ activity No.
79	1997	1794	sewer/pipe/manhole	1	127317493
Description of Accident: At approximately 11:00 a.m. on March 4, 1997, Employee #1 entered a recently constructed 8 ft deep by 4 ft diameter manhole to retrieve a clod of dirt on the bottom. He was one his way out when he fell back in and lost consciousness. Employee #1 died of asphyxia. He apparently was overcome by high levels of methane gas.					
80	1997	1623	sewer/pipe/manhole	1	122227283
Description of Accident: At approximately 4:30 p.m. on August 4, 1997, Employees #1 through #3 were working on a sewer system project in a residential area. Employee #1 descended into a 12 ft deep manhole to apply jointing compound and to remove some laser sighting equipment. After several minutes, Employees #2 and #3 noticed that Employee #1 had collapsed. They shouted to the foreman, who ran to the manhole, surveyed the situation, and immediately called 911 from his truck. Meanwhile, Employees #2 and #3 entered the manhole to rescue Employee #1. Employee #3 later stated that he did not notice any unusual odors, but that he and Employee #2 began to feel dizzy during their rescue efforts. They lifted Employee #1 to coworkers at the surface, after which Employee #3 climbed out of the manhole and collapsed. Employee #2 tried to ascend the ladder, but collapsed to the bottom of the manhole. Employees #2 and #3 were taken to separate hospitals and treated for carbon monoxide exposure. Employee #1 was taken to the emergency room, where he was pronounced dead. The autopsy report listed the cause of death as carbon monoxide inhalation. The employer had confined space entry procedures in place, but did not implement them. At the time of the accident, there was no rescue equipment near the manhole and testing was not done for toxic or combustible gases prior to the employees' entry. No mechanical ventilation was used for the manhole.					
82	1998	1794	sewer/pipe/manhole	1	127298925
Description of Accident: Employee #1 died of asphyxiation when he entered a sewer bore casing. Employee #1 entered the sewer bore casing when the casing struck a rock and was unable to get out. A second employee also went into the casing but managed to get out.					
83	1998	1623	sewer/pipe/manhole	1	301312757
Description of Accident: A construction crew of four men was tying an old sewer line into the new sewer system. Employee #1 broke a plug within the new sewer line and began to climb up the ladder toward the opening of the manhole. Gas rushed from behind the plug and overcame him, causing him to fall back into the hole. The second employee saw Employee #1 fall back into the manhole. He quickly went down to rescue him. The second employee partially reached the bottom of the hole before he decided to come back up. The two remaining employees eventually went down into the hole. The second employee managed to get out of the manhole and summon help. The Fire Department Rescue Team retrieved the third and fourth employees before they became totally incapacitated. Employee #1 died of asphyxiation. The other three employees were sent to the hospital for medical treatment.					
84	1998	1623	sewer/pipe/manhole	2	110040383
Description of Accident: Employees #1 and #2 were part of a construction crew building an extension sewer line that was to tap into an existing city line. The crew had exposed one side of a manhole in the city sewer line and a subcontractor had core-drilled a hole in it for placement of the new line. Some concrete remained intact after the drilling was completed. Employee #1 was lowered into the manhole using a chain draped over a rock bar. He was immediately overcome by the high levels of hydrogen sulfide. Employee #2 attempted to rescue him but was also overcome by the fumes. Both workers were killed.					
85	1998	1623	sewer/pipe/manhole	1	302098892
Description of Accident: Employee #1 entered a 9 ft deep manhole to apply sealant to the connecting concrete rings. This was the last, and the deepest, of the six manholes he had entered. Shortly after reaching the bottom, Employee #1 was overcome by hydrogen sulfide gas that had collected in the manhole. He was killed.					
86	1998	4911	sewer/pipe/manhole	1	301768784
Description of Accident: Some employees were installing a French drain system to collect water seeping from a slurry pond. The employees were entering the catch basin to do the final touch-up work by riding the bucket of a backhoe down into the basin. One of the employees, a 57-year old supervisor, was engulfed by vapors that were later found to be hydrogen sulfide. He died of inhalation of toxic fumes. Four other employees were hospitalized for exposure to the hydrogen sulfide.					

TABLE IV–9—CONFINED SPACES IN THE CONSTRUCTION INDUSTRY—Continued
FATAL ACCIDENTS AND INJURIES—1992–2000
[As listed in the Consad report]

Consad accident No.	Year	Industry SIC code	Type of confined space	Number of reported fatalities	Inspection/ activity No.
89	1999	7699	Tank	1	302710413
Description of Accident: An employee was painting the interior of a 15,000-gallon water storage tank with epoxy primer paint. An airless spray was being used for this task. An organic vapor air purifying respirator was in use and three small exhaust fans were drawing from the 12-in. pipe openings in the tank. The employee was found dead at the bottom of the section of the tank used for initial filling and settling. There was no confined space program or procedure in place at the time of the incident and the employee was working alone without the knowledge of the supervisor(s). The medical examiner's report stated that death was caused by an overexposure to organic vapors consistent with those found in the paint formulation (MiBK, Toluene, Xylene). The Atlantic City Fire Department Confined Space Rescue Team had measured approximately 3 of the LEL for these vapors at the time they removed the deceased from the tank.					
90	1999	1799	Other	1	302558580
Description of Accident: Employee #1 was spraying Sunflex, a waterproofing substance, inside the bottom half of a 7 ft by 5 ft by 9 ft concrete stoop while the coworker went to their truck to get more insulating boards. When the coworker returned, he found Employee #1 collapsed at the bottom of the stoop. Employee #1 was rushed to the hospital, where he later died.					
92	1999	1794	sewer/pipe/manhole	1	303139166
Description of Accident: Employee #1 entered a new manhole approximately 21 ft in depth and was overcome, lost consciousness, and was unresponsive. Employee #2 entered the manhole in an attempt to rescue Employee #1 and was also overcome and lost consciousness. Two additional co-workers attempt[ed] to rescue Employee's #1 and #2 but became dizzy, disoriented and experienced shortness of breath. These employees were able to exit the manhole. The manhole had been installed approximately two weeks earlier and was placed over an existing and active sewer line which had not yet been tapped. Employee #1 was pronounced dead at the scene and Employee #2 was hospitalized.					
95	2000	1731	sewer/pipe/manhole	2	119947521
Description of Accident: Two employees of an electrical contractor were working in a 7.9-meter-deep sump manhole at a water desalination facility site under construction. An employee of a general contractor found the employees unconscious at the bottom of the manhole. An outside rescue service from a local fire department responded and found the atmosphere in the manhole to contain 8 percent oxygen at the bottom of the sump. The two employees died of hypoxic asphyxia. Post accident evaluations found oxygen levels as low as 2 percent and elevated levels of nitrogen and carbon dioxide. The sump was found to be in contact with warm, moist soil through a series of interconnected perforated pipes designed to drain excess groundwater. It was suspected that biological activity in the surrounding soil consumed the available oxygen and generated excess levels of nitrogen and carbon dioxide.					
97	2000	1623	sewer/pipe/manhole	2	303961155
Description of Accident: At approximately 12:15 p.m. on September 26, 2000, Employees #1 and #2 were trying to unclog a sewer line. Employee #1 entered the north manhole to place a bucket that would catch all the debris coming out of the pipe. Employee #2 was able to release the blockage in the south manhole, and the water moved to the north manhole. Employee #1, who was still there, called for help and Employee #2 ran to his assistance. Both workers succumbed to gas present in the pipe, and died of asphyxia.					
98	2000	1771	sewer/pipe/manhole	1	303185839
Description of Accident: Employee #1 inserted an inflatable plug into a storm sewer pipe located at a street drain so that the pipe could be pumped of water in order to perform concrete work at the other end of the pipe. He was half way in the drain and was pushing on the inflatable plug to check its fit. The plug burst and blew him down an intersecting pipe where he drowned.					
99	2000	1799	Other	1	303682223
Description of Accident: Employees #1 and #2, who worked for a nested maintenance contractor, were finishing the turnaround of the sulfur recovery complex at a refinery. They were removing a 14 in. isolation blind from the overhead inlet of a horizontal receiver vessel. The vessel was part of an amine treating unit that had been emptied, steamed out, and drained a few days before. After several attempts, the overhead piping had been replaced and the blinds had been removed and reinstalled. Employees #1 and #2 were working from a scaffold when they were exposed to strong hydrogen sulfide emissions from the vessel. Employee #1 staggered away, but within minutes had lapsed into unconsciousness and died. Employee #2 managed to escape and reach grade level. He was hospitalized for observation and released with no lasting effects. The vessel had accumulated sour gas from a connected overhead gas line, tied into nearby sulfur trains that were operating at relatively low pressure. The source was a single leaking 12 in. gate valve that had been closed and locked out. Employees #1 and #2 were working without respiratory protection or gas detection equipment. The valve inspection program, lockout/tagout program, and respiratory protections were found lacking. At the time of the accident, the foreman was also overseeing other crews at the site.					

TOTAL NUMBER OF FATALITIES: 31

TABLE IV–9—CONFINED SPACES IN THE CONSTRUCTION INDUSTRY—Continued
FATAL ACCIDENTS AND INJURIES—1992–2000
[As listed in the Consad report]

Consad accident No.	Year	Industry SIC code	Type of confined space	Number of reported fatalities	Inspection/ activity No.
TOTAL NUMBER OF FATALITIES PREVENTABLE BY THE CONFINED–SPACES–IN–CONSTRUCTIONS PROVISIONS: 30					

Source: OSHA IMIS database, analyzed by OSHA, Directorate of Standards and Guidance and Directorate of Construction.

OSHA also reviewed the narratives for accuracy. OSHA found duplicate fatalities reported for CONSAD Accident Numbers 65, 69, and 72, and removed those duplicates from the analysis. In this regard, Appendix C.1 of the CONSAD Report erroneously shows two fatalities for accident number 65, two fatalities for accident 69, and three fatalities for accident 72. The IMIS database for these cases, however, reported a total of one, one, and two fatalities, respectively. OSHA then reduced the 34 fatalities cited in the initial IMIS data report to a final total of 30 fatalities for the period of 1992 to 2000 to account for the three duplicative fatalities, in addition to removing the fatality described in CONSAD Accident number 67, discussed previously. OSHA notes that the original CONSAD analysis may not include all confined-space accidents. For example, the supplemental analysis at the end of this chapter found several confined spaces where there were electrical hazards; the CONSAD analysis did not include any electrical hazards. It is possible that the original analysis incorrectly excluded confined spaces when the only hazards were electrical.

Due to a confidentiality agreement with BLS, OSHA could not publish detailed information about the CFOI data used in the PEA, and OSHA no longer has access to the research file containing the data. To account for the possibility of human error of the initial review of the CFOI data, OSHA made a proportionate reduction in the total fatality count of the CFOI data used in the PEA. Applying a factor of 30/34 (derived from the adjusted count for IMIS fatalities due to reporting errors) to the initial CFOI fatality count of 24, the total number of CFOI fatalities decreased to 21.

Therefore, for this FEA, OSHA concluded that a total of 51 construction-related fatalities due to confined-spaces entries occurred during the nine-year period from 1992 to 2000. Full compliance with the provisions of this standard would prevent an average of 5.7 fatalities each year related to confined spaces in construction; applying a probability prevention rate of 91 percent, the standard would prevent 5.2 fatalities each year.

AGCA noted that the results from a survey of 74 of AGCA's members, employing 28,900 full-time workers, showed no fatalities in confined spaces, and only two fatalities in construction, between 2005 and 2007 (p. 59). The finding that 74 employers had no fatalities in confined spaces over a three-year period does not detract from, or contradict, OSHA's analysis. OSHA believes that such a result is perfectly consistent with the estimate that, from 1992 to 2000, there was an average of 5.7 preventable confined-space fatalities per year among the millions of workers engaged in construction covered by this standard.

Another comment from the AGCA report made several points asserting that a standard on confined spaces in construction was unnecessary. First, AGCA claimed that the rate of fatal and serious injuries ''in the affected industries'' is declining, and, second, that OSHA's analysis is deficient because it does not compare the construction rates with rates across other industries. The report states that ''[t]he injury trends have cost and benefit implications for assessing the proposal on a forward looking basis, which are not considered in the OSHA report'' (p. 58). In this case, the analysis of confined space incidents for the period 2006 to 2009 show a slight increase, rather than a decline, in the number of fatalities as compared to the original 1992 to 2000 period analyzed for the original PEA. OSHA therefore finds no reason to reduce benefits or costs as result of a long term trend toward safer practices in confined spaces. The report does not support its claim that OSHA's analysis was somehow deficient in not comparing the rates of injury in construction with the rates in other industries, but OSHA notes that construction activities generally have high injury rates. Moreover, contrary to the commenter's assertion that the fatality rate is declining in comparison to the older set of data analyzed in the PEA, when OSHA analyzed newer fatality data from between 2006 and 2009 (see Table IV–10) for the purpose of confirming the result under the older data, OSHA did not observe any decline. Instead, it found the annual fatality rate for confined spaces in construction over this period to be higher than during the earlier period.

The National Utility Contractors Association (NUCA) urged OSHA to model the construction rule on the general industry rule, as OSHA did in this final rule. In this comment, NUCA stated:

> It is also our opinion that there is no sound evidence to support the view that a new and separate standard for construction will reduce the number of confined space injuries and fatalities. * * * Therefore, issuing a new, separate standard for construction will not only create untold confusion, but also an unnecessary burden—with no improvement in safety—on all contractors who have been successfully using the General Industry Standard as a guideline to safe entry into confined spaces.

(ID–075.)

NUCA also suggested the new classification system in the proposed rule would have little benefit in terms of reduced accidents in confined spaces, but did not provide specific data to support their claims (ID–075). Other commenters pointed to the absence of fatalities among employers that complied with the general industry standard when engaged in construction activities (*e.g.,* ID–035 and ID–113).

As discussed extensively in the preamble, this final rule is much more similar to the general industry rule than was the proposed rule, and it includes a number of cost-saving measures not in the proposed rule. For example, this final rule excludes work performed under subparts S and entirely from the scope of the standard and allows suspension of the permit in certain circumstances. At the same time, the final rule for construction also includes several important distinctions and clarifications in comparison to the general industry standard. For example, the new rule defines the term ''controlling employer'' and shifts some of the duties that the general industry standard assigns to the host employer to the controlling employer. This difference is important in the many situations, of which there are several reported in the database, involving host employers who need construction work but may not directly run the confined-space program.

This final rule for construction also requires continuous monitoring for atmospheric hazards during permit entries and during entries under the alternative procedures specified in § 1926.1203(e). With the improved technology available today, continuous monitoring involves few costs beyond the cost of the regular monitoring required by the general industry standard. Further, such monitoring is necessary in confined spaces where conditions change as the work progresses, either through the introduction of an unexpected substance into the permit space, as in accidents number 68 and 78, or the substances used as part of the work result in new hazards as in accidents number 89 and 90.

To further evaluate and confirm its finding that this final standard would reduce the number of fatalities and injuries when entering construction-related confined spaces, OSHA added a supplemental table (Table IV–10 shown below) using more recent accident data, and modified its methodology for selecting relevant confined-space fatalities. The Agency did not rely on this data in reaching any of the findings legally required to support this rulemaking, but the Agency concludes that this supplemental analysis confirms the overall validity of the data on which it based those findings.

The Agency examined selected narratives of fatal accidents that occurred in the years 2006 through 2009 and recorded in OSHA's IMIS database. To identify fatal accidents in confined spaces, OSHA conducted a terminology search of fatal accident narratives using a list of several terms appearing in confined-spaces-in-construction work.[42] To limit the analysis to accidents related to construction activities, OSHA identified construction-related accidents by those employers classified under the two-digit Standard Industrial Classification codes of 15, 16, and 17. As with the older data, OSHA also screened the accidents for citations to subparts P (Excavations) and S (Underground Construction). OSHA reviewed the cases and selected only those cases covered by this final standard and that the final standard would, with reasonable certainty, prevent if employer complied fully with its provisions. In sum, OSHA identified 23 records involving 31 fatalities from 2006 through 2009 that met all of the above criteria (construction-related activities; in SIC 15, 16, or 17; involved a confined space covered by this final standard; and were preventable by compliance with the provisions of the final standard). Table IV–10 presents these cases, along with a brief narrative for each case taken verbatim from the IMIS records.

As the narratives demonstrate, these accidents usually resulted from a failure to follow multiple provisions in the final standard. For example, in several of the accidents listed in Table IV–10, workers died or received injuries after entering confined spaces to attempt rescue. These accidents were preventable had employers followed appropriate rescue procedures, provided proper training, posted an attendant to prevent unauthorized entry, or through a combination of these steps, all prescribed by this final standard. In most other examples, the prohibition on entry without a permit program in place would prevent employee exposure to the hazard.

For the purposes of determining how the different provisions of the standard prevent the accidents identified in the supplemental analysis, OSHA grouped the provisions by general purpose. For example, OSHA grouped all provisions related to evaluation and classification of standards into one heading called ''Classification and Evaluation,'' and grouped all of the provisions related to setting up and implementing a permit system under the heading of ''Permit System''. OSHA used these headings to avoid a confusing list of overlapping and interdependent provisions, and to compare benefits to costs later in this section.

The Agency sometimes attributed an accident to a set of provisions even though it was unclear from the accident abstract whether the employer followed that provision on a voluntary basis. Therefore, although OSHA accounts for baseline compliance in terms of costs, it does not account for baseline compliance in terms of potential monetized benefits. OSHA believes from the descriptions of the fatalities and injuries presented in Table IV–10 that baseline compliance with most provisions, though high when examining compliance across all affected industries, was minimal in the situations in which these accidents occurred. It is unlikely that the accidents detailed in this chapter would occur had the affected firms had a proper confined-spaces program in place. Following some groups of provisions, such as ventilation and hazard isolation, would have assured that the accidents could not have possibly happened.

OSHA also used the term ''potentially'' in this analysis to describe the prevention of some accidents because, as noted above, some accident descriptions are unclear. The Agency also used the term because some provisions, such as the training and information-exchange provisions, do not directly and automatically prevent accidents, but instead contribute to the likelihood that employers will correctly follow other provisions and, therefore, prevent accidents. In the final section of this chapter, OSHA presents a break-even sensitivity analysis to examine further the number of injuries and fatalities that would need to be prevented for the benefits of this standard to equal its costs.

In some cases, a state had a confined-spaces rule in place at the time the accident occurred. In one accident, the state rule was a comprehensive rule similar to this final rule. OSHA removed this accident from the database. In other cases, the state rule included only some of the provisions in OSHA's final standard. In these cases, OSHA did not list provisions in the OSHA standard that are also mirrored in the state rule, but listed the OSHA provisions not mirrored in the state rule.

In the remainder of this section, OSHA describes the groups of provisions that it used in analyzing accidents, and the criteria for determining whether the provision could potentially prevent the accident. Some accidents involved more than one fatality, and, in these cases, different sets of provisions might be relevant to different fatalities.

Evaluation, Classification, and Notification Provisions: This group includes all provisions related to requirements to identify and classify confined spaces, such as §§ 1926.1203(a) and 1926.1203(b). The evaluation and classification provisions can trigger other employer duties, such as an employer duty to prevent entry under § 1926.1203(c), or to condition entry in accordance with § 1926.1203(d). For the purposes of this analysis, this group includes the provisions of § 1926.1203(c) that require employers to use barriers or other means

[42] The list of search terms included the following: Confined space, hole, pit, bin, boiler, manhole, tank, incinerator, scrubber, pier, sewer, transformer, vault, duct, storm drain, water main, drilled shaft, enclosed, enclosed beam, crawlspace, trench, tunnel, vessel, digester, lift station, cesspool, silo, air receiver, sludge gate, air preheater, step up transformer, turbine, chiller, bag house, mixer, reactor, and cofferdam.

necessary to prevent unauthorized entry to a confined space. Since no other preventive measures would go into effect without such evaluation and classification, OSHA found that these provisions had potentially preventive effects for all accidents examined.

Information-Exchange Provisions: This group includes all provisions related to requirements for host contractors, controlling contractors, and other contractors to exchange information, such as § 1926.1203(h). The accident descriptions are unclear regarding information-exchange activities. OSHA classified an accident as potentially prevented by these provisions if the description indicated the presence of more than one contractor or if the accident took place in an existing structure (mainly sewers) where information about the existing structure would almost certainly be known beforehand. OSHA did not consider the accident potentially prevented by this provision if it took place in a home or in new construction projects, unless there was an indication of multiple contractors present. In those cases, there is not typically a host employer with relevant knowledge about hidden hazards available, but there may be multiple employers present. Because the accident descriptions do not typically indicate whether there were multiple employers on a site, this approach may underestimate the number of multi-contractor sites.

Permit-Program Provisions: This group includes the provisions requiring a permit program or alternative procedures for entry, as well as the requirements for setting up and implementing systems, such as §§ 1926.1203(d), 1926.1203(e), and 1926.1204(a). OSHA determined that these provisions could have a role in potentially preventing accidents in all situations except where the entry took place by explicit orders of a supervisor or where the entry was for rescue purposes. (These two exceptions might be violations of these requirements, but it is unlikely that a permit system could prevent casualties related to rescue entry (though they might prevent the need for such entry) or entries explicitly approved by supervisors.) OSHA also noted situations in which an entry seemed to be unnecessary (such as entries to retrieve dropped items) and, therefore, was extremely unlikely to take place under a permit system with clear prohibitions on unauthorized entry. OSHA determined that all such accidents involving unnecessary entries would be preventable had employers complied with these provisions.

Early-Warning-System and Atmospheric-Testing or -Monitoring Provisions: This group includes all provisions that require or imply the need for atmospheric testing or monitoring, including § 1926.1203(a) (when monitoring is necessary for identification), §§ 1926.1204(b), 1926.1204(c), and 1926.1204(e). OSHA determined that these provisions could have a role in preventing accidents in all situations involving asphyxiation (whether due to lack of oxygen or toxic gasses) or a build-up of explosive vapors. This group also includes the requirement in § 1926.1204(e)(1)(iii) to monitor for non-isolated engulfment hazards, such as liquids flowing through a sewer system. OSHA determined that this provision could prevent accidents in which employees drown or asphyxiate when liquids or other flowables that were not previously in the confined space entered the space in the absence of barriers or other isolation methods designed to contain such hazards.

Ventilation and Hazard-Isolation Provisions: This group includes all provisions that require or imply the need for ventilation, as well as isolation of physical hazards, such as parts of § 1926.1203(e) and portions of § 1926.1204. OSHA included an accident as potentially preventable by these provisions whenever the accident occurred as a result of a hazard inside the confined space. For most of these accidents, either ventilation or hazard-isolation measures, such as disabling and locking out electrical hazards temporarily, could prevent the accident. For other accidents, such as some drownings, arranging for the bypass of water or other liquid solutions might have been possible, thereby preventing the accident.

Provisions Requiring an Attendant: This group includes all provisions that require or imply the need for an attendant when someone is inside the confined space. The attendant in most cases has two duties: (1) Assuring that continuous monitoring takes place (if it is appropriate) and warning the person to exit the space if necessary; and (2) conducting an appropriate non-entry rescue. For the purposes of this analysis, OSHA listed an accident as potentially preventable had an attendant been present if there was no notation of another person present when someone entered the confined space. There are many other situations in which the lack of an attendant may have been responsible for the accident because the person present was not continually assessing the conditions inside the permit space or was incapable of conducting a non-entry rescue or summoning rescue or emergency services; however, other provisions are more likely to potentially prevent such accidents.

Rescue-Capability Provisions: This group includes all provisions, such as §§ 1926.1204(i) and 1926.1211, that require the development and implementation of a plan addressing rescue capability and summoning emergency services, with the plan involving non-entry rescue when feasible. For the purposes of this analysis, OSHA listed an accident as potentially preventable by improved rescue capability for (1) all cases of asphyxiation when quick removal of endangered workers from the confined space and prompt treatment were necessary to prevent the fatality, and (2) for other accidents, such as drowning and electroshock, when timely removal and treatment might have an effect. OSHA did not consider this provision to have the potential to prevent deaths resulting from burns, even though it is possible that more immediate treatment or rescue before combustion occurred would mediate or prevent the accident. OSHA also noted under this provision the special, and all too numerous, cases when the rescuer(s) became a fatality.

Training Provisions: This group includes all provisions that require employers to develop and implement training, such as §§ 1926.1207 and 1926.1208. OSHA found that better training could potentially prevent all of the accidents, except for one accident that was preventable using only appropriate physical barriers.

Equipment Provisions: This group includes all provisions that require the employer to (1) provide necessary equipment, such as communication equipment, necessary for attendants to perform their duties (§ 1926.1203(d)(3)), or (2) develop appropriate lighting (§ 1926.1204(d)(5)). For the purposes of this analysis, OSHA listed an accident as potentially preventable by these provisions when employees working together had difficulties communicating or there was an indication of inadequate lighting or general difficulty locating physical hazards before contacting them. There are some provisions in this group that OSHA did not analyze in terms of their potential to prevent accidents. These provisions include requirements for barriers and disposable coveralls. However, OSHA's methods of searching for confined-space accidents could not identify the accidents that these provisions would prevent.

TABLE IV–10—CONFINED SPACES IN THE CONSTRUCTION INDUSTRY
FATAL ACCIDENTS AND INJURIES—2006–2009

Year	Industry SIC	Type of confined space	Number of reported fatalities	Activity No. 1
2006	1611	sewer	2	309775443

Description of Accident:
An employee climbed down into a sewer vault to retrieve a tool he dropped and lost consciousness. A second employee entered the sewer vault in an attempt to rescue his co-worker and also lost consciousness. Both employees died.

Provisions That Could Potentially Have Prevented the Fatality:
Evaluation and Classification
Information Exchange
Permit Program (1 of 2 fatalities)
(Not Ventilation and Hazard Isolation; Early Warning System and Atmospheric Testing or Monitoring; or Rescue Capacity because these were already required in the State where the accident took place)
Training

Year	Industry SIC	Type of confined space	Number of reported fatalities	Activity No. 2
2006	1623	storm drain	1	308437631

Description of Accident:
Employee #1 and his crew were installing storm drainage pipes in an older neighborhood. During the installation of the drainage pipes, damage had been caused on the existing natural gas pipe lines in the neighborhood. The odor of gas was present prior to the day of the installation, and the local gas company had been contacted to identify and repair the leaks. The smell of gas was still present and noticed by the supervisor, employees and others; however, the supervisor did not contact the gas company to investigate the odor, and to locate the leak. The supervisor also did not remove the employees from the excavation where the gas odor existed, and did not test the atmosphere of the excavation to determine if there was a hazardous atmosphere or condition in the excavation. The supervisor directed Employee #1 to enter the 48-inch diameter drainage pipe line to retrieve a laser surveying machine that was located approximately 90 feet within the pipe line. Natural gas that had escaped from two breaks in the gas line had accumulated within the storm drain pipe line. While Employee #1 was in the pipe line, the natural gas within it ignited. The specific ignition source was not identified. Even though severely burned, Employee #1 was able to exit the storm drain pipe line, and was taken to the hospital. Six days later, he died as a result of his injuries.

Provisions That Could Potentially Have Prevented the Fatality:
Evaluation and Classification
Information Exchange
Ventilation and Hazard Isolation
Early Warning System and Atmospheric Testing or Monitoring
Attendant
Training

Year	Industry SIC	Type of confined space	Number of reported fatalities	Activity No. 3
2006	1623	sewer	1	310350418

Description of Accident:
Three employees were working on a sewer system that was newly installed and not yet in use. A section of the line had been plugged and tested for leakage. Employee #1 entered the sewer vault, which was approximately 15 to 20 feet deep, to remove a plug. Employee #1 collapsed into approximately 6 inches of unidentified liquid at the bottom of the sewer vault. Employee #2 entered the sewer vault to assist Employee #1. Employee #2 also collapsed at the bottom of the sewer vault. Employee #3 attempted to provide assistance to Employees #1 and #2. Employee #3 began to feel ill about halfway down and then decided to emerge from the sewer vault. Fire/EMS Department responded to the scene. Co-workers of the employees attached a hose approximately 19 feet long to an air compressor and used it to blow air into the sewer vault. Employee #2 regained consciousness and was able to assist in rescuing Employee #1 and himself from the sewer vault. All three employees were transported to area hospitals. Employee #1 later died at the hospital. Employees #2 and #3 were treated, hospitalized, and released in the following days.

Provisions That Could Potentially Have Prevented the Fatality:
Evaluation and Classification
Information Exchange
Permit Program
(Not Ventilation and Hazard Isolation, Atmospheric Monitoring, or Rescue capacity because these were already required in the State where the accident took place)
Training

Year	Industry SIC	Type of confined space	Number of reported fatalities	Activity No. 4
2007	1541	manhole	1	311032809

Description of Accident:
Employee #1, while doing an elevation survey of the invert of a storm water pipe in a manhole, entered the manhole to find the bottom of the pipe. While in the manhole, Employee #1 was overcome due to a lack of oxygen and died. Employee #2 entered the same manhole, and was also overcome. Employee #2 was hospitalized and released the next day.

Provisions That Could Potentially Have Prevented the Fatality:
Evaluation and Classification
Information Exchange
Permit Program (Entry very preventable)
Ventilation and Hazard Isolation
Early Warning System and Atmospheric Testing or Monitoring Attendant
Rescue Capacity
Training

Year	Industry SIC	Type of confined space	Number of reported fatalities	Activity No. 5
2007	1623	lift station	4	307043844

Description of Accident:
The victim was in the process of assisting another company with the replacement of a sump pump in an underground lift station which collected draining and leached water from a construction debris landfill. Three employees of the other company entered the lift station and succumbed to exposure to hydrogen sulfide gas. The victim had entered the lift station in an attempt to assist/rescue the three victims from the other company, and also succumbed to hydrogen sulfide gas. Rescue services arrived at the scene and performed air quality monitoring which revealed that the victim and the three victims from the other company were exposed to concentrations of up to 200 PPM of hydrogen sulfide gas. Body retrievals were initiated at that point. The lift station was determined to be a permit-required confined space. The other company (host employer) had not evaluated the lift station to determine that it was a permit-required space. Both companies had not developed and implemented a written permit space program.

Provisions That Could Potentially Have Prevented the Fatality:
Evaluation and Classification
Information Exchange
Permit Program (3 of 4 fatalities)
Ventilation and Hazard Isolation
Early Warning System and Atmospheric Testing or Monitoring
Rescue Capacity (Attempted rescue resulted in a fatality)
Training

Year	Industry SIC	Type of confined space	Number of reported fatalities	Activity No. 6
2007	1623	manhole	2	310177456

Description of Accident:
Employees #1 and #2 were working in an approximately 7 ft diameter water vault located about 16 ft underground. The vault contained a 12 in. water main and a 4 in. water main that was equipped with a water meter. The vault had been constructed approximately ten days earlier and had sat undisturbed until the day of the accident, when the employees were scheduled to conduct a pressure test of the system. Employee #1, the foreman, went down into the vault to read the meter. When he did not return, Employee #2, a laborer, looked down through the manhole cover and saw Employee #1 laying on the ground. Employee #2 called out to a coworker that Employee #1 was down and then entered the vault through the manhole and climb down the ladder. The coworker came over to the manhole and saw Employee #1 on the ground and Employee #2 hanging upside down, with his leg caught between the ladder rungs. Neither employee responded to the coworker's calls. The coworker also started down the manhole but noticed an overpowering musty odor and abruptly stopped and exited. The Fire Department and paramedics responded to the job site and retrieved Employees #1 and #2, both of whom had died. At the time of rescue the Fire Department's four gas meters measured the oxygen level in the vault at approximately 9.2 ppm. In its referral to OSHA, the Fire Department referenced two workers who succumbed to an IDLH atmosphere.

Provisions That Could Potentially Have Prevented the Fatality:
Evaluation and Classification
Information Exchange
Permit Program (1 of 2 fatalities)
Ventilation and Hazard Isolation
Early Warning System and Atmospheric Testing or Monitoring
Rescue Capacity (Attempted rescue resulted in a fatality)
Training

Year	Industry SIC	Type of confined space	Number of reported fatalities	Activity No. 7
2007	1623	manhole	2	310253398

Description of Accident:
Employee #1 and Employee #2 were both asphyxiated when they entered a 12 ft manhole to perform grouting work. Employee #1 entered the 12 ft manhole and collapsed. Employee #2 entered the manhole to help Employee #1 and then Employee #2 collapsed. This was the company's first time performing sewer line work and Employee #1 and #2 entered the space without required testing. The employer did provide a tripod winch system over the manhole with cable attached to rescue harness. In addition, a scott gas detector was used to detect any gases in hole; none was detected. The oxygen level however was 8 near the top of the hole and 3 at or near the bottom of the hole.

Provisions That Could Potentially Have Prevented the Fatality:
Evaluation and Classification
Information Exchange
Permit program (1 of 2 fatalities)
Ventilation and Hazard Isolation
Early Warning System and Atmospheric Testing or Monitoring Provisions
Rescue Capacity (Attempted rescue resulted in a fatality)
Training

Year	Industry SIC	Type of confined space	Number of reported fatalities	Activity No. 8
2007	1623	manhole	1	311354807

Description of Accident:
Employee #1 entered manhole to remove line plugs to activate a manhole sewer system, the manhole was 10.5 ft deep. The probable cause of death was H2S poisoning as a result of employee working in a sewer manhole; this is according to the county's forensic science department. The manhole had not been entered and was not monitored for toxicity, oxygen level or explosive levels. No tripod was in-place for emergency retrieval of Employee #1.

Provisions That Could Potentially Have Prevented the Fatality:
Evaluation and Classification
Information Exchange
Permit Program
Ventilation and Hazard Isolation
Early Warning System and Atmospheric Testing or Monitoring Provisions
Attendant
Rescue Capacity
Training

Year	Industry SIC	Type of confined space	Number of reported fatalities	Activity No. 9
2007	1721	crawl space	2	126192012

Description of Accident:
Employee #1, a painting contractor, was hired by the property owner to apply primer over the creosote floor joists. Employee #1 and #2 were working in a crawl space under the bedroom of the residence applying primer to the floor joists. The incandescent work lamp or a broken light bulb ignited the vapors from the primer. The two employees were burned and died. The other employees suffered minor burn injuries. The contributing causal factors: The air in the crawl space was not flushed or purged of flammable vapors and no air testing to determine whether dangerous air contamination or oxygen deficiency existed. Arson and homicide investigators were called to the scene and were investigating the cause of the accident, which appeared to be accidental. The crawlspace was located underneath one of the bedrooms and was measured between 21 in. to 22 in. from the foundation to the floor of the bedroom.

Provisions That Could Potentially Have Prevented the Fatality:
Evaluation and Classification
Permit Program
(Not Ventilation and Hazard Isolation because this was already required in the State where the accident took place)
(Not Early Warning System and Atmospheric Testing or Monitoring because this was already required in the State where the accident took place)
Attendant
Training

Year	Industry SIC	Type of confined space	Number of reported fatalities	Activity No. 10
2008	1711	lift station	2	312320666

Description of Accident:

Year	Industry SIC	Type of confined space	Number of reported fatalities	Activity No. 10

Employee #1 entered a sewer lift station to check for leaks in the line. Employee #1 was overcome by hydrogen sulfide gas. A second employee entered the station to retrieve Employee #1, and also was overcome by the gas. Both employees died from overexposure to hydrogen sulfide gas.

Provisions That Could Potentially Have Prevented the Fatality:
Evaluation and Classification
Information Exchange
Permit Program
Ventilation and Hazard Isolation
Early Warning System and Atmospheric Testing or Monitoring Provisions
Rescue Capacity (Attempted rescue resulted in a fatality)
Training

Year	Industry SIC	Type of confined space	Number of reported fatalities	Activity No. 11
2009	1623	manhole	1	313122616

Description of Accident:
Employee #3 fell into a manhole and suffered a head injury and was life-flighted to the hospital. Employee #2 became unconscious in a manhole and was rescued and life-flighted to the hospital. Employee #1 entered the manhole to attempt rescue of employee #2 and became unconscious and died before he could be rescued.

Provisions That Could Potentially Have Prevented the Fatality:
Evaluation and Classification
Ventilation and Hazard Isolation
Early Warning System and Atmospheric Testing or Monitoring Provisions
Rescue Capacity (Attempted rescue resulted in a fatality)
Training

Year	Industry SIC	Type of confined space	Number of reported fatalities	Activity No. 12
2009	1791	tank	1	311964886

Description of Accident:
Employee #1 was found unresponsive on scaffolding in the residential water tank in which he was performing stick welding on the interior overhead of the tank. He was removed from the tank, and emergency services summoned. He could not be revived. The medical examiner determined that core body temperature of employee #1 exceeded 109 degrees Fahrenheit, indicating that the preliminary cause of death was hyperthermia.

Provisions That Could Potentially Have Prevented the Fatality:
Evaluation and Classification
Permit Program
Ventilation and Hazard Isolation (ventilation required beyond the amount needed to address welding fumes)
Attendant
Training

Year	Industry SIC	Type of confined space	Number of reported fatalities	Activity No. 13
2009	1794	manhole	1	309620219

Description of Accident:
An employee entered into 18-in. manhole to retrieve part of laser equipment and was overcome by methane and lack of oxygen. He died of asphyxiation.

Provisions That Could Potentially Have Prevented the Fatality:
Evaluation and Classification
Information Exchange
Permit Program (Entry very preventable)
Ventilation and Hazard Isolation
Early Warning System and Atmospheric Testing or Monitoring Provisions
Attendant
Rescue Capacity
Training

Year	Industry SIC	Type of confined space	Number of reported fatalities	Activity No. 14
2009	1794	tunnel	1	313553604

Description of Accident:
Employee #1 was inside a 24 inch pipe that ran through a tunnel underneath a highway. Employee #1 was approximately 140 feet inside the pipe when a rain storm flooded the pipe drowning the employee.

Provisions That Could Potentially Have Prevented the Fatality:
Evaluation and Classification
Information Exchange
Permit Program
Attendant
Rescue Capacity
Training
Early Warning System

Year	Industry SIC	Type of confined space	Number of reported fatalities	Activity No. 15
2006	1711	Crawl space	1	309539559

Description of Accident:
On August 7, 2006, Employee #1, of Mesquite Plumbing Company, entered the crawl space of a house undergoing renovations to insulate a new plumbing fixture that a coworker had installed. During the course of his work he contacted a live wire and was electrocuted.

Provisions That Could Potentially Have Prevented the Fatality:
Evaluation and Classification
Permit program
Ventilation and Hazard Isolation
Attendant
Rescue Capacity
Training

Year	Industry SIC	Type of confined space	Number of reported fatalities	Activity No. 16
2006	1623	manhole	1	310345053

Description of Accident:
On September 28, 2006, Employee #1, a construction worker, fell into a concrete manhole structure. He suffered a fractured neck and back. Employee #1 was flown by helicopter to the hospital, where he died.

Provisions That Could Potentially Have Prevented the Fatality:
Evaluation and Classification
Equipment (lack of cover or methods of assuring safety when a cover is removed)

Year	Industry SIC	Type of confined space	Number of reported fatalities	Activity No. 17
2007	1521	crawl space	1	120205794

Description of Accident:
On July 23, 2007, Employee #1, age 19, and a coworker were reinstalling an electrical outlet into a new bathroom wall after it had been removed from the pre-existing wall. The 120-volt outlet electrical box was energized and lying on the floor. Employee #1 went into a crawl space under the house while the coworker went to the electrical panel and shut off the power to the home. Employee #1 was having trouble seeing in the darkness of the crawl space, and he asked the coworker to turn on the power so he could use a halogen lamp that had a cord running up through the floor and into an outlet in the kitchen. When the coworker turned on the power, this also energized the electric conductors that Employee #1 was wiring in the junction box. He was lying on his back under the floor, on top of the water line for the home. This pipe had been used to ground the electrical system of the house when it was built and Employee #1 was electrocuted when he connected the wires. The coworker, hearing a noise, tried to communicate with Employee #1. When he did not get a response, he again turned off the electricity to the house. The coworker alerted the owner and tried to call 911 on his cell phone, but could not get through. He and the owner tried to call 911 on the house's land line, but it was electrically-based, and so they once again turned on the power to place the call. The owner then cut a hole in the floor, removed Employee #1 from the crawl space, and attempted CPR until paramedics arrived. The coroner stated cause of death was low voltage electrocution.

Provisions That Could Potentially Have Prevented the Fatality:
Evaluation and Classification
Permit Program
Ventilation and Hazard Isolation
Attendant
Training

Year	Industry SIC	Type of confined space	Number of reported fatalities	Activity No. 17

Equipment (lighting)
Rescue Capacity

Year	Industry SIC	Type of confined space	Number of reported fatalities	Activity No. 18
2007	1741	boiler	1	311213326

Description of Accident:
On December 11, 2007, Employee #1 was part of a crew engaged in stone work at a residential site. To complete the job, they covered the chimney with plastic. Once the plastic was in place, the coworkers went to put away the tools for the night, and left Employee #1 to stitch close [ ] any openings in the plastic covering. The chimney housed the vent for an Ultra 310 boiler system. When the coworkers returned, they found Employee #1, unconscious, in the plastic enclosure. He died of carbon monoxide poisoning.

Provisions That Could Potentially Have Prevented the Fatality:
Evaluation and Classification
Permit Program (Entry very preventable)
(Not Ventilation and Hazard Isolation or Rescue Capacity because this was already required in the State where the accident took place)
Attendant
Training

Year	Industry SIC	Type of confined space	Number of reported fatalities	Activity No. 19
2008	1711	crawl space	1	311794093

Description of Accident:
On or about 3:30 p.m. on November 6, 2008, Employee #1, a 31 year-old-male working for Atm Plumbing, was working in a crawl space under a private house. The crawl space was wet from recent rains. Employee #1 was using a manual operated pipe cutter to cut a water pipe when he received an electrical shock and became unconscious. Employee #2 was also under the house using a trouble light to illuminate the work area was not using a GFCI. Unbeknown to Employee #1 the water pipe that he was working on was also used for the electrical grounding system for the house. Employee #2 pulled him out of the crawl space. Paramedics transported Employee #1 to a local hospital where he was pronounced dead.

Provisions That Could Potentially Have Prevented the Fatality:
Evaluation and Classification
Permit Program
Ventilation and Hazard Isolation
Attendant
Training
Equipment
Rescue Capacity

Year	Industry SIC	Type of confined space	Number of reported fatalities	Activity No. 20
2008	1711	duct	1	311815492

Description of Accident:
On May 21, 2008, Employee #1 was with a crew installing a steel security grate inside the duct system of a 10-ton Trane air conditioning system (Model Number THC120A4RGAOW2B, Serial Number 8044100711L) that was located on a roof. As he crawled into the duct to weld the grate into place, the back of his head contacted an energized heat strip on the air conditioning unit coil. Employee #1 was electrocuted. The electrical power to the air conditioning unit had not been deenergized and locked or tagged out.

Provisions That Could Potentially Have Prevented the Fatality:
Evaluation and Classification
Permit Program
Ventilation and Hazard Isolation
Rescue Capacity
Training

Year	Industry SIC	Type of confined space	Number of reported fatalities	Activity No. 21
2008	1742	attic	1	312098551

Description of Accident:

Year	Industry SIC	Type of confined space	Number of reported fatalities	Activity No. 21

On May 17, 2008, Employee #1 was spraying foam insulation in the enclosed attic space of a two story, single-family home that was undergoing renovations. He had accessed the attic via an aluminum ladder through a hole in the second floor ceiling. A flash fire occurred, killing Employee #1. Inadequate ventilation contributed to the buildup of vapors. The ignition source was not determined.

Provisions That Could Potentially Have Prevented the Fatality:
Evaluation and Classification
Permit Program
Ventilation and Hazard Isolation
Early Warning System and Atmospheric Testing or Monitoring (Work may have caused build-up of vapors)
Attendant
Training

Year	Industry SIC	Type of confined space	Number of reported fatalities	Activity No. 22
2009	1731	crawl space	1	313555591

Description of Accident:
On August 18, 2009, Employee #1 was installing a new direct TV cable. Employee #1 was crawling under the house and came into contact with an energized wire. He was electrocuted.

Provisions That Could Potentially Have Prevented the Fatality:
Evaluation and Classification
Permit Program
Ventilation and Hazard Isolation
Rescue Capacity
Attendant
Training
Total Number of Fatalities: 30

Source: OSHA IMIS database, analyzed by OSHA, Directorate of Standards and Guidance and Directorate of Construction.

For the FEA's supplemental data as shown in Table IV–10, OSHA, as previously noted, carefully reviewed and selected from the IMIS database only those cases determined preventable by full compliance with the provisions of the final standard. As a result, OSHA did not need to apply a probability prevention rate to estimate the number of preventable fatalities. As itemized above, OSHA identified 30 preventable fatalities over the four-year period, 2006–2009, for an average of 7.5 fatalities prevented annually by full compliance with this final standard. This supplemental analysis supports OSHA's conclusions that the problem of confined-space fatalities did not diminish in the construction industry over this period, and that the regulated community still needs the final standard. OSHA does not believe this supplemental analysis is necessary, but believes that it will aid the public in understanding OSHA's conclusions.

It is important to note that the approach used in this estimation is conservative in that there are other fatal events that were likely preventable but not included in the IMIS database. For example, the Bureau of Labor Statistics' Census of Fatal Occupational Injuries for 2011 showed 111 fatalities in construction from exposure to harmful substances or environments, and 123 fatalities from contact with objects and equipment (these numbers include 4 fatalities in new single-family housing construction from contact with objects and 10 fatalities in residential remodeling from exposure to harmful substances or environments). Some fatal injuries that are preventable by the final standard may not appear in the IMIS database because the database only includes accidents involving a fatality or a catastrophe with three or more injuries that result in hospitalization.

Estimation of Averted Injuries

In a 1994 report to OSHA, the Confined Spaces Work Group of the Advisory Committee on Construction Safety and Health (ACCSH) estimated that the ratio of lost time injuries (LTI) to fatalities in confined spaces was approximately 100:1 for general industry and 200:1 for construction (see ACCSH, 1994, pg. 6). In the PEA, OSHA used this range of 100 to 200 LTIs per fatality to estimate the number of injuries prevented by the proposed rule. At the public hearing on the proposed rule, the Edison Electric Institute's representative noted, ''There's no explanation or support for the assertion that there has been under-counting of injuries, however, and we cannot discern any basis for multiplying these numbers by 100 and 200'' (ID–210, Tr. p.99). As noted above, OSHA explained that those estimates came from the ACCSH report, which was the best available evidence. The commenter did not dispute those numbers or, more importantly, provide any alternatives numbers as its best evidence. Perhaps the commenter mistakenly concluded that OSHA multiplied the IMIS *injury* numbers by 100 and 200; however, the multiplication applied to the numbers of *fatalities,* because OSHA does not have data on the number of non-fatal injuries.

In this FEA, OSHA provided updated estimates of the number of non-fatal injuries involving confined spaces in construction and further clarified the basis for its estimates. As a preliminary matter, the Agency notes again that OSHA's IMIS database, which is the source of information about fatal accidents, does not report most injuries. As noted above, the IMIS database includes only accidents involving a fatality or a catastrophe with three or more injuries that result in hospitalization. Therefore, the IMIS database seldom captures injuries involving accidents that do not result either in a fatality or hospitalization of three or more workers.[43] Because OSHA

[43] The Survey of Occupational Injuries and Illnesses (SOII) produces annual estimates of counts and rates of new workplace injuries and illnesses,

could not find a data source for reliable estimates of non-fatal injuries in confined spaces in construction,[44] OSHA again relied on the expertise of ACCSH for these estimates.

Recognizing the age of the ACCSH Work Groups' LTI estimates of 100:1 and 200:1, OSHA attempted to corroborate these estimates using data from the BLS CFOI and the BLS Survey of Occupational Injuries and Illnesses (SOII). According to BLS,[45] in 2009, there were a total of 4,090 occupational fatalities and 3,277,700 nonfatal occupational injuries for private industry overall, and 834 fatalities and 251,000 nonfatal injuries for the construction industry. Using these estimates of fatalities and injuries, the ratio of injuries to fatalities is 800:1 for all private industries, and 300:1 for the construction industry.

In light of the large injury-to-fatality ratios apparent in the recent CFOI and SOII data, OSHA confirmed that the ratios recommended by the expert ACCSH Confined Spaces Work Group are reasonable and conservative, and used the average of the two ratios (150 injuries per fatality) in this FEA to estimate the number of non-fatal injuries. Calculations relating publicly reported injury-to-fatality statistical data in construction also confirm the reasonableness of the estimates OSHA used.[46]

Based on OSHA's annual estimate of 5.2 confined-spaces-in-construction fatalities avoided when fully complying with the provisions of this standard, and the 91 percent preventability rate, OSHA estimated that there would have been a total of between 520 and 1,040 confined-spaces-in-construction non-fatal injuries during the period of 1992 to 2000, with a midpoint of 780 as the total number of non-fatal injuries avoided each year when fully complying to the provisions of this standard. Applying a similar methodology of a 100:1 to 200:1 fatality-to-injuries ratio to the supplemental data in Table IV–10, OSHA estimates that, given 30 fatalities between the period of 2006 to 2009, there would be a total of 3,000 and 6,000 non-fatal injuries prevented by the final standard in that time period, or an average of 750 and 1,500 (with a midpoint of 1,125) injuries prevented per year.

Assignment of Monetary Values to Avoided Injuries and Fatalities

In the PEA, OSHA used a willingness-to-pay approach to estimate a monetary value of $50,000 for each prevented injury and $6.8 million for each prevented fatality. One commenter stated that the estimated value of $50,000 per prevented injury had ''absolutely no foundation or source for accuracy'' and was ''substantially inflated,'' but did not provide any specifics or suggest an alternative (ID–100). The AGCA report suggested that OSHA instead use workers' compensation claims, which it estimated to be $242,770 per fatality and $31,664 per injury (ID–222).

Workers' compensation claims do not reflect a willingness-to-pay approach or represent the full costs associated with workplace fatalities and injuries. Workers' compensation systems cover medical expenses and partial payment of wages lost as a result of workplace accidents, or, in the case of fatalities, burial costs and part of lost future wages. However, workers' compensation does not cover other costs resulting from fatalities and injuries, such as pain and suffering. Therefore, it would be inaccurate to base estimates of total societal costs of injuries and illnesses on workers' compensation claims.

As in the PEA, and following the approach recommended by OMB Circular A–4 (OMB, 2003) and common analytic practice, OSHA developed estimates of the benefits of avoided injuries and fatalities in this FEA based on the willingness-to-pay to avoid a marginal increase in the risk of a fatality or injury, as explained below. In addition, in this FEA, OSHA updated the estimated monetary value of reductions in fatalities and injuries presented in the PEA from 2002 to 2009 dollars. While a willingness-to-pay (WTP) approach clearly has theoretical merit, an *individual's* willingness to pay to reduce the risk of fatality may underestimate the total willingness to pay, which could include the willingness of others—particularly the immediate family—to pay to reduce that individual's risk of fatality.[47]

For estimates using the willingness-to-pay concept, OSHA relied on existing studies of the imputed value of fatalities avoided based on the theory of compensating wage differentials in the labor market. These studies rely on certain critical assumptions for their accuracy, particularly that workers understand the risks to which they are exposed and that workers have legitimate choices between high- and low-risk jobs. These assumptions are far from realized in actual labor markets.[48] A number of academic studies, as summarized in Viscusi & Aldy (2003), show a correlation between higher job risk and higher wages, suggesting that employees demand monetary compensation in return for a greater risk of injury or fatality. The estimated trade-off between lower wages and marginal reductions in fatal occupational risk—that is, workers' willingness to pay for marginal reductions in such risk—yields an imputed value of an avoided fatality: The willingness-to-pay amount for a reduction in risk divided by the reduction in risk.[49] OSHA used this approach in many recent proposed and final rules. (See, for example, 69 FR 59305, 59429 (Oct. 4, 2004) and 71 FR

but also is subject to under-reporting for a variety of reasons, including missing cases, the reporting of sample cases from large establishments, timeliness of updates to the logs and data collection, and employer doubts about the recordability of some cases (see Ruser, 2008). Furthermore, OSHA is unable to confirm the determination of accidents in ''confined spaces'' as defined by SOII and, therefore, relied on OSHA's IMIS database.

[44] OSHA takes note of the AGCA survey finding of only 2 confined-space injuries among the 74 responding employers (ID–0222, p. 29). However, this finding does not furnish a basis for estimating the number of injuries preventable with full compliance with this rule due to its lack of representativeness. Not all of the respondents even had confined spaces on their job sites. Moreover, AGCA designed the survey explicitly not to learn about injuries in confined spaces, but ''to determine the impact of compliance costs for contractors under OSHA's Proposed Rule on Confined Space [sic]. . . . '' It instructed respondents to ''carefully review the background information detailed below . . . before submitting your information. OSHA's proposed rule for confined space [sic] in construction is complicated, costly to implement, and does not provide significant increases in safety above the existing general industry standard.'' The survey did not provide a definition of a confined space or otherwise seek to ensure that the person filling out the survey was familiar with the appropriate definition.

[45] Table A–1, Fatal Occupational Injuries by Industry, Event and Exposure, available at *http://www.bls.gov/iif/oshwc/cfoi/cftb0241.pdf*, and Table 2, Number of Nonfatal Occupational Injuries and Illnesses by Case Type and Ownership for Selected Industries, 2009 News Release USDL 10–1451, available at *http://www.bls.gov/news.release/pdf/osh.pdf.*

[46] See, for example, Dong, X., et al. (2011).

[47] See, for example, Thaler and Rosen (1976), pp. 265–266; Sunstein (2004), p. 433; or Viscusi, Magat and Forrest (1988), the last of whom write that benefits from improvement in public health ''consist of two components, the private valuation consumers attach to their own health, plus the altruistic valuation other members of society place on their health.'' This paper uses contingent valuation methods to suggest that the effect of altruism could significantly alter willingness-to pay estimates for some kinds of health improvement. There are, however, many questions concerning how to measure this and the conditions under which it might matter.

[48] See, for example, the discussion of wage compensation for risk for union versus nonunion workers in Dorman and Hagstrom (1998).

[49] For example, if workers are willing to pay $90 each for a 1⁄100,000 reduction in the probability of dying on the job, then the imputed value of an avoided fatality would be $90 divided by 1⁄100,000, or $9,000,000. Another way to consider this result would be to assume that 100,000 workers made this trade-off. On average, one life would be saved at a cost of $9,000,000.

10099 (Feb. 28, 2006), the preambles for the proposed and final hexavalent chromium rule, and 78 FR 56274, 56388 (Sept. 12, 2013), the preamble for the proposed respirable crystalline silica rule.) The Agency views the WTP approach as the best available, and relied on it to monetize benefits. Viscusi & Aldy (2003) conducted a meta-analysis of studies in the economics literature that use a willingness-to-pay methodology to estimate the imputed value of life-saving programs and found that each fatality avoided valued at approximately $7 million in 2000 dollars. Using the GDP Deflator (U.S. BEA, 2010), this $7 million base number in 2000 dollars yields an estimate of $8.7 million in 2010 dollars for each fatality avoided.[50 51]

OSHA views these estimates as the best estimates currently available, and will use them to monetize avoided fatalities and injuries resulting from this final standard.

Net Benefits

Table IV–11, which repeats Table IV–1 for the convenience of the reader, provides a summary of the estimated costs, benefits, and net benefits of the final standard, using discount rates of 7 percent and, alternatively, 3 percent, as recommended by OMB Circular A–4. OSHA estimated the total benefits of the final standard to be $93.6 million annually—of which $45.2 million come from prevented fatalities and $48.4 million from prevented injuries. OSHA took the annualized costs of $60.3 million, using a 7 percent discount rate, from Table IV–13 in Chapter 6 of this FEA. OSHA estimated net benefits of the final rule to be $33.3 million annually, using a 7 percent discount rate. OSHA estimated that compliance with the final standard will provide $1.55 of benefits per dollar of cost.

TABLE IV–11—NET BENEFITS

[Millions of 2009 dollars]

	7% Discount rate	3% Discount rate
Annualized Costs		
Evaluation, Classification, Information Exchange, and Notification	$12.4	$12.2
Written Program, Issue Permits, Verify Safety, Review Procedures	4.2	4.2
Provide Ventilation and Isolate Hazards	2.8	2.7
Early Warning System and Atmospheric Testing or Monitoring	11.4	11.3
Attendant	3.6	3.6
Rescue Capability	8.2	7.6
Training Provisions	11.3	11.3
Other Requirements	6.4	6.3
Total Annual Costs	60.3	59.2
Annual Benefits		
Number of Injuries Prevented		780
Number of Fatalities Prevented		5.2
Monetized Benefits		$93.6
Net Annual Monetized Benefits (Benefits Less Costs)		
	$33.3	$34.4

Potential Net Benefits of the Individual Provisions of the Rule

As indicated in Table IV–11, the estimated benefits of the final standard are nearly 50 percent larger than the estimated costs. Nevertheless, it is possible that the costs of particular provisions could exceed their benefits. To address this possibility, OSHA conducted a supplemental analysis of the net benefits of the individual provisions of the final rule that have associated costs.

Because the final rule contains jointly interacting and overlapping provisions, there are two logistical issues with performing a provision-by-provision sensitivity analysis of whether benefits exceed costs in this case: (1) The available data do not permit OSHA to determine the numbers of accidents that every combination of provisions could prevent; and (2) a simple marginal analysis will not fully address the question of whether benefits exceed costs for the rule as a whole. It might, for example, take two or more provisions to prevent a class of accident: An analysis of the effects of a requirement to do x if situation y is the case would be dependent on not only the requirement to do x if situation y is the case, but also a requirement to train workers to do x, as well as a requirement to inform workers of when y is the case. In such circumstances, while each provision alone might pass a marginal benefit-cost test, all of the provisions together might not pass a benefit-cost test because the provisions would prevent the same accidents. The three provisions, each costing $5 million (for a total cost of $15 million), might prevent only $12 million worth of accidents because the three provisions would prevent the exact same accidents. Thus, even if a provision-by-provision sensitivity analysis were possible for

[50] The Agency notes that two recent studies mentioned in this chapter—Kniesner et al. (2010) and Kniesner et al. (2012)—report similar estimates. The median quintile estimate of the imputed value of an avoided fatality in Kniesner et al. (2010) is $9.2 million in 2010 dollars, while Kniesner et al. (2012) provide a range of estimates between approximately $5 million and $12 million in 2012 dollars. For the purpose of this PEA, OSHA chose to rely on the Viscusi and Aldy (2003) meta-analysis rather than the two more recent individual studies.

[51] An alternative approach to valuing an avoided fatality is to monetize, for each year added to a life, an estimate from the economics literature of the value of that statistical life-year (VSLY). See, for instance, Aldy and Viscusi (2007) for a discussion of VSLY theory and FDA (2003), pp. 41488–9, for an application of VSLY in rulemaking. OSHA did not investigate this approach.

this rule, that analysis might still not demonstrate the total benefits of the overall combination of provisions. Moreover, for the purpose of determining whether benefits of a rule exceed the costs, one cannot simply test each provision individually, but must find ways to examine situations involving likely joint effects of the provisions of the rule.

This provision-by-provision analysis addresses both of these problems and takes the form of a break-even sensitivity analysis that compares the potential benefits of a set of provisions against the costs of those provisions and, separately, all provisions that, when combined, achieve those particular benefits. Thus, a break-even sensitivity analysis in this case represents an estimate of the percentage of potentially preventable accidents that an individual provision, or a combination of provisions, must prevent for the benefits to equal the costs. Any percentage of preventable accidents a provision or combination of provisions prevents that are greater than this percentage would result in benefits exceeding costs.

For each narrative of the 30 preventable confined-spaces-in-construction fatalities and injuries for the period 2006–2009 presented in Table IV–10, OSHA listed the sets of provisions of the final rule that, if followed, would potentially prevent the fatalities. For some provisions, such as requirements to evaluate and classify spaces and to develop and implement permit systems, the narratives do not clearly state whether or not employers met these requirements. In these cases, OSHA listed those provisions as being among those that would potentially prevent the fatality, even though it is possible that the employer took steps to implement the required provisions. For other provisions, such as those for early warning system and atmospheric testing or monitoring, the narratives do not clearly state that there was such monitoring, but it seems unlikely that someone would enter some of these extremely dangerous atmospheres had information on that danger been available as a result of an early warning system and atmospheric testing or monitoring. Finally, it is clear from the descriptions that employers simply did not follow provisions relating to ventilation and hazard isolation. Table IV–12 shows the aggregate results for each set of provisions organized according to the organization of costs provided in Chapter 5. Table IV–12 then monetizes the prevented fatalities and injuries associated with each cost category and compares that monetized total to the estimated costs for each cost category. Finally, OSHA estimated the percentage of benefits that a given provision needs to produce zero net benefits (that is, when the estimated value of the prevented injuries and fatalities equals the estimated cost of the related provision). Any percentage greater than zero net benefits will produce positive net benefits. Table IV–12 also shows the results of this analysis.

Before examining the benefits attributable to the provisions of the final standard, OSHA examined the break-even sensitivity of the standard as a whole and found that if compliance with the standard prevented 45 percent of the fatalities recorded, then the benefits would equal the costs; with any higher percentage prevention, benefits would exceed the costs. OSHA considers it a near certainty that compliance with the final standard would achieve this level of benefits. For example, full compliance with the final standard would avoid almost all fatalities involving asphyxiation, and 60 percent of the accidents involved asphyxiation. Thus, if full compliance with the final standard prevents just one class of accidents, the standard would result in benefits that exceed costs.

To discuss the results shown in Table IV–12, OSHA will consider the results for each provision in turn, as described in the following paragraphs.

Evaluation and Classification: The portions of the standard covered by this cost category are only effective if combined with other measures. Evaluation and classification alone, without taking the further steps needed to ameliorate the hazards, would be largely pointless. The need for this provision, in the context of benefit-cost analysis, is to assure that employers do not have to treat every confined space as containing hazards; rather, it allows employers to simply restrict entry or to implement the subsequent parts of their confined-spaces program only when a hazard exists within a given confined space.

This set of provisions is critical to reducing the costs of all other provisions more than directly preventing fatalities. If the evaluation and classification provisions reduce the costs of the standard as a whole by 5 percent ($3.1 million costs of this provision divided by $60.3 million costs of the remaining provisions), then these provisions will be useful. Given the vast number of confined spaces that do not require the ensuing steps, these provisions are almost certainly cost effective, and are necessary given the standard as a whole has positive net benefits—as was shown above.

To further evaluate the necessity and benefit of the evaluation and classification provisions, it is necessary to examine state programs. Only two of the accidents examined from 1992–2000 and 2006–2009 occurred in states with comprehensive programs similar to what OSHA is proposing. Five accidents occurred in states that required some provisions included in OSHA's confined-spaces-in-construction rule, such as ventilation and atmospheric monitoring, but did not require evaluation or permit systems. This result may suggest that there may be advantages to a full, comprehensive program that explicitly requires evaluation and classification. However, OSHA has not been able to do any quantitative analysis of the rates of confined space fatalities in these states as against other regulatory regimes.

Information Exchange: The exact economic benefits of information exchanges are particularly difficult to pinpoint. Nevertheless, the benefits of these provisions will exceed the cost if the final standard prevents 10 percent of the potentially affected accidents.

Permit Programs: Table IV–12 shows that if these provisions prevent 4 percent of the accidents where they are potentially relevant, then the benefits will equal the costs, and if they prevent more than 4 percent, the benefits will exceed the costs. A system of permits might prevent, or have been a key part of preventing, many fatalities. As a result, achieving a 4 percent prevention rate seems reasonable. Further, at least 12 percent of the accidents potentially prevented by this provision (Incidents 2 and 13) involved casual entry (*e.g.,* to retrieve a dropped item), or entry prior to testing, that a proper permit system would completely prevent. Preventing these two accidents alone would assure that the benefits of the provision exceed the costs.

Early Warning Systems, and Atmospheric Testing and Monitoring: Early warning systems, and atmospheric testing and monitoring, can prevent accidents that result in asphyxiation or caused by explosive gases, or where early warning of oncoming liquids would prevent drowning. The presence of atmospheric testing or monitoring data would prevent most of these accidents because it is unlikely that anyone would knowingly enter a space with a lethal or explosive atmosphere, especially when provisions are in place to assure against unauthorized entry. Table IV–12 shows that if these provisions prevent 14 percent of the accidents for which they are potentially relevant, then the benefits will equal the costs, and if they prevent more than 14 percent of the accident, the benefits will exceed the costs. OSHA believes that it is likely that atmospheric monitoring could prevent a much higher percentage of these accidents. In addition, there is one accident potentially prevented by an early warning system.

Requirement for an Attendant: This heading includes the provisions that require an attendant whenever an employee enters a permit-required confined space, such as §§ 1926.1204(f), 1926.1209(f) and 1926.1209(h). These provisions function in conjunction with the requirements for adequate rescue capacity. In the absence of appropriate rescue capacity, persons standing by a confined space may attempt a rescue that exposes them to the hazard. Table IV–12 shows that if these provisions prevent 6 percent of the accidents in which the person who died entered a confined space completely alone, then the benefits will equal the costs, and if the provisions prevent more than 6 percent of the accidents, the benefits will exceed the costs. OSHA believes that it is reasonable that appropriately trained and equipped attendants could prevent this percentage of accidents.

Ventilation and Hazard Isolation: The standard generally requires the use of ventilation when possible to address atmospheric hazards, but it can be difficult for the purposes of this sensitivity analysis to determine in which situations ventilation, rather than PPE, might be sufficient. It is clear, however, that when ventilation is appropriate, assuring its effectiveness would completely prevent ventilation-related fatalities. The same is true for hazard-isolation methods such as deactivating and locking out electrical sources and creating by-passes for water around confined spaces. Table IV–12 shows that if these provisions prevent 3 percent of the accidents for which they are potentially relevant, then the benefits will equal the costs, and if they prevent more than 3 percent of these accidents, the benefits will exceed the costs. Therefore, even if proper ventilation or isolation prevented one in five of the fatalities identified as potentially avoidable with proper ventilation or isolation, then the benefits of these provisions would exceed the costs. While the exact number of situations in which ventilation or isolation would have been the hazard-reducing measure of choice is uncertain, OSHA is confident that at least 3 percent of those identified would require ventilation or isolation.

Rescue Capacity: These provisions include all requirements related to rescue, including the requirement for non-entry rescue whenever feasible. Table IV–12 shows that if these provisions prevent 9 percent of the accidents for which they are potentially relevant, then the benefits will equal the costs, and if they prevent more than 9 percent of the accidents, the benefits will exceed the costs. Given that 15 percent of the accidents for which OSHA identified inadequate rescue capacity as a factor in a fatality involved deaths of additional workers during an attempted rescue, then following provisions for non-entry rescue would reasonably prevent more than 9 percent of all accidents involving inadequate rescue capacity. However, if employers follow all other provisions of the rule, then there will be less need for rescue. As a result, this set of provisions will be necessary if other provisions are not available or are not followed 9 percent of the time, or if conditions change after the confined-space entry in ways that result in a need for rescue.

Equipment: These provisions cover the requirement that employers provide adequate lighting and other equipment needed for confined-spaces work as specified in § 1926.1204(d). Table IV–12 shows that if these provisions prevent 47 percent of the accidents for which they are potentially relevant, then the benefits will equal the costs, and if they prevent more than 47 percent of the accidents, the benefits will exceed the costs. However, as noted above, OSHA did not include many of the accidents that proper equipment would prevent, such as accidents caused by vehicles hitting persons working near a confined space or illnesses caused by improper clothing. As a result, it is likely that OSHA underestimated the number of fatalities and injuries prevented by proper equipment.

TABLE IV–12—COMPARISON OF BENEFITS ASSOCIATED WITH INDIVIDUAL COST CATEGORIES AND COSTS *

Cost provision	Number of fatalities potentially affected by provision (2006–2009)	Estimated number of fatalities per year potentially affected by provision	Monetized value of annual fatalities [a]	Estimated number of injuries per year potentially affected by provision	Monetized value of injuries [b]	Total monetized value of annual fatalities and injuries potentially affected by the provision	Costs of provision	Percentage of potential benefits needed to break even with costs [c] (percent)
All	30	7.5	$65,250,000	1125	$69,750,000	$135,000,000	$60,300,000	45
Evaluation and Classification	30	7.5	65,250,000	1125	69,750,000	135,000,000	3,100,000	2
Information Exchange	18	4.5	39,150,000	675	41,850,000	81,000,000	9,300,000	11
Permit System	22	5.5	47,850,000	825	51,150,000	99,000,000	4,200,000	4
Early Warning System and Atmospheric Testing or Monitoring	18	4.5	39,150,000	675	41,850,000	81,000,000	11,300,000	14
Ventilation and Hazard Isolation	22	5.5	47,850,000	487.5	51,500,000	99,000,000	2,800,000	3
Attendant	13	3.25	28,275,000	487.5	30,225,000	58,500,000	3,600,000	6
Rescue Capability	20	5	43,500,000	750	46,500,000	90,000,000	8,200,000	9
Training	29	7.25	63,075,000	1087.5	67,425,000	130,500,000	11,300,000	9
Equipment	3	0.75	4,350,000	112.5	6,975,000	13,500,000	6,3000,000	47

* In 2009 dollars.
[a] Based on an estimated value of $8.7 million per fatality avoided.
[b] Based on an estimated value of $62,000 per injury avoided.
[c] Costs of provision divided by total monetized value of fatalities potentially prevented by the provision.
* **Note:** OSHA did not apportion the benefits of a prevented fatality among the provisions that could prevent the fatality; instead, the Agency attributed the entirety of the benefits of a prevented fatality to each provision that could prevent the fatality.
Source: OSHA, Directorate of Standards and Guidance, Office of Regulatory Analysis.

5. Technological Feasibility

In accordance with the OSH Act, OSHA must demonstrate that occupational safety and health standards promulgated by the Agency are technologically feasible. OSHA demonstrates that a standard is technologically feasible ‘‘by pointing to technology that is either already in use or has been conceived and is reasonably capable of experimental refinement and distribution within the standards deadlines.’’ *American Iron and Steel Inst.* v. *OSHA (Lead II),* 939 F.2d 975, 980 (D.C. Cir. 1991) (per curiam) (internal citation omitted). OSHA reviewed each of the requirements imposed by the final rule and determined that compliance with the requirements of the rule is technologically feasible for all affected industries, that employers can achieve compliance with all of the final requirements using readily and widely available technologies, and that there are no technological constraints associated with compliance with any of the final requirements.

Several factors support OSHA's determination regarding the technological feasibility of the final rule. First, OSHA concluded that compliance with existing § 1910.146 was technologically feasible when it promulgated those standards in 1993 (58 FR 4539), and that conclusion held true over OSHA's two decades of experience with that standard. Likewise, this conclusion holds true with respect to provisions in the final rule that OSHA based on the existing general industry standard. A number of commenters stated that they are complying with the general industry standard in construction operations, which also supports a finding of technological feasibility. (See *e.g.,* ID–047, –075, –086, –092, –120, –124, –180).

Second, the provisions in the standard not based on the existing standard are also technologically feasible. The new standard requires employers to identify confined spaces at their worksites, establish a written program and issue permits for qualifying confined spaces, exchange information on the hazards of permit spaces with other affected employers, train affected employees, provide for rescue and emergency services, and assign duties to authorized entrants, attendants, and supervisors. None of these requirements, including the new requirements not in § 1910.146, present any technological feasibility concerns. These provisions simply require observation of hazards, training, and communication among all parties, including employees and all employers at a worksite—all of which are clearly feasible.

In Section III of the preamble to the final rule, ''Summary and Explanation of the Final Rule,'' OSHA responded to issues associated with the technological feasibility of specific provisions. In that section of the preamble, OSHA discussed technological feasibility concerns raised by rulemaking participants and the technological feasibility of provisions that differ from the general industry rule, including the requirement for continuous monitoring of atmospheric hazards in final § 1926.1203(e)(2)(vi) and § 1926.1204(e)(1)(ii). In addressing potential concerns about the technological feasibility of continuous monitors that would be capable of identifying various types of atmospheric hazards, OSHA included an exception that applies if the employer can demonstrate that the appropriate devices are not commercially available for this purpose.

One commenter suggested that requirements to exchange information and coordinate entry operations represent ''an unnecessary burden'' and ''in some cases may be infeasible,'' which OSHA takes to mean technologically infeasible, for the homebuilding industry (ID–124). Although this commenter cited industry statistics indicating that homebuilders tend to be small businesses that rely on subcontractors to handle specialized tasks, the commenter failed to show how this situation renders multi-employer communication requirements of the rule technologically infeasible for that industry. OSHA does not mandate any particular equipment for coordinating communications, and the Agency did not find evidence in the record suggesting that the exchange of information and entry coordination, which OSHA believes already occurs in the course of regular communications conducted by employers on construction worksites, is infeasible. At a time when most individuals have mobile phones, remote communication should be possible in most locations. In any case, in construction work, home-building contractors are able to successfully communicate with a variety of specialists about what work needs to be done and at what time. Therefore, there should be no feasibility problems in communicating essential safety information in the same way.

There was only one other provision of the proposed standard that elicited concerns from industry stakeholders about technological feasibility. That provision, which appears as § 1926.1204(e)(1)(iii) of the final standard, requires that employers provide an early warning system that will detect non-isolated engulfment hazards as a part of the permit-required confined space program. Such hazards can result, for example, when runoff from a heavy storm upstream in a sewer flows downstream into the work area. As noted in the IMIS reports, an employee died in 2009 when a rainstorm sent water rushing into a 24-inch pipe inside which the employee was working. Other examples would be if sewage, sand, grain, or other ''flowable'' solid substances flow into the area in which an employee is working.

Two commenters questioned the availability of early warning system technology (ID–059 and –098). A third commenter (ID–216) raised similar objections and, in particular, expressed concerns about the technical demands imposed on the employer to account for all of the factors involved in properly positioning the system.

In response to these comments, OSHA observes that manufacturers have designed early warning systems for years to alert workers to migrating engulfment hazards, including migrating engulfment hazards present in a space subject to final § 1926.1204(e)(1) (see, for example, *http://www.memecosales.com/products/level/blok-aid/* or *http://www.flygt.com/en-us/Pumping/Products/Monitoring-and-Control-equipment/Pages/Alarm-telemetry.aspx*). The range of available early warning systems runs from customized high-flow warning devices to simple fluid-level meters with audible alarms. The wide availability and application of such systems attest to their affordability and practicability under a range of circumstances. OSHA also notes that, in a series of stakeholder meetings in October 2000, various participants discussed the range of early warning systems, including monitors, cameras, and attendants positioned upstream outside confined spaces (see transcripts of stakeholder meetings, available at *https://www.osha.gov/doc/reference_documents.html*). The commenters generally characterized the systems as easy to implement and commonly used.

Even though this technology is clearly available, the standard does not require employers to use a device such as the early warning system. An employer may determine that an effective compliance solution would simply be to position detection and monitoring devices to provide early warning, or to station an employee to accomplish that function. In any case, given the option of using an employee to provide direct observation as one potential method of fulfilling the requirement, there is no doubt that the requirement may be accomplished with existing technology.

In conclusion, employers can achieve compliance with all of the requirements of the final standard with readily and widely available technologies or through the use of human observers. To demonstrate technological feasibility, OSHA must establish a ''reasonable possibility that the typical firm will be able to . . . meet the [standard's requirement] in most of its operations.'' *Lead II,* 939 F.2d at 980 (internal citation omitted). Given the wide availability of options for early warning systems, the final rule meets this legal test.

6. Costs of Compliance

Introduction

In this chapter, OSHA presents the estimated costs of the final rule for confined spaces in construction. These are the costs that employers would incur to achieve full compliance with the final rule, relative to the current baseline. They do not include costs employers incurred to achieve current compliance with the existing requirements.

Table IV–13 presents OSHA's estimate of the total annualized costs of the final rule by provision and by industry sector, expressed in 2009 dollars. As OSHA typically does, it annualized capital costs over the estimated useful life of the equipment, and annualized one-time costs over 10 years. Consistent with OMB's Circular A–4 (OMB, 2003), OSHA calculated annualized costs using two alternative discount rates: 7 Percent and 3 percent. As shown, OSHA estimated the total annualized cost of the final rule to be about $60.3 million using a discount rate of 7 percent, and $59.2 million using a discount rate of 3 percent.

TABLE IV–13—ANNUALIZED COMPLIANCE COSTS OF OSHA'S FINAL STANDARD FOR CONFINED SPACES IN CONSTRUCTION, BY PROVISION

Provision or hazard control	7 Percent rate	3 Percent rate
Evaluation, Classification, and Notification	$12,363,600	$12,208,018
Classify	948,249	948,249
Notice	2,091,862	1,936,279
Information Exchange	9,323,489	9,323,489
Issue Permits, Verify Safety, Review Procedures	4,196,574	4,190,373
Annual Review	154,746	154,746
Issue Permits	2,710,594	2,710,594
Written Program	1,331,234	1,325,033
Ventilation and Hazard Isolation	2,830,611	2,748,652
Isolation	784,364	771,079
Vent	2,046,247	1,977,573
Atmospheric Monitoring	11,395,322	11,282,168
Test Prior/During	10,661,160	10,551,394
Calibrate	734,162	730,773
Standby Person	3,623,866	3,623,866
Rescue Capability	8,157,084	7,576,244
Rescue	5,745,876	5,379,002
Retrieval	2,411,208	2,197,241
Training	11,340,155	11,296,556
Training	5,696,017	5,676,653
Supervisor Training	5,644,139	5,619,903
Other Requirements	6,402,728	6,269,690
Clothing	2,744,697	2,744,697
Barriers	2,801,408	2,723,063
Communication Equipment	624,044	584,200
Lighting	183,363	171,656
Alarms	61,252	57,644
Total Compliance Costs	60,321,976	59,207,135

Source: U.S. Department of Labor, OSHA, Directorate of Standards and Guidance, Office of Regulatory Analysis-Safety.

The structure of the equations which calculate the costs is the following equation:

$$TC = \sum_{k=1}^{27} \sum_{j=1}^{25} \sum_{i=1}^{3} NP_{ijk} \times NC_{ijk} \times H_{ijk} \times UC_{ijk}$$

Where TC = Total Cost, k subscripts each cost category, j subscripts each industry type, i subscripts the project size, NP is the number of projects in that size category, NC is the current non-compliance rate, H is the number of hours, and UC is the unit cost.

Using a discount rate of 7 percent, OSHA estimates that the annualized compliance costs for the major provisions of the final standard are as follows: Evaluation and classification of enclosed spaces, information exchange, and notification ($12.4 million); developing and reviewing written programs, issuing entry permits, and verifying the safety of confined spaces ($4.2 million); isolating hazards and providing sufficient ventilation ($2.8 million); conducting atmospheric monitoring ($11.4 million); having an attendant ($3.6 million); planning and providing rescue capability ($8.2 million); providing training ($11.3 million); and other requirements ($6.4 million).

Estimating Compliance Costs

The approach to compliance-cost estimation in this FEA follows the approach in the PEA and in the CONSAD analysis. However, the cost estimates in this FEA changed relative to the PEA to reflect changing construction practices over time, changes from the proposed to the final rule (including more closely aligning the final rule with the confined-spaces rule for general industry), and OSHA's responses to comments on the proposal and on the PEA.

For each type of construction activity identified by the CONSAD expert panel, OSHA took an estimate of the total number of construction projects from the F.W. Dodge data (the same source used for the PEA) and applied a category-specific number of confined spaces per project to derive the number of confined spaces. OSHA then used the number of confined spaces along with other pertinent estimates to determine the number of affected workers, and applied unit-cost estimates to calculate the costs of each provision of the standard, taking into account current compliance. OSHA derived many of the costs of this final rule by multiplying hourly wages by the labor hours required to fulfill a given requirement. As previously noted, OSHA annualized equipment purchase costs based on the estimated useful life of the equipment, and annualized one-time expenditures over a 10-year period.

AGCA presented an alternative economic analysis, prepared by Dr. Helvacian, of the compliance costs of the proposed rule, stating that the analysis in the PEA ''must be updated for the most recent data on establishments, employees, wages and benefits, and for prices for construction machinery and equipment'' (ID–222). In this FEA, OSHA updated its analysis of compliance costs to reflect more recent data, when these data were available. Specifically, to account for changes in wages and prices over time, OSHA updated the wages and capital and equipment costs presented in the PEA to 2009 dollars based on the percentage change in the GDP price deflator from 2002 to 2009, published by the U.S. Commerce Department, Bureau of Economic Analysis.[52] Dr. Helvacian's economic analysis was based partially on a survey of AGCA's member employers. The survey respondents have an average of 98.8 confined spaces per job, with a median of 3 spaces per job. This large disparity between the average and the median suggests the possibility that there was widespread misunderstanding among the respondents regarding what constitutes a confined space. By comparison, the average number of confined spaces per project based on the CONSAD report is 5.7, with an average of 193 entries per project.[53] OSHA believes that it would be unsound to extrapolate the commenter's survey results, based on only 74 respondents and 5 categories of construction projects, to the entire construction industry. In contrast, CONSAD based its estimates on results stratified by 25 project categories organized by project size. Furthermore, OSHA notes that adjusting the estimated average number of confined spaces and entries to reflect the commenter's reported median estimate would reduce OSHA's estimated compliance costs.

OSHA chooses not to adopt the commenter's estimated number of confined spaces. OSHA believes that the research conducted by CONSAD continues to provide detailed information that is not available elsewhere (for example, information related to entries into confined spaces and the distribution of confined spaces across construction projects). Therefore, OSHA finds that the CONSAD report, with appropriate updates and adjustments for the changing rule provisions and industry practices, provides the best available data related to entries into confined spaces in construction, and continues to rely on data published in that report to estimate compliance costs.

Dr. Helvacian's analysis also suggested that the number of hours required to comply with the proposed rule was greater than that estimated in the PEA (ID–222). However, although the report provided some aggregate time estimates, they were not sufficiently detailed for OSHA to analyze the estimates by specific requirements. Furthermore, OSHA notes that Dr. Helvacian based the survey results on the AGCA members' understanding of the proposed rule rather than the final rule, which the survey's introduction described as ''complicated, costly to implement, and does not provide significant increases in safety above the existing general industry standard'' (ID–222). For these reasons, OSHA is not adjusting its time estimates based on the AGCA survey results.

OSHA received a number of comments stating that many construction contractors were already complying with the general industry standard. For example, an association of utility contractors commented that its members ''enter into confined spaces on a regular basis in the course of their construction operations. They have been using the General Industry Standard (29 CFR 1926.146) since it was issued in 1993 and have customized their confined space programs and training to comply with that standard'' (ID–075). Another commenter, a construction-safety consultant, stated that employers were already complying with a state standard on confined spaces, which the state based on OSHA's general industry standard (ID–047). Tom Skaggs, representing the Mechanical Contractors Association of America, testified that the industry was successfully protecting workers ''through voluntary compliance with OSHA's general industry standard'' (ID–210, Tr. p. 278; see also ID–180 for his written testimony). Other commenters also stated that much of the construction industry adheres to the general industry standard (*e.g.,* ID–086, –092, –120, –124).

Based on these comments, and in light of the changes from the proposed rule to the final rule that more closely align the final rule with the general industry rule, OSHA revised its estimated rates of current industry compliance upward in this FEA for many of the provisions of the final rule. Table IV–6, introduced earlier in Chapter 3 of this FEA, presents these revised compliance rates. Because the final rule requirements concerning information exchange, continuous monitoring, and early warning systems and rescue vary from the general industry rule, the Agency did not adjust the estimated compliance rates related to these provisions in this FEA.

To adjust compliance rates, OSHA used information on state confined-space standards for construction. The states that have confined space standards for construction are: California, Kentucky, Maryland, Michigan, Minnesota, Virginia, Washington, and Alaska. These eight states have different confined-space requirements that comply with some or all of the OSHA requirements in the final rule, depending on the state. OSHA assumed that the original CONSAD compliance rate would be applicable in states without state standards, and assumed full compliance with the provisions of the standards specific to each of these eight states. The content of the state construction standards varies by state, so OSHA calculated weighted average compliance rates for each provision of the standard based on the proportion of establishments in each state having that provision. As the record shows, this approach may underestimate the actual compliance rates since many construction employers have come into compliance with the general industry

[52] Source: *http://www.bea.gov/iTable/iTable.cfm?ReqID=9&step=1#reqid=9&step=3&isuri=1&903=13.*

[53] This estimate excludes single-family housing projects. OSHA added these projects to the analysis in this FEA.

standard, and, therefore, with provisions of this final rule, whether or not they are located in the states with confined-space standards for construction. These employers come into compliance with the general industry standard because, in part, they perform both general industry and construction work. OSHA also modified some compliance rates from the CONSAD report to account for large projects having greater compliance rates than smaller projects within the same activity type.

Table IV–14 presents the estimated unit costs associated with each requirement in the final rule. Following this table is a discussion of OSHA's estimated compliance costs by requirement.

TABLE IV–14—UNIT-COST ESTIMATES FOR CONTROLS NECESSARY TO ACHIEVE COMPLIANCE WITH THE FINAL STANDARD

Activity or equipment	Unit cost/useful life
Construction supervisor wage (including benefits)	$42.16 per hour.
Skilled worker wage (including benefits)	$29.60 per hour.
General construction employee wage (including benefits)	$24.93 per hour.
Clerical employee wage (including benefits)	$22.53 per hour.
Unskilled worker wage (including benefits)	$22.67 per hour.
Confined-space notification signs	$18.92/5 years.
Host employer/controlling contractor information exchange	8 minutes of supervisor time.
Controlling contractor/entry employer information exchange	20 minutes of supervisor time for each entity involved.
Controlling contractor/other worksite employer information exchange	5 minutes of supervisor time for 10 percent of employers.
Entry coordination	10 minutes of supervisor time for 3 supervisors per coordinated entry.
Written program	1 hour per project.
Issue permits/maintain records/review procedures	10 minutes of supervisor time and 5 minutes of clerical time per permit issued.
Implement and verify alternative entry procedures	5 minutes of supervisor time and 5 minutes of clerical time per non-permitted space entry.
Time to isolate a hazard (*e.g.,* with double block and bleed method, lockout/tagout system, etc.).	5 minutes skilled employee time.
Lock	$13.80/2 years.
Tag	$1.61 each.
Portable ventilation system	$1,332/5 years.
Operation and maintenance costs for ventilation system	Add 10% per year to cost of system.
Set up ventilation system	10 minutes skilled employee time.
Ventilate confined space prior to entry	45 minutes skilled employee time.
Set up atmospheric monitoring equipment	20 minutes skilled employee time per entry.
Atmospheric-monitoring equipment (three-gas monitor)	$1,000/5 years.
Atmospheric-monitor calibration test	1 calibration per 160 hours of use.
Attendant	1 additional construction employee for duration of entry for anywhere from 3 hours to 3,400 hours.
Establish rescue procedures	1 hour supervisor time per project.
Entry rescue equipment	$5,328.56 per set/5 years.
Non-entry rescue equipment	$3,248.54/20 years.
Rescue team training	For each team of 4 employees: 16 hours skilled worker time (4 hours per employee) plus 4 hours supervisor time; plus for 1 employee: 4 hours skilled worker time for CPR training.
Training for entrants and attendants	Entrants (3–75 workers per project): 0.25 hours construction worker time; attendants (2–6 workers per project): 0.25 hours construction worker time; plus 1.5 minutes supervisor time per trained worker and 1.5 minutes clerical time per worker.
Training program development	4 hours supervisor time plus 1 hour clerical time for program development plus 6 hours supervisor time for training plus 1 hour clerical time per project.
Disposable coveralls	$8.94 per set.
Traffic barricades (pair)	$165.64/3 years.
Barricade tape	$2.12 per 100 feet.
Sign	$18.92/5 years.
Installation of sign or barricade	5 minutes per sign or barricade.
Two-way radios	$214.13/3 years.
Safety lantern for emergency lighting	$19.04/3 years.
Air horn for emergency evacuation	$23.79/3 years.

Sources: Wage data from Bureau of Labor Statistics. Other data from CONSAD report, Tables 6.1, 6.2, D.1, and D.2; and OSHA, Directorate of Standards and Guidance, Office of Regulatory Analysis-Safety.

Evaluation and Identification, Information Exchange, and Notification

The proposed standard required employers to evaluate confined spaces and their hazards, and to classify them as one of several types of confined spaces. In the PEA, OSHA estimated that compliance with the requirements would primarily involve a supervisor's time to categorize the confined space and evaluate its hazards.

Many commenters found the proposed multiple classification system for confined spaces unnecessarily burdensome. One commenter stated that ''[t]he four new classifications . . . will require drastic changes to existing confined space programs at great financial expense to the construction industry'' (ID–124). Another commenter objected to ''the cost to the contractor for re-educating employees in the new terminology,'' and supported the continued use of the ''the existing process'' in § 1910.146, the general industry standard (ID–035).

In contrast to the proposed standard, the final rule requires employers to evaluate confined spaces and their hazards (*i.e.,* determine whether a workspace is a confined space and identify the types of hazards that workers may encounter), and to identify those confined spaces that are permit spaces or covered by alternate procedures. This simplified requirement mirrors the requirements of OSHA's general industry standard for confined spaces. OSHA estimates that the time required to evaluate confined spaces as permit-required spaces would be substantially less than the time required to comply with the more complex proposed classification system, and, therefore, the Agency estimated an average time of about 12 minutes to evaluate a permit space and identify hazards. OSHA believes this estimate is appropriate given the many comments indicating that employers are already familiar with the general industry rule and its required classification process. For example, one commenter, which surveyed its members about the proposed standard, reported that ''identifying confined spaces [is] currently performed as part of normal business activities,'' and that ''within the past 15 years, many contractors have become accustomed to 29 CFR 1910.146 and have adjusted their safety programs to comply with this standard'' (ID–222).

For purposes of estimating the extent of current compliance, OSHA considers that projects in compliance with the proposed requirements to issue entry permits would also be in compliance with the final requirements for evaluating spaces as permit-required or not. Therefore, OSHA bases its compliance rates for these provisions on the compliance rates estimated for the provisions related to issuing entry permits. OSHA calculated the annual compliance cost for evaluating and classifying confined spaces by multiplying the supervisor's hourly wage rate by the number of hours per project required to identify and evaluate confined spaces, which can vary by project type. OSHA applied this total to the percentage of projects not already in compliance and summed across all projects. Using this approach, OSHA estimates an annualized cost of about $948,249 to comply with this requirement.

For example, to see how OSHA determined the cost of classification, we will examine one of the 25 types of projects: Construction on warehouses. Within this category there were 130 small projects, 220 medium projects, and 23 large projects.

The total cost for the large projects was derived by taking the number of projects (23) times the current non-compliance rate (42%) times the number of hours per project (1.5). This calculation yields a product of 14.49 hours. Multiplying that number by the unit cost ($42.16 per hour)—the cost of an hour of supervisor's time—yields $610.90, the cost of classification of large warehouse construction project confined spaces.

To determine the total cost of classification of all permit required confined spaces, the costs of all types of projects (small, medium, and large) for all 25 types of construction, weighted by each project-cell-types current non-compliance rate, are summed up. A total of 94 cells are added up to produce the total cost of classification.

The final rule includes specific requirements for employers at worksites with confined spaces to share information they may have about the hazards confronting their workers or other workers. One commenter stated that ''[i]t is essential to add in the costs to implement this proposed rule by all the employers on each construction site . . . , '' and that the ''estimated time necessary to attend to each confined space on each construction project by the proposed controlling contractor is 6 to 8 hours'' (ID–100). In providing this estimate, the commenter delineates several requirements that fall under the duties of entry employers and host employers. The commenter correctly notes the requirement that the controlling contractor exchange information with other worksite employers; however, by counting requirements for entry employers with the requirements for controlling contractors, the commenter overstates the time burden on controlling contractors. Another comment, in the report prepared by Dr. Helvacian, noted that employers had concerns about the costs of complying with requirements for ''information gathering'' and ''information sharing and coordination'' (ID–222). Although OSHA believes that employers on construction sites currently conduct the information exchange described in this chapter as part of their usual and customary business practices, in this FEA (unlike in the PEA) the Agency included estimated costs for information-exchange requirements, as follows.

Under final § 1926.1203(h)(1) and (h)(2), the host employer and the controlling contractor must exchange information about known permit spaces, such as location, past experiences with hazards in the spaces, and other pertinent information. Neither the host employer nor the controlling contractor has to enter the confined spaces to obtain this information. OSHA estimates that supervisors for the host employer and the controlling contractor will engage in eight minutes of conversation per project to fulfill this information-exchange requirement.

Under final § 1926.1203(b)(2), (h)(2), (h)(3), (h)(5), and (i), controlling contractors and entry employers must exchange information about permit spaces and their hazards. They also must share most of this information with employee representatives. OSHA estimates the information exchange requirement can be fulfilled with an average of 20 minutes of communication (one pre-entry and one post-entry conversation, each lasting 10 minutes) per project between a supervisor for the controlling contractor and an entry employer plus a worker-authorized representative of that entry employer

Under final § 1926.1203(h)(2), before entry operations begin, the controlling contractor must provide information about the permit-required spaces to employers with employees whose activities could foreseeably expose them to a hazard in the permit-required space. OSHA expects that employers on a worksite will not usually have employees engaged in work that could foreseeably expose them to such a hazard. To estimate the cost of compliance with this provision, OSHA anticipates that the controlling contractor's supervisor will engage in one 5-minute conversation with 10 percent of all non-entry employers on a worksite. OSHA calculated the number of non-entry employers on a worksite from estimates made by CONSAD of the number of non-entry workers on projects, assuming an average employer size of 20 employees.

Under final § 1926.1203(h)(4), the controlling contractor must coordinate entry operations when multiple employers enter simultaneously or when an employer makes an entry while other work performed at the site (outside the confined space) may result in a hazard in the confined space. To obtain the cost of compliance with this information-exchange provision, OSHA estimates that the controlling contractor and two employers will engage in one 10-minute conversation per coordinated entry. To estimate the number of coordinated entries, OSHA used estimates in the CONSAD report on the number of simultaneous entries per project. OSHA assumes that all estimated simultaneous entries will require coordination, and estimates that

10 percent of all entries will be subject to hazards as a result of work outside the confined space.

Although the CONSAD report did not provide direct estimates of compliance rates for the information-exchange requirements, OSHA believes that these compliance rates are similar to the compliance rates associated with the requirements for notification to non-entrant employees (ID–003, Table D.2). OSHA also believes it is reasonable to assume that projects in compliance with requirements addressing notification to non-entrant employees would also be in compliance with requirements addressing employer-to-employer communication.

OSHA calculated the annual compliance cost for information exchange on each project by multiplying the supervisor's hourly wage rate by the number of hours per project for each type of required information exchange. To estimate the cost of information exchange between host employers and controlling contractors, OSHA modeled eight minutes of three supervisors' time per project. Similarly, to estimate the cost of information exchange between controlling contractors and entry employers, OSHA modeled 20 minutes of supervisor time for the controlling contractor, a worker-authorized representative, and each of the entry employers on the project. To estimate the cost of information exchange between the controlling contractor and employers on the worksite having employees whose work may result in a hazard in the confined space, OSHA modeled five minutes of supervisor time for the controlling contractor and 10 percent of non-entry employers present. Finally, to estimate the cost of coordinating simultaneous entries, OSHA modeled 10 minutes for 3 supervisors (*i.e.,* the controlling contractor and two entry employers) for each such entry. For all of these calculations, OSHA applied the totals to the percentage of projects not already in compliance (*i.e.,* 1 minus the compliance rate) and summed these values across all projects. Using this approach, OSHA estimates an annual cost of approximately $9.3 million to comply with the information-exchange requirements in the final rule.

One commenter stated that the requirements to exchange information and coordinate entry operations represent ''an unnecessary burden'' and ''in some cases may be infeasible'' (ID–124). OSHA addresses this comment as a technological-feasibility issue in the section on technological feasibility, but the commenter's unsupported argument also would fail if directed at economic infeasibility. Although this commenter cited home-building industry statistics indicating that homebuilders tend to be small businesses that rely on subcontractors to handle specialized tasks, the comment did not explain how this condition renders the multi-employer and communication requirements of the rule economically infeasible for that industry.

Under final § 1926.1203(b) and (c), employers must inform exposed employees of the existence of permit spaces and the dangers they pose. In the PEA, OSHA estimated that complying with this requirement involved an average of five minutes per notified worker. In the FEA, the Agency no longer includes such notification costs. Rather, OSHA followed the PEA in assuming that employers will achieve compliance with the notification requirement by posting a sign at each confined space. OSHA estimates that signs have a five-year life, and that installation takes five minutes per sign. The Agency calculates the cost of signs as the unit cost of one sign times the number of signs per project, and calculates the installation costs as five minutes (1⁄12 of an hour) times the unskilled worker's hourly wage times the number of signs per project. OSHA applies these totals to the percentage of projects not already in compliance, summed across all projects. Treating the installation cost as a recurring cost, and treating signs as a capital cost with a useful life of five years, OSHA estimates that the annualized cost of signs, including materials and labor, to be $2.0 million.

Two stakeholders representing utility contractors, in similarly worded comments, stated that notifying non-authorized entrants ''could mean informing 25–100 or more employees on the jobsite, which would be extremely time consuming'' (ID–124 and ID–075). However, OSHA believes that, beyond posting the signs, there should be no additional costs associated with the requirement to inform exposed employees of the existence of permit spaces and the danger posed by unauthorized entry. OSHA notes that, under 29 CFR 1926.21(b)(2), employers must already provide general training to employees engaged in construction work to ensure that they recognize the hazards on the worksite, including applicable signage warning of hazards. As one commenter stated, ''In reference to warning employees not to attempt an unauthorized rescue, it should be part of every construction employee's training . . . because this warning applies to all construction rescue operations'' (ID–075).

In summary, OSHA estimates the total annualized costs related to the final requirements for evaluation and classification, information exchange, and notice to employees to be $12.1 million.

Written Program, Permit Issuance, and Annual Review

The proposed standard required that employers on worksites with confined spaces either develop a confined-space program and maintain a copy of the written program, or, alternatively, maintain a copy of the standard at the site. For analytical purposes, OSHA assumed that employers would choose the least-cost alternative and maintain a copy of the standard at the site in lieu of developing a written program. In contrast, final § 1926.1203(d) is similar to the general industry provision in that it requires entry employers to develop and implement a written permit-space program, and final § 1926.1204(n) requires employers to review the permit-space program.

In this FEA, OSHA estimates one hour of supervisor time per project to write a program. OSHA based this estimate on the paperwork-burden determination made in the proposed rule for developing such a program, which no commenter disputed. OSHA also notes the wide availability of written model permit-space programs provided by government entities, trade associations, and others, that employers could adapt with a limited number of revisions to comply with the new standard (see, for example, *http://www.purdue.edu/rem/home/booklets/ConSpProg.pdf*). OSHA calculated compliance costs associated with the requirement to develop a written program as a one-time cost consisting of one hour times the supervisor's hourly wage times the number of projects. OSHA applied this total to the percentage of projects not already in compliance, and annualized the costs using assumptions on the share of projects that are new to a contractor each year—yielding a total annualized cost of approximately $1.3 million. OSHA notes that, in practice, an employer is likely to develop one, somewhat generic, program, and then apply it later to other projects. Given the ready availability of model programs online and elsewhere, adapting one with limited revisions to a company's particular needs is not especially difficult or time consuming. In addition, following the PEA, OSHA estimates five minutes of supervisor time per program for the annual review, and computes the cost for this review as five minutes (1⁄12 of an hour) times the supervisor's hourly wage times the number of projects not already in compliance—yielding an estimated annual compliance cost of about $155,000.

Final § 1926.1205 requires employers to issue entry permits, and final § 1926.1206 specifies the information employers must include in the permits. In the PEA, OSHA estimated that compliance with the requirements to issue written entry permits when necessary, and to review procedures periodically, would primarily involve supervisor time; OSHA estimated that 15 minutes of supervisor time per permit issued was sufficient for this purpose. For this FEA, OSHA estimated compliance costs associated with issuing permits separately from the compliance costs associated with the annual review of the permit-space program. Following the analysis by CONSAD, OSHA estimates that compliance with these provisions will involve 10 minutes of supervisor time to issue a permit, 5 minutes of clerical time to write the permit, as well as 5 minutes of supervisor time to provide written verification regarding the safety of non-permit spaces, and 5 minutes of clerical time for recordkeeping for non-permit spaces. The total estimated annual costs in this final standard associated with issuing entry permits and written verifications of safety are $2.7 million.

In summary, OSHA estimates that the annualized costs of the final requirements to provide a written program, issue written permits, and conduct an annual review of the program total to $4.2 million.

One commenter stated that the requirement to develop a confined-space program might require the assistance of a third party, and asserted that program development could cost contractors $10,000 (ID–112). However, the commenter did not explain the basis for the $10,000 estimated cost of program development, and did not specify which elements of ''program development'' were in its estimate. For example, OSHA separately estimated the costs of providing a written confined-space program and developing a training program. Furthermore, OSHA notes that the final rule does not require employers to engage a third party in the development of a confined-space program. Indeed, a variety of examples of confined-space programs are widely available on the Internet, which employers may adapt for their needs; in addition, OSHA will provide a small entity compliance guide to aid employers in developing such programs.

Isolating Hazards and Providing Ventilation

Final §§ 1926.1203(e) and 1926.1204 refer to isolating hazards and providing ventilation to ensure safe entry conditions for permit-required spaces and confined spaces covered by alternate procedures. As in the PEA, OSHA estimates that isolating hazards and providing ventilation would require the time of a skilled construction employee, additional costs for locks and/or tags, the purchase costs, and the operating and maintenance costs for a portable ventilation system. OSHA included the unit costs for these items in Table IV–14 above. OSHA received no specific comments on the preliminary compliance costs in the PEA related to these provisions. While recognizing that isolation costs may vary according to the hazards isolated, OSHA nevertheless considers the cost estimates in the PEA for blanking and bleeding and lockout/tagout to be reasonable estimates of isolation costs; therefore, OSHA applied the same cost methodology to this section of the final standard.

OSHA estimated isolation costs by multiplying the skilled worker hourly wage times 10 minutes (1⁄6 or an hour) times the number of entries per project requiring blanking, plus the skilled worker hourly wage times 5 minutes (1⁄12 of an hour) times the number of entries per project requiring double block and bleed, plus the skilled worker hourly wage times 10 minutes (1⁄6 of an hour) times the number of entries per project requiring lockout/tagout, plus the cost of tags and locks annualized over a 2-year useful life. OSHA applied these totals to the percentage of projects not already in compliance, summed across all projects. Similarly, OSHA estimated ventilation costs as the purchase costs and operating and maintenance costs for portable ventilation systems applied to the percentage of projects not already in compliance, summed across all projects. OSHA based this estimate on a unit cost of about $1,332 per portable ventilation system, annualized over a useful life of 5 years, and 10 minutes (1⁄6 of an hour) of setup time multiplied by the unskilled worker hourly wage. The Agency applied these totals to the percentage of projects not already in compliance, summed across all projects. Based on this method, OSHA estimates total annualized costs related to isolating hazards and providing ventilation to be $2.5 million for this final rule.

Monitoring, Early Warning Systems, and Attendants

Final §§ 1926.1203(e) and 1926.1204(e) set forth requirements for monitoring hazards, which generally include continuous monitoring, or periodic monitoring of sufficient frequency, to ensure acceptable entry conditions, as well as an early warning system for non-isolated engulfment hazards. The monitoring provision reflects the requirements in § 1910(d)(5) of the general industry standard, while the requirement for an early warning system is unique to the construction standard (that is, not included in the general industry standard).

Costs related to monitoring and early warning consist of both equipment costs and labor costs associated with attendants and other employees who perform these functions. The following paragraphs include a discussion of the costs related to attendants and other employees who perform monitoring and early warning for hazards under specified conditions.

One commenter stated that the early warning system for engulfment hazards will be ''quite expensive for a contractor to purchase, install and maintain with calibration'' (ID–098), while some other commenters suggested that the requirement for an early warning system would force employers to hire more employees for the purpose of monitoring for these hazards (ID–059 and ID–112). OSHA provides a choice to employers for how they comply with the early warning requirement: They may use early-warning equipment or they may rely on personnel to provide warning. OSHA expects that employers will do whatever is less costly; in some cases this will be a worker exclusively assigned to monitoring duty, and in other cases it will be cheaper to use a monitoring device. OSHA calculated the costs based on the use of personnel to perform this function because it is simpler to calculate on a per-instance basis; however, OSHA does not expect that the cost of purchasing a device would be significantly higher on a per-instance basis when employer can use the device over a number of projects and over several years. In some cases the equipment cost will be lower than the labor estimates included in this analysis.

OSHA expects that incumbent workers can discharge the early warning-monitoring duty, and estimates the total cost as the construction worker's hourly wage multiplied by the number of entry hours per project, which varies by project. OSHA applied these totals to the percentage of projects not already in compliance, summed across all projects. Based on this method, OSHA estimates total annualized costs of $3.6 million to comply with the requirement to provide an early warning system.

To assign costs to the use of equipment required to monitor atmospheres in confined spaces, OSHA estimated in the PEA that gas monitors have an average useful life of 2.5 years, and that their unit cost (in 2009 dollars) is $1,660. One commenter (ID–222, p. 12) stated that an average monitor would cost ''around $2,000,'' and that an employer would need to have two units and additional sensors due to reliability problems with such equipment. The Agency notes that employers in general industry have successfully used monitoring equipment under the general industry standard, and the Agency believes that reliable equipment is commercially available. Moreover, based on OSHA research, the price of a gas monitor has fallen to around $1,000, and industry practice suggest that a gas monitor has a useful life of 5 years; these are the estimates used in this FEA.

OSHA estimated 20 minutes of supervisor time to set up the monitoring equipment, taking into account the possibility that, in some cases (with a test occurring after 160 hours of use—a conservative estimate according to industry experts). OSHA calculated the costs related to monitoring as the equipment cost ($1,000) annualized over a useful life of 5 years, plus operating and maintenance costs equal to 5 percent of equipment costs, plus calibration costs based on use time, plus observation and testing costs based on the duration of entries, which varies by project. OSHA applied these totals to the percentage of projects not already in compliance, summed across all projects. Based on these calculations, OSHA estimates that annualized compliance costs for monitoring total to $11.3 million.

A commenter stated that employers had concerns about the recordkeeping cost of retaining monitoring data for 30 years (ID–222). However, OSHA notes that although employers must make exposure records for employees exposed to hazards available for 30 years under pre-existing OSHA requirements (*i.e.,* 29 CFR 1910.1020), this final rule does not require that routine monitoring records be kept for 30 years.

Final § 1926.1204(f) requires employers to post an attendant outside the permit space for the duration of authorized entry operations, and final § 1926.1209 sets forth the duties of attendants, which include assessing the entrants and the conditions inside and outside the permit space to detect prohibited conditions and summoning rescue and other emergency services. The requirement for an attendant is similar to a requirement in the general industry standard. In this FEA, as in the PEA, OSHA estimates that the cost of posting an attendant is the wage rate of a skilled construction worker multiplied by the time that entrants spend in the confined space.

Rescue Capability

The proposed standard sets forth several requirements for non-entry and entry rescue, including provisions for preparing, protecting, and training entry-rescue employees. In the PEA, OSHA estimated that compliance with rescue-related provisions would have a total annualized cost of approximately $9.6 million, including costs for non-entry rescue and in-house entry rescue teams for many construction projects. One comment characterized the estimated costs related to rescue ''planning and compliance'' as ''drastically low and inaccurate'' (ID–124). Several commenters seized on the proposed requirement to summon an entry-rescue team whenever an employer initiates a non-entry rescue. For example, at the hearing, testimony from the National Utility Contractors Association suggested that the proposed rule required employers to have ''a standby entry rescue team that can respond to the incident in a timely manner'' (ID–210, Tr. p. 177). Another commenter stated that the rescue requirements are ''unreasonable and burdensome'' (ID–075). This commenter, representing utility contractors, elaborated on its concerns:

> It is not always practical or feasible to have a rescue team onsite and it is very expensive to have a team on standby unless it is the local fire/police rescue squad. The proposed rule should be revised to permit entry into the average PRCS without having a rescue team onsite or on standby. Most fire department rescue squads can handle the majority of confined space rescues, such as manhole, pipe, vault and underground tank rescues. However, due to liability, most fire departments will not assume the responsibility of being the *designated* rescue team on standby, although they will respond to a call and perform the rescue. In our opinion it is safer to have professionals respond than to depend on employees who have had some training and probably no experience handling an actual rescue. *Id.* (emphasis in original).

Other commenters suggested that rescue equipment costs could be high. One commenter stated: ''At the very least, the equipment would include a tri-pod, retrieval device, ventilation equipment, air monitors, two air-supplied respirators, air cart and air bottles or air compressor designed to provide breathing air, stokes stretcher and necessary equipment to package the victim and much more'' (ID–075). Another commenter stated that the ''rescue equipment required could vary greatly. A Confined Space Rescue Team Kit, consisting of a tripod, rescue harnesses/helmets, blower, rope, hardware, software, etc., can easily cost upwards of $17,000 per set'' (ID–112).

In response to these and other comments, OSHA revised the requirements for rescue and emergency services for the final rule. For example, OSHA dropped the requirement in proposed § 1926.1211(h)(2) that required employers to summon an entry-rescue team every time they initiated non-entry rescue. OSHA also clarified the Agency's preference for non-entry rescue, which typically consists of a retrieval system and is, therefore, less expensive than entry rescue. Moreover, it appears that some of the commenters mistakenly included costs for equipping contracted rescue services (rather than in-house services of employees) when asserting that OSHA's estimates were too low; employers would not incur such costs as the result of this final rule, and OSHA, therefore, did not include these costs in this analysis.

Final § 1926.1204(i) requires employers to develop and implement procedures for: Providing rescue and emergency services, including procedures for summoning emergency assistance in the event of a failed non-entry rescue; rescuing entrants from permit spaces; providing necessary emergency services to rescued employees; and preventing unauthorized personnel from attempting a rescue. Paragraph (a) of § 1926.1211 specifies the criteria according to which employers can choose rescue and emergency services; § 1926.1211(b) specifies requirements for employers who choose to designate their own employees as the rescue service; and § 1926.1211(c) sets forth requirements related to retrieval systems used to facilitate non-entry rescue from permit spaces. These provisions are similar to the general industry standard for confined spaces. For cost-estimation purposes in the PEA, OSHA judged that entry employers would designate employees who use self-contained breathing apparatuses to provide entry rescue services. OSHA also determined that the rescue-related compliance costs incurred by these employers include expenditures for training and equipment. The Agency used the time of a skilled construction worker to estimate the labor costs associated with training four employees in rescue operations, conducting practice rescue operations, and training one employee in CPR. Separately, OSHA estimated costs of retrieval lines for employers electing non-entry rescues. Thus, for the proposed rule, the Agency estimated costs for entry rescue and non-entry rescue separately.

Final § 1926.1211(c) requires employers to use non-entry rescue, such as retrieval equipment, unless the retrieval equipment would increase the overall risk of entry or would not contribute to the rescue of the entrant. Therefore, for this FEA, OSHA estimated that employers that use non-entry rescue (retrieval lines) would not also designate employees for entry rescue for the same project, but would instead continue to rely solely on emergency services in the event of non-entry rescue failure. OSHA estimated a unit cost per entrant of $3,250 for retrieval systems. The cost of retrieval systems includes the cost of harnesses, which, according to one commenter, cost $100 each and have a useful life of 5 years (ID–112). However, harnesses are a small part of a retrieval system's total cost. In addition to the equipment cost of retrieval lines for each entrant, employers using non-entry rescue would incur additional costs, including one hour of supervisor time to establish rescue procedures and one hour of practice annually for a supervisor and team of 4 non-entry rescuers.

OSHA judges that, when employers do not employ non-entry rescue, they will rely on in-house rescue teams only when entrants use a self-contained breathing apparatus, and will rely on outside rescue service in other situations. OSHA estimates one hour of supervisor time to establish rescue procedures for all employers electing entry-rescue procedures. Following the PEA, OSHA modeled additional costs only for employers using in-house rescue teams; these costs include one hour of practice annually for a supervisor and a team of four rescuers, as well as costs for annual training, CPR training, and entry-rescue equipment.

OSHA did not receive any comments addressing its method of estimating costs for employers using in-house rescue services.

In the PEA, OSHA estimated that confined-space entry-rescue team kits will cost approximately $5,330 per unit (in 2009 dollars). While rescue team kits as such are not required by the standard, they are a simple way for an employer to obtain the equipment *typically* necessary for an adequate rescue team. OSHA concurs with the comment that unit costs for these rescue kits can vary considerably, but a review of commercially available kits shows that the estimate developed by OSHA is reasonable. For example, one commercially available system priced at $2,735 includes a tripod rescue/retrieval system, blower, gas monitor with calibration capability, and a harness. Another system, priced at $4,450, includes a two-way communication system, talk box, cable splitter, operator headset, face masks, speaker harnesses, cables, hooks, and connectors. Confined-space rescue kits are available at a price range of $3,000–$4,500. These kits typically include a wide range of items such as a tripod with bag, spine splint, collar kit, 4:1 rescue kit, full-body harnesses, tag line, belay line, anchor sling, continuous-loop sling, handled ascender, helmets, ascending stirrup, rope pad, rope guard, and carabiners.[54] Based on these prices, and given that OSHA estimated costs for communication devices, ventilation equipment, and gas monitors elsewhere in this analysis, OSHA believes that its estimate of $5,330 for a rescue kit more accurately reflects the requirements of the standard than does the estimate of $17,000 suggested by the commenter. Indeed, OSHA's cost estimate may be an overestimate of the true cost to the extent that a particular confined space covered by the final standard may not require some of the equipment included in commercially available kits.

The final rule requires non-entry rescue unless the retrieval equipment would increase the overall risk of entry or would not contribute to the rescue of the entrant. To calculate compliance costs, OSHA estimated that employers will use non-entry rescue with retrieval lines for projects whenever required under the standard, and will select entry rescue for all other projects. OSHA estimated that, for all projects, one hour of supervisor time is necessary to set up procedures, and estimates this cost as the supervisor's hourly wage, applied to all projects not already in compliance. In addition, OSHA estimated costs for projects that use non-entry rescue based on the equipment costs for retrieval lines ($3,250) multiplied by the number of entrants on a project. The Agency annualized this cost over a useful life of 20 years, with the total applied to the percentage of projects not already in compliance, adjusted for the number of projects with retrieval lines onsite but not properly used. OSHA estimated four hours of skilled worker time per year to capture the cost of non-entry rescue practice, and applied this total to the percentage of projects not already in compliance.

OSHA estimated costs for projects using entry rescue as the cost of providing in-house rescue for a subset of projects. For all other projects, OSHA estimated that employers will rely on local emergency responders to provide entry rescue, as most employers who have programs do today. For projects using in-house rescue, OSHA calculated the cost of 2 days of entry-rescue training for 4 skilled construction workers (16 hours times 4 workers times the skilled construction worker's hourly wage), 4 hours of CPR training for one skilled worker, and a set of rescue equipment annualized over a useful life of 5 years. OSHA estimated 4 hours of skilled worker time per year to capture the cost of non-entry rescue practice, and applied this total to the percentage of projects not already in compliance. Based on this method, OSHA estimates that the annualized costs for the requirements in the final standard to provide rescue capability total to $8.3 million.

Training

Final § 1926.1207 sets forth requirements for training entrants, attendants, and supervisors to ensure safe performance of the duties assigned under the standard.

In the PEA, OSHA estimated that annualized training costs associated with the proposed standard would total to $8.1 million. As stated in the PEA, this total reflected an adjustment to the estimates in the CONSAD report based on comments received from potentially affected small businesses, and the findings and recommendations made by a panel of reviewers. Several commenters stated that training under the proposed rule would be expensive. However, since the final rule represents a significant simplification of the requirements in the proposed rule, OSHA reduced the cost estimates accordingly. OSHA further notes that, although it anticipates that most affected employers will train workers once using a procedure that covers many topics, and conduct refresher training as appropriate along with training newly arrived employees, the Agency modeled training costs on a per-project basis to be consistent with the rest of the CONSAD-derived analysis. This assumption, along with the unit-

[54] See *http://www.majorsafety.com/index.cfm/product/450_105/confined-space-tripod-rescue-system-with-bw-gasalert-max-xt-and-blower.cfm*; *http://www.rocknrescue.com/acatalog/Con-Space-Rescue-Kit-3.html#aCSI_2dRES_2dKIT3*; *http://www.rocknrescue.com/acatalog/Skedco-Evac-Confined-Space-Rescue-Kit.html*.

cost figures used, results in a large and inflated estimate of the training costs.

OSHA notes that the duties of entrants and attendants as set forth in the final standard are now similar to the duties of comparable employees covered by the general industry standard, and that many commenters stated that they were already complying with the general industry standard. In addition, 29 CFR 1926.21(b), a decades-old provision applicable to confined spaces in construction, already requires some training on the characteristics of confined spaces and associated safety practices. Many comments echoed the statement that ''affected construction workers are already extremely familiar with the existing general industry standard'' (ID–148). Therefore, consistent with the observations above, OSHA believes that the training required for employees will be less extensive than was suggested by the Agency's preliminary training cost estimates.

For this final analysis, OSHA estimates that the costs associated with training entrants and attendants would primarily involve supervisor and employee time necessary for the supervisor to conduct the training. For this FEA, OSHA estimated that employers will spend four hours of supervisor time plus an hour of clerical time developing or revising the training programs for entrants, attendants, and supervisors. OSHA estimates 15 minutes of training for entrants and attendants (1 supervisor and 1 clerical worker are modeled to provide training to a class of 10 entrants). OSHA also includes 1 hour of supervisor training, and 6 minutes of supervisor time to provide the training, per project (again, assuming a class size of 10). As a reminder, most supervisors are already familiar with the general industry rule and, therefore, with many provisions of this final rule. Based on these underlying unit costs, OSHA estimates that the annualized training-related costs under the final standard will be $11.3 million.

Other Compliance Costs

Other compliance costs associated with the final standard include providing disposable coveralls when necessary, emergency lights, traffic barriers, and communication equipment. OSHA identified these costs in the PEA and received no specific comments on the compliance costs for these requirements. Therefore, the Agency used the same methodology in this FEA to estimate these costs.

OSHA modeled the clothing costs based on workers wearing disposable coveralls. The Agency multiplied the number of worker entries requiring disposable coveralls for each project type (by activity and size) by the number of projects in that category that are not currently in compliance and by the unit-cost for disposable coveralls of $8.94 per set. The number of entries requiring this clothing is a subset of the entire number of entries. The estimated annual cost for disposable overalls comes to $2.7 million.

To calculate the costs of emergency lights, OSHA estimated the number of simultaneous entries for each project type. OSHA then multiplied that number by the unit cost of a lantern, $19.04, and annualized it over a useful life of 3 years. Finally, OSHA multiplied the cost per project by the number of projects not in compliance for each category, and summed across categories. The resulting cost is about $193,000 a year.

To calculate the costs of traffic barriers, OSHA added costs for traffic barricades and barricade tape. The Agency estimated that 50 percent of all projects require these controls. OSHA then annualized the unit cost of $165.64 for a traffic barricade over 3 years, and the unit cost of barricade tape at $2.12. The total annualized cost of these barriers comes to $2.9 million.

To calculate the costs of communication equipment, OSHA assumes that employers use two-way radios. OSHA estimated using this equipment for each simultaneous entry. The useful life of this equipment is typically three years. OSHA multiplied annualized costs by the number of simultaneous entries per project and by the number of projects not in compliance per category, and summed the results across categories. The total annual communication costs come to about $55,000.

The total annualized costs for these other requirements come to $6.5 million.

Respiratory Protection

In this FEA, OSHA did not include costs for respiratory protection for two reasons. First, OSHA designed the final rule to prevent an employee's exposure to confined-space hazards whenever possible, thereby obviating the need for respirators and other PPE in those cases; the provisions of the final rules designed to prevent such exposure include training, information exchanges, and a program that ensures appropriate testing and evaluation, monitoring, planning, and control of the space to prevent unauthorized entry (including unauthorized rescues). This approach is fundamental to OSHA's regulatory policy, which recognizes a hierarchy of controls consisting of engineering controls when possible, then work-practice controls when engineering controls are not possible, and finally personal protective equipment only when the other controls are not feasible.[55] Second, consistent with the design of the final rule, none of the safety benefits estimated in this FEA were attributable to respiratory protection. The Agency believes that it would be inconsistent to attribute costs, but not benefits, to respiratory protection (unless, of course, the respiratory protection requirement generates costs but not benefits).

This treatment of respiratory protection in the FEA is fundamentally different from OSHA's earlier treatment of respiratory protection in the PEA. In the PEA, OSHA included costs for employers to provide respiratory protection. These costs included the purchase of the appropriate type of respirator (*e.g.,* self-contained breathing apparatus, powered air purifying respirators, dust masks), time and materials for cleaning respirators, and other necessary equipment such as a

[55] The following excerpt from the preamble to OSHA's Cadmium standard at 57 FR 42101, 42340 (Sept. 14, 1992) provides a typical summary of OSHA's concerns about reliance on PPE and the importance of the hierarchy of controls:

Engineering controls are preferred by OSHA for a number of reasons. Engineering controls are reliable, provide consistent levels of protection to large numbers of workers, can be monitored continually and inexpensively, allow for predictable performance levels, and can remove toxic substances from the workplace. Once removed, the toxic substances no longer pose a threat to the employee. Moreover, the effectiveness of engineering controls does not depend to any marked degree on human behavior, and . . . the operation of equipment is not as vulnerable to human error as is the use of personal protective equipment . . .

Respirators are another, important method of compliance. However, to be used effectively, respirators must be individually selected; fitted and periodically refitted; conscientiously and properly worn; regularly maintained; and replaced as necessary. In many workplaces, these preconditions for effective respirator use are difficult to achieve with sufficient consistency to provide adequate protection. The absence of any of these preconditions can reduce or eliminate the protection the respirator provides to the employee.

Because there are so many ways that respirators can be rendered ineffective and so many potential problems associated with their use, OSHA has traditionally relied less on respirators than on engineering and work-practice controls in the hierarchy of controls. For example, where work is strenuous, the increased breathing resistance of certain types of respirators may contribute to an employee's health problems and may reduce the acceptability of wearing a respirator to employees. Although experience in industry shows that most healthy workers do not have physiological problems wearing properly chosen and fitted respirators, common health problems can cause difficulty in breathing while an employee is wearing a respirator.

compressor or air supply, depending on the type of confined space and the type of work performed in the space. Furthermore, the Agency used a relatively low rate of current respirator compliance in the PEA, resulting in significant estimated costs (approximately $11.6 million in 2009 dollars) for respirator protection.

The revised treatment of respirator-protection costs in this FEA remedies several issues retrospectively identified in the PEA. First, OSHA designed the final rule to avoid respirator use by relying instead on training, information exchanges, and a program that ensures appropriate testing and evaluation, monitoring, planning, and control of the space to prevent unauthorized entry (including unauthorized rescues). The costs estimated for respirator protection in the PEA failed to fully appreciate the underlying logic of the proposed rule to avoid respirator use whenever possible. Second, OSHA did not attribute any benefits to respirator protection in the PEA. Removing the respirator-protection costs in the FEA resolves the inconsistent treatment of respirator costs and respirator benefits in the PEA.

The third issue concerns the relatively low rate of respirator compliance used to estimate the costs of respirator protection in the PEA. These rates reflected the findings of the 1994 CONSAD report. As noted earlier in this FEA, some commenters questioned the continued relevance of the CONSAD report produced in 1994 (ID–222, p. 20). In light of these comments, OSHA reexamined the CONSAD report and concluded that, generally, while it is the best available data source for this rulemaking, the Agency had to make adjustments in particular areas to reflect updated information. One of these areas involves CONSAD's outdated assumptions and data regarding respirator use. Based on surveys conducted in 1993, the CONSAD report assumed a high rate of non-compliance with the Respiratory Protection standard that existed at the time, and the PEA included significant respirator costs under the assumption that the new confined-spaces standard for construction would have a significant impact on respirator use. However, the CONSAD assumption did not account for the publication of OSHA's significantly revised Respiratory Protection standard in 1998 (63 FR 1152 (Jan. 8, 1998)). In that 1998 rulemaking, OSHA reviewed its enforcement data for the years 1990–1996, acknowledged that many of the respiratory-protection programs were deficient, and designed the new standard to improve employer's selection, maintenance, fit testing, and training for proper respirator use, and ''to provide employers with the tools needed to implement an effective respiratory protection program'' (63 FR 1160). The rulemaking increased monitoring requirements and awareness and understanding of the respirator requirements. In light of these revisions to the Respirator Protection standard subsequent to the CONSAD report, OSHA concluded that the new standard would significantly enhanced employer compliance with the respiratory-protection requirements by reducing misinterpretations and inconsistencies (63 FR 1158). Enhanced compliance increased the respiratory protection provided to workers, making it unnecessary to rely on the provisions of this final confined-space rulemaking to protect workers from respiratory hazards.

The new confined-spaces standard does not require any additional respirator use beyond that already required by the existing Respiratory Protection standard. OSHA believes that the much-reduced need for respirator protection in confined spaces in the future (as a result of this final rule) will not increase, and could arguably decrease, future respirator use in confined spaces in construction relative to current respirator use.

Annualized Costs by NAICS Industry

Based on the cost estimates for the individual provisions contained in this final standard, Table IV–15 shows, by affected industry engaged in construction activity, annualized compliance costs for all establishments, annualized compliance costs for all small entities (as defined by the Small Business Act and the Small Business Administration's (SBA's) implementing regulations; see 15 U.S.C. 632 and 13 CFR 121.201), and annualized compliance costs for all very small entities (those with fewer than 20 employees). OSHA annualized the costs presented in Table IV–15 using the discount rate of 7 percent, which is, along with a discount rate of 3 percent, recommended by OMB in Circular A–4.

TABLE IV–15—ANNUALIZED COSTS, BY INDUSTRY, FOR ALL CONSTRUCTION ENTITIES AFFECTED BY THE FINAL CONFINED-SPACE STANDARD FOR ALL ESTABLISHMENTS, SMALL ENTITIES, AND VERY SMALL ENTITIES

NAICS	Industry	All establishments	Small entities (SBA-defined)	Very small entities <20 employees)
221310	Water Supply and Irrigation Systems	$51,635	$14,299	$8,738
236115	New Single-Family Housing Construction (except Operative Builders).	813,505	578,128	351,852
236116	New Multifamily Housing Construction (except Operative Builders).	955,662	533,573	174,635
236118	Residential Remodelers	8,277,207	7,853,017	4,342,753
236210	Industrial Building Construction	2,331,853	527,967	175,989
236220	Commercial and Institutional Building Construction	11,862,610	5,868,843	1,747,634
237110	Water and Sewer Line and Related Structures Construction	8,687,099	4,956,577	1,400,582
237130	Power and Communication Line and Related Structures Construction.	2,125,111	697,984	105,944
237310	Highway, Street, and Bridge Construction	15,614,845	4,915,948	1,061,237
237990	Other Heavy and Civil Engineering Construction	1,405,363	513,278	145,898
238190	Other Foundation, Structure, and Building Exterior Contractors	1,627,010	1,069,906	428,448
238210	Electrical Contractors and Other Wiring Installation Contractors	1,627,010	877,857	330,259
238220	Plumbing, Heating, and Air-Conditioning Contractors	2,471,532	1,450,572	551,757
238310	Drywall and Insulation Projects	1,627,010	686,015	203,983
238910	Site Preparation Contractors	844,522	559,703	211,959
	Total	60,321,976	31,103,667	11,241,667

Source: U.S. Department of Labor, OSHA, Directorate of Standards and Guidance, Office of Regulatory Analysis-Safety.

Time Distribution of Compliance Costs

Table VI–4 provides the estimated stream of unannualized compliance costs for 10 years following the effective date of the final standard.

TABLE VI–4—DISTRIBUTION OF COMPLIANCE COSTS BY YEARS

Year 1	$ 93,068,644
Year 2	50,514,323
Year 3	50,950,150
Year 4	55,365,256
Year 5	50,950,150
Year 6	76,163,971
Year 7	55,801,082
Year 8	50,514,323
Year 9	50,950,150
Year 10	55,365,256

Source: Department of Labor, OSHA, Directorate of Standards and Guidance, Office of Regulatory Analysis-Safety.

7. Economic Feasibility Analysis and Regulatory Flexibility Determination Introduction

In this chapter, OSHA investigates the economic impacts of its final standard on confined spaces in construction. This impact investigation has two overriding objectives: (1) To determine whether the final rule is economically feasible for all affected industries, and (2) to establish if the Agency can certify that the final standard will not have a significant economic impact on a substantial number of small entities.

Economic Feasibility

Section 6(b)(5) of the OSH Act states: ''The Secretary . . . shall set the standard which most adequately assures, *to the extent feasible,* on the basis of the best available evidence, that no employee will suffer material impairment of health or functional capacity. . . .[56] [Emphasis added.] OSHA interpreted the phrase ''to the extent feasible'' to encompass economic feasibility. The U.S. Court of Appeals for the D.C. Circuit supported this interpretation in a 1974 decision.[57] The court noted that ''Congress does not appear to have intended to protect employees by putting their employers out of business . . .,'' [58] and then proceeded to define the concept of ''economic feasibility'' and to indicate its boundaries:

> Standards may be economically feasible even though, from the standpoint of employers, they are financially burdensome and affect profit margins adversely. Nor does the concept of economic feasibility necessarily guarantee the continued existence of individual employers. It would appear to be consistent with the purposes of the Act to envisage the economic demise of an employer who has lagged behind the rest of the industry in protecting the health and safety of employees and is consequently financially unable to comply with new standards as quickly as other employers. As the effect becomes more widespread within an industry, the problem of economic feasibility becomes more pressing.[59]

Thus, according to the court, OSHA standards would satisfy the economic-feasibility criterion even if they impose significant costs on regulated industries and force some marginal firms out of business, so long as they did not cause massive economic dislocations within a particular industry or imperil the existence of the industry.[60] The implication for analysis of economic impacts is that OSHA must determine whether its standards will eliminate or alter the competitive structure of an industry, not to determine whether any individual plants may close.

In practice, the economic burden of an OSHA standard on an industry—and whether the standard is economically feasible for that industry—depends on the magnitude of compliance costs incurred by establishments in that industry and the extent to which they are able to pass those costs on to their customers. To determine whether a rule is economically feasible for an industry, OSHA begins with two screening tests to consider minimum threshold effects of the rule under two extreme cases: (1) All costs are passed through to customers in the form of higher prices, and (2) firms absorb all costs in the form of reduced profits. In the former case, the immediate impact of the rule would appear as increased industry revenues. In the absence of evidence to the contrary, OSHA generally considers a standard to be economically feasible for an industry when the annualized costs of compliance are less than a threshold level of one percent of annual revenues. Retrospective studies of previous OSHA regulations show that potential impacts of such a small magnitude are unlikely to eliminate an industry or significantly alter its competitive structure.[61]

In the second case, the immediate impact of the rule would appear as reduced industry profits. Again, in the absence of evidence to the contrary, OSHA generally considers a standard to be economically feasible for an industry when the annualized costs of compliance are less than a threshold level of 10 percent of annual profits. OSHA's choice of a threshold level of 10 percent of annual profits is low enough that even if the industry incurred all compliance costs upfront, the costs could still be met from profits without needing to resort to the credit market. Assuming a 7 percent discount rate and a 10-year annualization period, the compliance costs would equal about 70 percent of first-year profits; the industry could absorb these costs from profits without resorting to credit markets. The industry analysis refers to an average firm and its threshold level of profits. Some firms in any industry are below-average, and under-capitalized, poorly run, saddled with lawsuits, or operating in a shrinking market. OSHA cannot guarantee that not a single firm in any industry will become unprofitable in the first year because of this rule, but rather that the vast majority of firms will have their profits impacted by 10 percent or less.

To implement the economic feasibility screening tests described above, OSHA first compared, for each affected industry, annualized compliance costs to annual revenues and profits per (average) affected establishment. The results for all affected establishments in affected industries are in Table IV–14. Shown in the table for each affected industry are the total number of affected firms (entities) and establishments, the percentage of firms affected, annualized costs per affected establishment, annual revenues per establishment, annual profits per establishment, annualized compliance costs as a percentage of annual revenues, and annualized compliance costs as a percentage of annual profits.

To estimate costs for different NAICS construction industries, OSHA developed ''crosswalks'' from project types used in the CONSAD report to the appropriate NAICS. The Agency then used data from the *2007 Statistics of U.S. Businesses* to obtain information on the number of establishments and receipts (revenues), and data from the *Internal Revenue Service Corporation Source Book* to obtain the average of 2003–2007 profit rates for these sectors. Subsequently, OSHA allocated confined-space projects to sectors and size classes on the assumption that smaller establishments are less likely to work in such spaces than larger ones, and on an allocation rule whereby the Agency assigned each establishment a project before assigning any establishment a second project (for analytical tractability). Finally, OSHA

[56] 29 U.S.C. 655(b)(5).

[57] *Indus Union Dep't* v. *Hodgson,* 499 F.2d 467 (D.C. Cir. 1974).

[58] *Id.* at 478.

[59] *Id.*

[60] *Id.; see also Am. Iron and Steel Inst.* v. *OSHA,* 939 F.2d 975, 980 (D.C. Cir. 1991); *United Steelworkers of Am., AFL–CIO–CLC* v. *Marshall,* 647 F.2d 1189, 1265 (D.C. Cir. 1980).

[61] See OSHA's Web page, *http://www.osha.gov/dea/lookback.html#Completed*, for a link to all completed OSHA lookback reviews.

aggregated compliance costs by industry, divided by the number of affected establishments in the industry to derive average compliance costs per affected establishment by industry, and compared the quotient to average annual establishment revenues and profits by industry.

Note that, in any industry sector in construction, the final standard will affect directly only a small percentage of firms and establishments in any given year. Many business entities in affected industries do not regularly work with confined spaces. As demonstrated in Tables IV–16 and IV–3, respectively, the final standard will affect only about 6.3 percent of firms and 7.2 percent of establishments in the affected industries. OSHA estimates that the average cost of complying with the final standard, per affected establishment, will be less than $2,000 annually (compared with average revenues of about $2.6 million). The estimated costs of compliance represent about 0.08 percent of revenues and 1.6 percent of profits, on average, across all affected entities.

As previously noted, OSHA established a minimum threshold level of annualized costs, equal to 1 percent of annual revenues or 10 percent of annual profits, below which the Agency concluded that costs are unlikely to threaten the economic viability of an affected industry. The key result from Table IV–16, for purposes of determining economic feasibility, is that annualized compliance costs do not represent more than 0.48 percent of revenues for affected firms in any industry. Furthermore, there is only one industry, NAICS 236210 (Industrial Building Construction), in which annualized compliance costs for affected firms exceed 10 percent of annual profits. For that industry, annualized compliance costs are equal to 10.56 of annual profits. However, the Agency believes that the final standard would still be clearly feasible for this industry because, first, the final standard affects only 1.84 percent of all firms in that industry each year (see Table IV–4). Second, OSHA believes that firms engaged in confined-spaces work are larger and more profitable than average, so profit losses to them are likely to be less than modeled. Third, OSHA does not believe that industries will absorb all or most of the costs of the final standard in lost profits. The price elasticity of demand in construction is sufficiently inelastic to enable affected firms to substantially offset variable compliance costs through minor price increases—here, less than 0.5 percent—without experiencing any significant reduction in total revenues or in net profits. Consequently, the Agency concludes that the final standard for confined spaces in construction is economically feasible for all affected industries.[62]

TABLE IV–16—POTENTIAL ECONOMIC IMPACTS FOR ENTITIES AFFECTED BY THE FINAL STANDARD FOR CONFINED SPACES IN CONSTRUCTION

[2009 dollars]

NAICS industry code	Industry name	Affected		Affected firms as a percentage of total (percent)	Annualized compliance costs per affected firm	Average revenues per firm ($ thousands)	Average profits per firm ($ thousands)	Annualized costs as a percentage of affected firm revenues (percent)	Annualized costs as a percentage of affected firm profits (percent)
		Firms	Establishments						
221310 ...	Water Supply and Irrigation Systems.	22	65	0.61	$2,347	$2,235	$132	0.11	1.78
236115 ...	New Single-Family Housing Construction (except Operative Builders).	1,075	1,321	1.75	757	1,691	77	0.04	0.99
236116 ...	New Multifamily Housing Construction (except Operative Builders).	830	883	19.22	1,151	5,774	262	0.02	0.44
236118 ...	Residential Remodelers	9,405	9,602	9.44	880	757	34	0.12	2.57
236210 ...	Industrial Building Construction ..	71	106	1.84	32,843	6,865	311	0.48	10.56
236220 ...	Commercial and Institutional Building.	5,401	6,408	13.08	2,196	9,519	431	0.02	0.51
237110 ...	Water and Sewer Line and Related Structures Construction.	2,579	2,765	18.85	3,368	3,787	227	0.09	1.49
237130 ...	Power and Communication Line and Related Structures Construction.	127	341	2.49	16,733	6,968	417	0.24	4.01
237310 ...	Highway, Street, and Bridge Construction.	3,486	4,275	31.83	4,479	10,230	612	0.04	0.73
237990 ...	Other Heavy and Civil Engineering Construction.	778	965	14.96	1,806	4,633	277	0.04	0.65
238190 ...	Other Foundation, Structure, and Building Exterior Contractors.	1,163	1,182	20.40	1,399	1,243	57	0.11	2.46
238210 ...	Electrical Contractors	2,046	2,680	2.59	795	1,635	74	0.05	1.07
238220 ...	Plumbing, Heating, and Air-Conditioning Contractors.	2,264	2,934	2.28	1,092	1,688	65	0.06	1.68
238310 ...	Drywall and Insulation Projects ..	1,640	2,284	7.53	992	1,941	89	0.05	1.12
238910 ...	Site Preparation Contractors	225	255	0.55	3,753	1,647	79	0.23	4.77

[62] In Chapter 6 of this FEA, OSHA explained why it was not including costs for respiratory protection as part of the estimated costs of the final standard. The Agency notes that this feasibility determination would not change with respect to any affected industry even if OSHA attributed to the final standard the respiratory-protection costs included in the PEA. Using the PEA assumptions, and updating unit-cost information for half masks and HEPA filters (based on currently available online price quotes), OSHA finds that none of the annualized costs for any NAICS code exceed the Agency's threshold of presumptive feasibility of one percent of revenues. The annualized costs for only one NAICS code, 236210 (Industrial Building Construction), exceed the threshold of presumptive feasibility of 10 percent of annual profits. The overall annualized costs for this NAICS code would total roughly $2.8 million after including the costs for respiratory protection; this figure represents 0.57 percent of annual revenue and 12.6 percent of annual profit for this industry. However, for the reasons stated above, the Agency believes that the final standard would be feasible for this industry even after including the respiratory-protection costs.

TABLE IV–16—POTENTIAL ECONOMIC IMPACTS FOR ENTITIES AFFECTED BY THE FINAL STANDARD FOR CONFINED SPACES IN CONSTRUCTION—Continued

[2009 dollars]

NAICS industry code	Industry name	Affected		Affected firms as a percentage of total (percent)	Annualized compliance costs per affected firm	Average revenues per firm ($ thousands)	Average profits per firm ($ thousands)	Annualized costs as a percentage of affected firm revenues (percent)	Annualized costs as a percentage of affected firm profits (percent)
		Firms	Establishments						
	Total	31,112	36,066	6.27	1,939	2,559	121	0.08	1.60

Source: U.S. Department of Labor, OSHA, Directorate of Standards and Guidance, Office of Regulatory Analysis-Safety.

Regulatory Flexibility Screening Analysis

To determine if the Assistant Secretary of Labor for Occupational Safety and Health can certify that the final standard for confined spaces in construction will not have a significant economic impact on a substantial number of small entities, the Agency applied long-standing screening tests to consider minimum threshold effects of the final standard on small entities. The minimum threshold effects for this purpose are annualized costs equal to one percent of annual revenues, or annualized costs equal to five percent of annual profits, applied to each affected industry. OSHA applied these screening tests both to small entities and to very small entities. For purposes of certification, affected small entities or very small entities in any affected industry cannot exceed the minimum threshold effects.

Table IV–17 shows that the annualized costs of the standard do not exceed one percent of annual revenues for small entities in any affected construction industry, but they do exceed five percent of annual profits for small entities in two construction industries—NAICS 236210 (Industrial Building Construction) and NAICS 238910 (Site Preparation Contractors). Table IV–18 shows that the annualized costs of the standard exceed one percent of revenues and five percent of annual profits for very small entities in NAICS 236210 (Industrial Building Construction), and exceed five percent of annual profits for very small entities in two other construction industries—NAICS 237130 (Power and Communication Line and Related Structures) and NAICS 238910 (Site Preparation Contractors). OSHA is, therefore, unable to certify that the final standard will not have a significant economic impact on a substantial number of small entities in construction, and must prepare a Final Regulatory Flexibility Analysis (FRFA) (see Chapter 8 below).

TABLE IV–17—POTENTIAL ECONOMIC IMPACTS FOR SMALL ENTITIES AFFECTED BY THE FINAL STANDARD FOR CONFINED SPACES

[2009 dollars]

NAICS industry code	Industry name	Affected firms	Average compliance costs per affected firm ($)	Average revenues per firm ($ thousand)	Average profits per firm ($ thousand)	Costs as a percentage of affected firm revenues	Costs as a percentage of affected firm profits	Cost as a percentage of overall category firm revenues	Costs as a percentage of overall category firm profits
221310	Water Supply and Irrigation Systems.	16	894	713	42	0.13	2.13	0.00	0.01
236115	New Single-Family Housing Construction (except Operative Builders).	942	614	1,255	57	0.05	1.08	0.00	0.02
236116	New Multifamily Housing Construction (except Operative Builders).	719	742	3,600	163	0.02	0.46	0.00	0.08
236118	Residential Remodelers	9,384	837	736	33	0.11	2.51	0.01	0.24
236210	Industrial Building Construction.	24	21,999	2,827	128	0.78	17.18	0.01	0.11
236220	Commercial and Institutional Building.	4,398	1,334	4,950	224	0.03	0.60	0.00	0.06
237110	Water and Sewer Line and Related Structures Construction.	2,248	2,203	2,462	147	0.09	1.50	0.02	0.25
237130	Power and Communication Line and Related Structures Construction.	95	7,347	3,012	180	0.24	4.08	0.00	0.08
237310	Highway, Street, and Bridge Construction.	2,738	1,795	4,304	258	0.04	0.70	0.01	0.19
237990	Other Heavy and Civil Engineering Construction.	579	884	2,085	125	0.04	0.71	0.00	0.08
238190	Other Foundation, Structure, and Building Exterior Contractors.	1,100	973	936	43	0.10	2.27	0.02	0.44
238210	Electrical Contractors	1,424	616	1,037	47	0.06	1.31	0.00	0.02
238220	Plumbing, Heating, and Air-Conditioning Contractors.	1,700	853	1,130	44	0.08	1.96	0.00	0.03
238310	Drywall and Insulation Projects.	1,119	613	1,127	52	0.05	1.19	0.00	0.06

TABLE IV–17—POTENTIAL ECONOMIC IMPACTS FOR SMALL ENTITIES AFFECTED BY THE FINAL STANDARD FOR CONFINED SPACES—Continued

[2009 dollars]

NAICS industry code	Industry name	Affected firms	Average compliance costs per affected firm ($)	Average revenues per firm ($ thousand)	Average profits per firm ($ thousand)	Costs as a percentage of affected firm revenues	Costs as a percentage of affected firm profits	Cost as a percentage of overall category firm revenues	Costs as a percentage of overall category firm profits
238910 ...	Site Preparation Contractors.	167	3,352	1,223	58	0.27	5.74	0.00	0.02
	Total	26,653	1,167	1,533	71	0.08	1.64	0.00	0.09

* Source: U.S. Department of Labor, OSHA, Directorate of Standards and Guidance, Office of Regulatory Analysis—Safety.

TABLE IV–18—POTENTIAL ECONOMIC IMPACTS FOR VERY SMALL ENTITIES (FEWER THAN 20 EMPLOYEES) AFFECTED BY THE FINAL STANDARD FOR CONFINED SPACES

[2009 dollars]

NAICS industry code	Industry name	Annual number of affected firms	Average compliance costs per affected firm ($)	Average revenues per affected firm ($ thousand)	Average profits per affected firm ($ thousand)	Costs as a percentage of affected firm revenues	Costs as a percentage of affected firm profits	Cost as a percentage of overall category firm revenues	Costs as a percentage of overall category firm profits
221310	Water Supply and Irrigation Systems.	11	794	532	31	0.15	2.54	0.00	0.01
236115	New Single-Family Housing Construction (except Operative Builders).	580	607	977	44	0.06	1.37	0.00	0.01
236116	New Multifamily Housing Construction (except Operative Builders).	271	644	1,650	75	0.04	0.86	0.00	0.06
236118	Residential Remodelers.	7,104	611	545	25	0.11	2.47	0.01	0.18
236210	Industrial Building Construction.	8	21,999	1,471	67	1.45	31.92	0.00	0.08
236220	Commercial and Institutional Building.	1,327	1,317	2,273	103	0.06	1.28	0.00	0.05
237110	Water and Sewer Line and Related Structures Construction.	642	2,182	1,105	66	0.20	3.30	0.01	0.19
237130	Power and Communication Line and Related Structures Construction.	17	6,232	945	57	0.66	11.02	0.00	0.05
237310	Highway, Street, and Bridge Construction.	601	1,766	1,814	109	0.10	1.63	0.01	0.12
237990	Other Heavy and Civil Engineering Construction.	166	879	1,007	60	0.09	1.46	0.00	0.06
238190	Other Foundation, Structure, and Building Exterior Contractors.	706	607	552	25	0.11	2.40	0.01	0.32
238210	Electrical Contractors	544	607	575	26	0.11	2.33	0.00	0.02
238220	Plumbing, Heating, and Air-Conditioning Contractors.	655	842	622	24	0.14	3.51	0.00	0.03
238310	Drywall and Installation Projects.	336	607	599	27	0.10	2.21	0.00	0.04
238910	Site Preparation Contractors.	64	3,312	681	33	0.49	10.18	0.00	0.02
	Total	13,032	863	827	38	0.10	2.27	0.00	0.07

Source: U.S. Department of Labor, OSHA, Directorate of Standards and Guidance, Office of Regulatory Analysis—Safety.

8. Final Regulatory Flexibility Analysis

The Regulatory Flexibility Act, as amended in 1996 and 2010, requires that an agency prepare a final regulatory flexibility analysis for any rule expected to have a significant economic impact on a substantial number of small entities (5 U.S.C. 601–612). Under the provisions of the law, such an analysis must contain:

1. A description of the impact of the rule on small entities;

2. A statement of the need for, and objectives of, the rule;

3. The response of the agency to any comments filed by the Chief Counsel for Advocacy of the Small Business Administration in response to the

proposed rule, and a detailed statement of any change made to the proposed rule in the final rule as a result of the comments;

4. A statement of the significant issues raised by public comments in response to the initial regulatory flexibility analysis, a statement of the assessment of the agency of such issues, and a statement of any changes made in the proposed rule as a result of such comments;

5. A description, and estimate, of the number of small entities to which the rule will apply, or an explanation of why no such estimate is available;

6. A description of the projected reporting, recordkeeping, and other compliance requirements of the rule, including an estimate of the classes of small entities that will be subject to the requirements, and the type of professional skills necessary for preparation of the report or record; and

7. A description of the steps the agency took to minimize the significant economic impact on small entities consistent with the stated objectives of the applicable statutes, including a statement of the factual, policy, and legal reasons for selecting the alternative adopted in the final rule, and why the agency rejected each of the other significant alternatives to the rule considered by the agency which affect the impact on small entities.

1. A Description of the Impact of the Final Rule on Small Entities

As shown in Table IV–19, the estimated total annualized cost of the final standard for all affected small entities in construction (as defined by SBA) is $31.1 million. Also shown in that table are annualized costs per affected small entity by industry. These costs per affected small entity range from $613 for NAICS 238310 (Drywall and Insulation Projects) to $21,999 for NAICS 236210 (Industrial Building Construction). The average yearly cost per affected small entity is $1,167.

To assess the potential economic impact of the final rule on affected small entities, OSHA calculated the ratios of these annualized compliance costs to yearly profits and to yearly revenues. These percentages for each construction industry are in Table IV–17 (see Chapter 7 of this FEA). As shown, among small entities potentially affected by the final rule, the annualized cost of the rule is equal to approximately 0.07 percent of annual revenues. In no construction industry does the annualized cost of the rule for affected small entities exceed 0.7 percent of annual revenues. Accordingly, on average, prices for affected small entities in construction would have to increase by about 0.08 percent to completely offset the cost of the final rule. For affected small entities in the most impacted industry, NAICS 236210 (Industrial Building Construction), prices would have to increase by about 0.8 percent to completely offset the cost of the final rule.

Only to the extent that such price increases are not possible would there be any effect on the average profits of affected small entities. Even in the unlikely event that entities could not pass the costs of the final rule through in the form of higher prices, the entities could absorb the costs completely through a reduction in profits of 1.64 percent, on average, for affected small entities (as shown in Table IV–17). In all but two of the affected industries, the affected small entities could absorb the compliance costs completely through an average reduction in profits of less than 5 percent; the reduction in profits would not exceed 17.2 percent for affected small entities in any of the construction industries, again assuming these entities could not pass through the costs.

To further ensure that OSHA fully analyzed and considered the potential impacts on small entities, the Agency separately examined the potential impacts of the final standard on very small entities, defined as those entities with fewer than 20 employees. As shown in Table IV–20, OSHA estimated the total annualized cost of the final standard for all affected very small entities in construction to be $11.2 million. Also shown in that table are annualized costs per affected small entity by industry. These costs per affected small entity range from $607 for several construction industries to $21,999 for NAICS 236210 (Industrial Building Construction). The average yearly cost per affected small entity is $862.

To assess the potential economic impact of the final standard on very small entities, OSHA calculated the ratios of the annualized costs of the final rule to yearly profits and to yearly revenues. These percentages for each affected construction industry are in Table IV–18. As shown, among very small entities potentially affected by the final rule, the annualized cost of the rule is equal to approximately 0.10 percent of annual revenues. In no construction industry does the annualized cost of the rule for affected very small entities exceed 1.45 percent of annual revenues. Accordingly, on average, prices for affected very small entities in construction would have to increase by about 0.10 percent to completely offset the cost of the final rule. For affected very small entities in the most impacted industry, NAICS 236210 (Industrial Building Construction), prices would have to increase by about 1.45 percent to completely offset the cost of the final rule.

TABLE IV–19—ANNUALIZED COMPLIANCE COSTS ASSOCIATED WITH THE FINAL CONFINED-SPACES STANDARD FOR SMALL ENTITIES, BY NAICS INDUSTRY

[2009 dollars]

NAICS industry code	Industry name	Affected firms	Affected establishments	Affected firms as a percentage of total (percent)	Annualized compliance costs	Cost per firm
221310	Water Supply and Irrigation Systems	16	18	0.5	$14,299	$894
236115	New Single-Family Housing Construction.	942	953	1.5	578,128	614
236116	New Multifamily Housing Construction.	719	728	17.1	533,573	742
236118	Residential Remodelers	9,384	9,468	9.4	7,853,017	837
236210	Industrial Building Construction	24	24	0.7	527,967	21,999
236220	Commercial and Institutional Building	4,398	4,463	10.9	5,868,843	1,334
237110	Water and Sewer Line and Related Structures Construction.	2,248	2,272	16.8	4,956,577	2,205

TABLE IV–19—ANNUALIZED COMPLIANCE COSTS ASSOCIATED WITH THE FINAL CONFINED-SPACES STANDARD FOR SMALL ENTITIES, BY NAICS INDUSTRY—Continued

[2009 dollars]

NAICS industry code	Industry name	Affected firms	Affected establishments	Affected firms as a percentage of total (percent)	Annualized compliance costs	Cost per firm
237130	Power and Communication Line and Related Structures Construction.	95	112	1.9	697,984	7,347
237310	Highway, Street, and Bridge Construction.	2,738	2,784	26.8	4,915,948	1,795
237990	Other Heavy and Civil Engineering Const..	579	584	11.6	513,278	886
238190	Other Foundation, Structure, and Building Exterior Contractors.	1,100	1,112	19.5	1,069,906	973
238210	Electrical Contractors	1,424	1,446	1.8	877,857	616
238220	Plumbing, Heating, and Air-Conditioning Contractors.	1,700	1,722	1.7	1,450,572	853
238310	Drywall and Insulation Projects	1,119	1,130	5.3	686,015	613
238910	Site Preparation Contractors	167	169	0.4	559,703	3,352
	Total	26,653	26,985	5.4	31,103,667	1,167

Source: U.S. Department of Labor, OSHA, Directorate of Standards and Guidance, Office of Regulatory Analysis-Safety.

TABLE IV–20—ANNUALIZED COMPLIANCE COSTS ASSOCIATED WITH THE FINAL CONFINED-SPACES STANDARD FOR VERY SMALL ENTITIES, BY NAICS INDUSTRY

[2009 dollars]

NAICS industry code	Industry name	Affected firms	Affected establishments	Affected firms as a percentage of total	Annualized compliance costs ($)	Cost per firm ($)
221310	Water Supply and Irrigation Systems	11	11	0.3	8,738	794
236115	New Single-Family Housing Construction.	580	580	1.0	351,851	607
236116	New Multifamily Housing Construction.	271	271	7.2	174,635	644
236118	Residential Remodelers	7,104	7,105	7.3	4,342,753	611
236210	Industrial Building Construction	8	8	0.2	175,989	21,999
236220	Commercial and Institutional Building	1,327	1,329	3.9	1,747,634	1,317
237110	Water and Sewer Line and Related Structures Construction.	642	642	5.7	1,400,582	2,182
237130	Power and Communication Line and Related Structures Construction.	17	17	0.4	105,944	6,232
237310	Highway, Street, and Bridge Construction.	601	601	7.5	1,061,237	1,766
237990	Other Heavy and Civil Engineering Const.	166	166	3.8	145,898	879
238190	Other Foundation, Structure, and Building Exterior Contractors.	706	706	13.5	428,448	607
238210	Electrical Contractors	544	544	0.8	330,259	607
238220	Plumbing, Heating, and Air-Conditioning Contractors.	655	655	0.7	551,757	842
238310	Drywall and Insulation Projects	336	336	1.8	203,983	607
238910	Site Preparation Contractors	64	64	0.2	211,959	3,312
	Total	13,032	13,035	2.9	11,241,667	863

Only to the extent that such price increases are not possible would there be any effect on the average profits of affected very small entities. Even in the unlikely event that the entities could not pass through the costs of the final rule in the form of higher prices, small affected entities could absorb the costs completely through an average reduction in profits of 2.27 percent (as shown in Table IV–18). In all but three of the affected industries, the affected small entities could absorb the compliance costs completely through an average reduction in profits of less than 5 percent; the reduction in profits would not exceed 32 percent for affected small entities in any of the construction industries, again assuming that no costs could be passed through.

In practice, given the small incremental increases in prices potentially resulting from compliance with the final standard and the lack of readily available substitutes (including foreign competition) for the products and services provided by the covered construction industry sectors, OSHA believes demand to be sufficiently inelastic in each affected industry to enable small and very small entities to substantially offset variable compliance costs through minor price increases without experiencing any significant reduction in total revenues or in net profits.

Further, it is important to note that cost assignment to entities by size is approximate, and in some instances larger firms may bear the burden, so the impacts on individual small entities is suggestive only, not definitive. Indeed, the limitations of available economic data and the Dodge report data make it impossible to assign small projects to small firms in a way that represents economic reality. Because OSHA did not assign fractions of projects to firms, it is likely that the Agency overestimated the costs of the final rule on small and very small entities. Accordingly, OSHA believes that it overstated its estimates of impacts on small entities.

With this important caveat, the Agency notes that there are industries in which impacts are above the conventional thresholds of 1 percent of revenue and 5 percent of profit for some small and very small entities. However, only a few firms account for the impacts as shown from the fact that the costs are negligible when expressed as a percentage of overall revenues and profits for the industry-size class (see the last two columns of Table IV–17 and Table IV–18).

2. A Statement of the Need for, and Objectives of, the Rule

The primary objective of the final rule is to provide an increased degree of occupational safety for employees performing construction work in confined spaces. Another objective of the final rule, in support of the primary objective, is to provide updated, clear, and comprehensive safety standards regarding construction work in confined spaces to the relevant employers, employees, and interested members of the public. The estimated 5.2 fatalities and 780 injuries annually that the final rule would prevent (assuming full compliance) demonstrate the need for the final rule.

The legal basis for the rule is the responsibility given the Department of Labor through the Occupational Safety and Health (OSH) Act of 1970. The OSH Act authorizes and obligates the Secretary of Labor to promulgate mandatory occupational safety and health standards as necessary ''to assure so far as possible every working man and woman in the Nation safe and healthful working conditions and to preserve our human resources.'' 29 U.S.C. 651(b). Additional legal authority for this final rule includes 29 U.S.C. 653, 655(b), and 657; and 40 U.S.C. 3701.

3. The Response of the Agency to Any Comments Filed by the Chief Counsel for Advocacy of the Small Business Administration in Response to the Proposed Rule, and a Detailed Statement of Any Change Made to the Proposed Rule in the Final Rule as a Result of the Comments

In addition to the issues raised by the SBREFA panel, SBA's Office of Advocacy provided recommendations for OSHA to consider (OSHA–2007–0026–0119.1). The Agency provides the following responses to these recommendations (quoted verbatim):

SBA Recommendation 1: While the proposed rule is much improved from the draft version of the rule reviewed during the SBREFA process, it is still very complicated and difficult to understand. Advocacy recommends that OSHA try to further streamline the rule and harmonize it as much as possible with the existing general industry standard (or consider adopting a single rule for both industries). Advocacy notes that many employers operate on work sites that include both general industry and construction confined spaces and employees may encounter both types of confined spaces in close proximity. As many of the SERs pointed out to the SBAR Panel, having two separate standards could double the cost of their safety and training programs (especially if they contract out these services) and cause unnecessary confusion on the job site. Further, the distinction between ''maintenance'' and ''construction'' work in various facilities is often unclear. Having two different standards increases the complexity of compliance and could ultimately increase risk. This was, and remains, a key concern of the SERs.

OSHA's Response: When possible, OSHA adapted requirements in the general industry confined spaces standard to construction using parallel language. For example, § 1926.1205, Permitting process, in the final standard contains provisions virtually identical to those in § 1910.146(e), Permit system, in the general industry standard, rather than retaining the distinct classification system that OSHA proposed. However, the final standard for confined spaces in construction bears important distinctions from the general industry standard due to:

- Advances in safety systems (for example, monitoring procedures that detect increases in atmospheric hazards, as required in § 1926.1204(c)(5));
- Unique conditions associated with construction, such as greater emphasis on assessing hazards at sewer worksites and the need for information exchange in a complex multi-employer environment;
- Requests from stakeholders and commenters to allow greater flexibility for employers, such as permitting employers to enter a confined space under the alternative procedures specified by final § 1926.1203(e) if they isolate physical hazards within a space, or permitting employers to suspend a permit (rather than cancelling it) in response to certain temporary changes in conditions;
- Improvements in language for clarity and enforcement considerations.

SBA Recommendation 2: Advocacy is concerned about the host-employer and controlling-contractor provisions of the proposed rule and remains apprehensive about OSHA's imposition of legal obligations on employers for employees who are not their own. This policy seems to emanate from OSHA's *Multi-Employer Citation Policy,* which has never been promulgated as a rule and whose legal status has been called into question in the recent *Secretary of Labor* v. *Summit Contractors, Inc.* decision. Advocacy filed a similar comment about the host-contractor provisions in OSHA's proposed Electric Power Transmission rule. Some of the key concerns of small businesses are that host employers may not even be engaged in construction work (and therefore have no expertise on confined spaces), and that contractors may be working in remote locations with no interaction or oversight. Advocacy appreciates that OSHA has tried to limit the scope of this provision by only requiring host-employers or controlling contractors to provide information they actually possess (as opposed to having to obtain information they do not already have); however, these provisions are highly controversial and are opposed by many small businesses. Advocacy recommends that OSHA eliminate these requirements from the rule.

OSHA's Response: The U.S. Court of Appeals for the Eighth Circuit vacated the cited *Summit* decision in *Solis* v. *Summit Contractors, Inc.,* 558 F.3d 815 (8th Cir. 2009), and the Commission subsequently reiterated its support for OSHA's multi-employer citation policy and OSHA's authority to hold employers responsible for actions of employees who are not their own. *Solis* v. *Summit Contractors, Inc.,* 23 BNA OSHC 1196, 1202–03 (No. 05–0839, 2010). OSHA continues to believe, as stated in the NPRM:

> On multi-employer worksites, an employer's actions can affect the health and safety of another employer's employees. It is critical for the safety of all employees on a

worksite that contractors and subcontractors communicate with each other. Requiring communication between employers is an efficient way to ensure that each employer learns important information about the confined space hazards present so that all employees are adequately protected. (72 FR 67358.)

In this final rule, OSHA made every effort to minimize the impact of the information-exchange requirements on host employers and controlling contractors. OSHA believes that the affected parties conduct such multi-employer communication currently with minimal disruption to business operations, and that the obligations specified by the final standard will become routine and easy to fulfill for employers who must initiate a system for regular communication. OSHA provided a detailed explanation of its decision to retain these requirements, along with its authority for these requirements, in its discussion of final § 1926.1203(h) and (i).

SBA Recommendation 3: Advocacy notes that there are no single-family residential builders included in the economic analysis or the Initial Regulatory Flexibility Analysis (IRFA); however, it appears that there are confined spaces on these construction sites. If OSHA is assuming that no single-family residential builders will incur costs or be affected by the rule (possibly because OSHA is assuming that all of this work is subcontracted out and these subcontractors are already included), then OSHA should state this clearly in the rule. If not, these costs should be included in the economic analysis and IRFA [sic FRFA] (including the costs for the host-employer and controlling-contractor provisions and the paperwork and recordkeeping requirements associated with them). Advocacy notes that because the net benefits of this rule (*i.e.,* benefits minus costs) are only $8.2 million, the additional costs for single-family residential builders could mean that the costs of this proposed rule outweigh its benefits.

OSHA's Response: In this FEA, OSHA analyzed the costs and impacts to residential single-family builders for confined spaces in single-family dwellings that are subject to the final standard (see Chapters VI and VII of this FEA). OSHA determined that, even with these costs included, the benefits of the final standard significantly exceed the costs.

SBA Recommendation 4: In the Regulatory Flexibility Act section, it would be helpful if OSHA clarified in the first paragraph that ''an RFA analysis is required for any proposed rule that is expected to have a significant economic impact on a substantial number of small entities'' (rather than saying ''for certain proposed rules''). Further, OSHA should affirmatively declare in the IRFA [sic FRFA] that OSHA expects this proposed [sic final] rule will have a significant economic impact on a substantial number of small entities.

OSHA's Response: In the opening paragraph of this FRFA, OSHA made the following clarifying statement: ''The Regulatory Flexibility Act, as amended in 1996, requires that an agency prepare a final regulatory flexibility analysis for any rule expected to have a significant economic impact on a substantial number of small entities . . .'' However, the overall thrust of SBA's recommendation is inconsistent with the RFA, as well as with OSHA's official procedures.[63] According to both the RFA and OSHA's official procedures, the Agency *must* prepare an FRFA only if it is unable to certify that the final standard will not have a significant economic impact on a substantial number of small entities. In Chapter 7 of this FEA, the Agency explained that it was unable to certify that the final standard will not have a significant economic impact on a substantial number of small entities and that, therefore, it must prepare an FRFA.

Note that OSHA may prepare an FRFA even when it has no requirement to do so. In fact, OSHA may, and has, voluntarily prepared FRFAs for purposes of transparency even when the Agency is able to certify that the final standard will not have a significant economic impact on a substantial number of small entities.

SBA Recommendation 5: Also, in Item 7 of the IRFA (Alternatives), OSHA should have summarized the significant alternatives it considered and invited public comment on them (OSHA simply mentions that some were considered). Advocacy notes that a ''significant'' alternative is defined as one that: (1) Reduces the burden on small entities; (2) is feasible; and (3) meets the agency's underlying objectives. Since it appears that none of the alternatives OSHA considered meets these criteria, OSHA should have stated that fact and invited public comment on its determination. This is a significant issue because many of the SERs recommended that OSHA either adopt the general industry standard or harmonize the two sets of rules as much as possible.

OSHA's Response: OSHA did discuss, and request comment on, several regulatory alternatives, including the major alternative supported by the SBA of aligning the new rule more closely with the general industry rule (see discussion at 72 FR 67396, which incorporates discussions of regulatory alternatives in Table 6 on page 67397, and PEA Chapter 3 at OSHA–2007–0026–0002). The Agency considered these alternatives in terms of (1) reducing the burden on small entities; (2) feasibility; and (3) satisfying the Agency's statutory obligations and objectives. Furthermore, in referring the public, in Item 7 of the IRFA, to more extensive discussions of the alternatives elsewhere, OSHA attempted to comply with both the spirit and the letter of § 605(a) of the RFA to avoid duplicative analyses.

OSHA believes that it addressed the recommendation to a large extent by extensively reworking the proposed standard to this final format, which closely reflects the general industry standard, and thereby reduces the burden on small entities. In this FEA, OSHA evaluated the impacts of more stringent and less stringent regulatory alternatives. The final standard in large part reflects the general industry standard, tailored to address the unique characteristics of the construction industry. A more stringent regulatory alternative to the final standard would require that employers identify and distinguish the type of confined space according to the classification system specified in the proposed rule. OSHA estimates that the more complex classification system, present in the proposed rule but not in this final standard, would increase compliance costs by $1.7 million, not including any costs required for additional training.

One less stringent alternative would relieve employers of the requirement to have a written program for each permit-required entry, and would instead require making a copy of the standard available to employees. OSHA estimates that the requirement for a written program imposes compliance costs of about $1.3 million. OSHA believes that having a written program onsite maintains consistency with the general industry standard and provides specific guidance about how employees are to address hazards in the confined spaces; entry supervisors and employees may need to refer to the program quickly during the entry. The proposed rule allowed employers to simply keep a copy of the standard at the worksite instead of a written program because the proposed standard provided specific and detailed requirements for each potential type of confined space; however, commenters criticized this

[63] Available online at: *http://www.dol.gov/dol/regs/appendix.htm.*

approach as overly complex. The final standard is not conducive to replacing a written program with a copy of the standard because it takes a more generic approach to confined-space requirements than the proposal; this approach is similar to the general industry standard, which also requires employers to maintain a written program on site.

SBA Recommendation 6: Advocacy recommends that OSHA include a list of examples of confined spaces for each of the proposed categories to make the proposed standard easier to understand. For example, the only example cited for the Continuous System-Permit-Required Confined Space category is a ''sewer.'' It would be helpful if OSHA provided additional examples. Similarly, since the SERs and many small businesses have said they find the existing categories to be too complex and confusing, Advocacy recommends that OSHA consider providing a table with four columns listing: (1) The category of confined space; (2) examples of confined spaces under that category; (3) a sequential list of the steps an employer must take to comply with the requirements for that particular category; and (4) a cross-reference to the regulatory citation. OSHA should include this table as an Appendix to the rule as it has done for Entry Permits, which is very helpful.

OSHA's Response: As noted earlier in this chapter, for the final standard OSHA simplified the classification system for confined spaces, making the recommended supplemental lists, tables, and examples unnecessary. OSHA also plans to issue additional guidance documents to help employers comply with this simpler standard.

SBA Recommendation 7: Finally, OSHA should clarify the definition of a ''confined space'' itself, which is currently unclear. For example, it is unclear what is meant by ''not designed for continuous employee occupancy.'' It would be helpful if OSHA provided some examples for clarification. Also, OSHA should specifically state whether foundations, attics, and crawl spaces in single-family residential homes are considered confined spaces. Finally, OSHA should clarify whether there is any legal distinction between ''enclosed'' and ''confined'' spaces, as the term ''enclosed'' spaces is also used in the preamble.

OSHA's Response: In the Summary and Explanation section of the preamble to the final standard, OSHA clarifies its definition of a ''confined space,'' and § 1926.1201(a) of the standard includes a note with a non-exhaustive list of potential confined spaces that commonly occur on a construction worksite. This list provides examples for employers who may be unfamiliar with confined spaces in construction. The same section of the preamble addresses the scope of the standard with respect to affected spaces in single-family residential construction. In the final rule, OSHA does not distinguish between an ''enclosed space'' and a ''confined space'' because the final rule does not include requirements for enclosed spaces. OSHA amended the ''enclosed spaces'' provision of subpart V, § 1926.953, as part of this rulemaking, and defined that term for purposes of subpart V. OSHA does not use the term in the preamble of the NPRM or the final rule other than in response to SBREFA comments, the removal of § 1926.21(b), and the ACCSH recommendation to address enclosed spaces, which OSHA did not adopt.

4. A Statement of the Significant Issues Raised by the Public Comments in Response to the Initial Regulatory Flexibility Analysis, a Summary of the Assessment of the Agency of Such Issues, and a Statement of Any Changes Made in the Proposed Rule as a Result of Such Comments

On September 26, 2003, OSHA convened a Small Business Advocacy Review Panel (the Panel) for this rulemaking in accordance with the provisions of the Small Business Regulatory Enforcement Fairness Act of 1996 (Pub. L. 104–121), as codified at 5 U.S.C. 601 *et seq.* The Panel consisted of representatives of OSHA, the Office of Information and Regulatory Affairs in the Office of Management and Budget, and the Office of Advocacy within the U.S. Small Business Administration. The Panel received oral and written comments on a draft proposal and a draft economic analysis from small entities (businesses) potentially affected by the rule. The Panel, in turn, prepared a written report which it delivered to the Assistant Secretary for Occupational Safety and Health (and is available in the docket on Regulations.gov as OSHA–2007–0026–0037). The report summarized the comments received from the small-entity representatives (SERs), and included recommendations from the Panel to OSHA regarding the proposal and the associated analysis of compliance costs. OSHA sought comment in the NPRM on a variety of issues of particular interest to small businesses as a result of the recommendations of the Panel. Table IV–21 below provides the Panel recommendations and a summary of OSHA's response to each of these recommendations in light of comments made on the record.

TABLE IV–21—OSHA RESPONSE TO RECOMMENDATIONS BY THE SMALL BUSINESS ADVOCACY REVIEW PANEL FOR THE PROPOSED STANDARD ON CONFINED SPACES IN CONSTRUCTION

Panel recommendation	OSHA's response
1. The SERs generally believed that OSHA had underestimated the costs of the draft proposed standard. The Panel recommended that OSHA revise its economic and regulatory flexibility analysis as appropriate to reflect the SERs' comments on underestimation of costs, and that the Agency compare OSHA's revised estimates to alternative estimates provided by the SERs. For those SER estimates that OSHA did not adopt, OSHA should explain its reasons for preferring an alternative estimate, and solicit comment on the issue.	The Agency relied, in part, on the comments and alternative cost estimates from the SERs to help ensure that the estimated costs of compliance with the final standard would reflect the actual costs that businesses might incur when complying with the requirements specified by the standard. OSHA reduced or eliminated some requirements altogether (such as those addressing hazardous-enclosed spaces) in light of the information provided and issues raised by the SERs. The Agency revised or clarified other requirements (such as those involving communications to/from controlling employers and the classification of spaces) to avoid the potential for misinterpretations regarding the applicability of the requirements and the specific actions necessary to ensure compliance. OSHA discusses the revisions in further detail below in the responses to specific Panel recommendations separately addressing each of these issues.

TABLE IV–21—OSHA RESPONSE TO RECOMMENDATIONS BY THE SMALL BUSINESS ADVOCACY REVIEW PANEL FOR THE PROPOSED STANDARD ON CONFINED SPACES IN CONSTRUCTION—Continued

Panel recommendation	OSHA's response
2. Many SERs observed that OSHA had underestimated the cost of training. They were concerned particularly about the length of time required for training, training the trainers, renewal training, and multilingual training. The SERs also noted that much retraining could be avoided if OSHA adopted the general industry rule because most firms already have trained their employees on that rule. Some SERs also noted that they still need to train employees on the general industry standard because some of their work would come under the general industry standard. In these situations, they would need to continue training on the general industry standard while adding training on the construction standard, and on how employees should determine which standard applies. Because OSHA's economic analysis examined training on a project basis, it is difficult to compare OSHA's cost estimates to the estimates provided by the SERs. The Panel recommends that OSHA carefully analyze the SERs' comments on training costs by developing methods for comparing these cost estimates to those estimates provided in OSHA's economic analysis. OSHA then should compare these costs to its present cost estimates, and revise its training costs as necessary based on all of the available information.	The Agency reviewed its estimates of the costs of complying with the training requirements in the proposed standard in light of the additional information provided by the SERs. OSHA understands that many businesses would have to comply with both the general industry and the construction industry versions of the OSHA confined-spaces standards, depending on the circumstances. Under the final standard, OSHA decided not to allow compliance with the general industry standard in lieu of compliance with this final standard for construction projects because there are situations where the general industry standard would not adequately protect construction employees because of the unique characteristics of construction work (see section II.B. (''History'') of this document for a discussion of this issue). However, to simplify the process for employers in confined spaces where both general industry and construction work is ongoing, OSHA provided a statement of enforcement policy which has the effect of allowing all employers in that space to comply with a single set of rules: The construction standard. That policy, along with the changes that bring the construction rule closer in line with the general industry rule and address much of the information provided by the SERs, should reduce the training costs.
3. Many SERs stated that OSHA had neglected some elements of monitoring costs, such as the need for a competent person to conduct the monitoring, the need for the entire crew to wait while a supervisor performs the monitoring, the short life span in the field of monitoring equipment, and costs associated with calibrating the equipment. Those SERs affected by the hazardous-enclosed spaces portion of the draft proposed rule were concerned particularly about increased monitoring costs. The Panel notes that if the SERs' views about the life of equipment and the need for the entire crew to suspend work during monitoring are correct, and no other assumptions are changed, the costs of monitoring would be three to five times higher than OSHA estimated, adding $6 to $12 million to the cost of the draft proposed standard. The Panel recommends that OSHA consider these factors and revise its monitoring cost estimates accordingly, and that monitoring costs reflect the total actual costs associated with conducting monitoring, including the cost of transporting and maintaining equipment, and the costs associated with crew members waiting for the completion of monitoring activities.	The Agency reviewed its estimates of the costs of complying with the atmospheric-monitoring requirements in the proposed standard in light of the additional information provided by the SERs. The Agency decided not to revise the use of a five-year useful life of monitoring equipment absent additional evidence demonstrating that a shorter span was more appropriate. In any case, the effect on total costs of minor variances in the life of equipment would be small. OSHA increased the costs associated with setting up monitoring equipment to 20 minutes (instead of 10 minutes) to reflect the possibility of additional losses of productive work time by other employees. OSHA also doubled the costs associated with periodic calibration of the equipment to reflect possible additional time, costs associated with the transportation of equipment, and other incidental expenses.
4. Many SERs were concerned that the hazardous enclosed spaces provisions of the draft proposed rule would result in extensive costs with few benefits. Some SERs thought the provisions required little recordkeeping beyond what they currently do. Also, some SERs noted that OSHA had underestimated the costs associated with recordkeeping. The Panel is concerned that the hazardous enclosed spaces provision would require major atmospheric testing and monitoring burdens not identified in the cost analysis. The Panel recommends that OSHA carefully examine the benefits and costs of this portion of the rule and compare these requirements carefully to what is required under other existing regulations, and to existing construction industry practice.	As recommended by the Panel, OSHA carefully examined the hazardous-enclosed space portion of the draft proposed standard. OSHA also reexamined applicable existing requirements, the extent of occupational risks involved, and the potential for risk reduction with the promulgation of additional regulatory requirements for hazardous-enclosed spaces. Based on this reexamination, the Agency decided not to promulgate any new or additional requirements for hazardous-enclosed spaces. OSHA believes that other existing standards adequately cover potential hazards associated with these spaces (for example, 29 CFR 1926.55). Therefore, OSHA eliminated all requirements involving hazardous-enclosed spaces, and no such requirements appear in the final standard.
5. Most SERs were concerned that the treatment of controlling employers in the draft proposed standard would result in additional costs for controlling employers in the form of increased monitoring and supervision of subcontractor activities. SERs also were concerned with the costs and time required to meet the coordination and communication requirements of the draft proposed standard. The Panel recommends that, if OSHA does not clarify these provisions, then it should examine further the possible costs of the controlling-employer provisions in the draft proposed rule. Also, OSHA should be certain that it has accounted for all of the burdens associated with this provision.	The Agency clarified the duties of the controlling employer in § 1926.1203 of the final standard (General requirements). In its explanation of paragraph (h) of this section, OSHA provided additional information about the type of information that the controlling employer must share with its subcontractors, and OSHA further clarified in a note to this paragraph that the controlling or host employer do not have to enter a confined space to collect the specified information for its subcontractors. Therefore, the Agency believes that compliance with final § 1926.1203 would not result in a significant added cost to controlling employers. Its purpose is to aid them in their duties to safely coordinate the activities of their subcontractors within the space.
6. Many SERs were concerned that the increased complexity of the classification system would add not only to the training costs but also to the costs associated with classifying confined spaces. The Panel recommends that, if the classification process is not simplified, OSHA should further analyze the costs associated with classifying confined spaces.	The Agency revised the classification system in the final standard to clarify and simplify the classification of confined spaces. The Agency believes this system reflects current practice under the general industry standard when employers apply it to construction work, thereby reducing the compliance burden for employers.

TABLE IV–21—OSHA RESPONSE TO RECOMMENDATIONS BY THE SMALL BUSINESS ADVOCACY REVIEW PANEL FOR THE PROPOSED STANDARD ON CONFINED SPACES IN CONSTRUCTION—Continued

Panel recommendation	OSHA's response
7. OSHA estimated that the draft proposed standard potentially affects small entities performing construction work in confined and enclosed spaces. Small entities in eight specific construction industry classifications were identified as being potentially affected by the draft proposed standard. These classifications include Residential Housing (SIC 1522); Industrial Buildings (SIC 1541); Other Nonresidential Buildings (SIC 1542); Highway and Street Construction (SIC 1611); Bridge and Tunnel Construction (SIC 1622); Water, Sewer, and Pipeline Construction (SIC 1623); Other Heavy Construction (SIC 1629); and Structural Steel Erection (SIC 1791). For each of these industry classifications, Table 3 in the Panel report shows estimates of the total number of small firms in the industry, the number of establishments operated by these firms, the number of employees of these firms, and the total sales of these firms. These figures represent the best available estimates for the numbers of potentially affected small entities meeting the definition of a small entity established by the Small Business Administration for these particular industry sectors. In summary, an estimated 86,012 small entities are potentially affected by the draft proposed standard. These firms operate an estimated 86,158 establishments, employ an estimated 921,831 employees, and generate total sales estimated at $192 billion. In addition to the small entities identified above.	As noted in the response to item 4 above, OSHA did not include the requirements addressing hazardous-enclosed spaces that the Panel believed may impose a burden on the industrial sector for General Contractors for Single Family Homes in the final standard.
8. Almost all of the SERs found the draft proposed standard difficult to follow. The SERs stated that they currently were using the general industry standard and were familiar with it. A few SERs saw some advantages to the differences between the draft proposed standard and the general industry standard, but even these SERs did not believe that these advantages were sufficient to justify the amount of training the draft proposed standard would require. The Panel recommends that OSHA either make the standard easier to follow, consider a standard closer to the general industry standard, or develop a standard in which the classification provisions that provide greater flexibility to employers are optional rather than required.	In the final standard, OSHA addressed the concerns of the SERs about the difficulty in following the text of the proposed standard. OSHA reorganized the regulatory text to follow more closely the general industry structure preferred by the SERs. The final standard specifies the general duties, the standards pertaining to permit-required confined spaces, the permitting process, entry permits, training, rescue services, and specific duties assigned to entrants, attendants, and supervisors. OSHA recognized and addressed problematic situations common to construction sites not clearly addressed by the general industry standard (e.g., sites where there is no host, the kind of information that entities need to exchange, conducting the initial hazard assessment of a previously unclassified space). OSHA adopted many of the general industry provisions, and adjusted them for use on a construction worksite.
9. Most SERs were confused by the distinctions between types of confined spaces. One SER referred to the distinctions as "metaphysical." The Panel recommends that if these distinctions are retained, they should be made clearer, or OSHA should consider making such classifications optional.	In the final standard, OSHA greatly simplified the system for classifying confined spaces (relative to that in the proposed standard) by removing the series of classifications in the proposed rule and simply requiring that employers identify all confined spaces where their employees may work, and designate them as either permit-required confined spaces (*i.e.,* permit spaces) or non-permit spaces. Within the subcategory of permit spaces, employers must identify and address the hazards, such as through hazard isolation or atmosphere control; the final rule addresses these responsibilities using performance language in §§ 1926.1203 (General requirements) and 1926.1204 (Permit-Required Confined Space Program) and does not require the additional classifications required by the proposed rule.
10. Many SERs noted that the hazardous-enclosed spaces requirements would result in a major recordkeeping burden. Some SERs believed that these requirements represented major new requirements for many contractors. OSHA notes that a few of the SERs seemed unacquainted with some of the requirements of existing regulations. The Panel notes that the requirement to evaluate each potentially hazardous space, implicit in § 1926.1225(a)(3), could radically alter the compliance requirements and the costs of the rule in ways not reflected in OSHA's Preliminary Initial Regulatory Flexibility Analysis. The Panel recommends that OSHA more carefully explain the relation of these requirements to existing requirements and practice, and explain the need for different requirements.	See the Agency's response to item 4 above.

TABLE IV–21—OSHA RESPONSE TO RECOMMENDATIONS BY THE SMALL BUSINESS ADVOCACY REVIEW PANEL FOR THE PROPOSED STANDARD ON CONFINED SPACES IN CONSTRUCTION—Continued

Panel recommendation	OSHA's response
11. SERs were concerned that the provisions addressing controlling employers would require general contractors to develop confined-space expertise and provide confined-space supervision. OSHA's intent with these provisions was not to change existing relations between general contractors and their subcontractors, but rather to assure that general contractors provide subcontractors with the information they possess relevant to confined spaces. Some SERs agreed that additional information could be useful. The Panel recommends that OSHA clarify this requirement to indicate that the role of the controlling employer is only to provide any information they possess concerning confined spaces.	As stated above, OSHA clarified the responsibilities of controlling employers in final § 1926.1203. In addition to sharing specific information that it may have about the space with its affected subcontractors, the note to that section clearly states that employers do not have to enter a confined space to gather such information for its subcontractors. The purpose of this section is not to change existing relations between general contractors and their subcontractors, but rather to assure that general contractors provide subcontractors with information relevant to the safety of their subcontractors' employees working within a confined space. The proposed standard did not require controlling employers to develop confined-space expertise to fulfill their duties, and neither does the final standard.
12. OSHA's Hazard Communication standard also provides guidance to employers on the use of certain chemicals in the workplace. However, OSHA does not see any conflict between this standard and the draft proposed standard. The Hazard Communication standard provides general precautionary information regarding the use of certain chemicals and products; the draft proposed standard provides more explicit requirements for conditions specific to confined and enclosed spaces. Also, many construction contractors still will need to follow the general industry standard [for confined spaces] in some types of work, and thus need to train their workers in using two different standards, and when to apply each standard. The SERs identified other federal standards that they believe address the hazards associated with confined and enclosed spaces, including OSHA standards for Ventilation (§ 1926.57) and for Gases, Vapors, Fumes, Dusts, and Mists (§ 1926.55), and EPA and HUD rules on abatement work. Accordingly, the Panel recommends that OSHA clarify the exact relation between the draft proposed standard and other standards affecting work by construction employers in confined or enclosed spaces, including the Hazard Communication standard, the general industry standard, the Permissible Exposure Limit standards, the Ventilation standard, the Gases, Vapors, Fumes, Dusts, and Mists standard, and applicable EPA and HUD standards.	OSHA recognized that the confined spaces standard may overlap with provisions in other part 1926 standards. In the preamble discussion of this final rule, OSHA clarified the relationship between this standard and other pre-existing construction standards which may be applicable in a confined space. In § 1926.1201(c) of the final standard, OSHA explains how overlapping standards would interact with each other, and the obligations of an employer in such situations. OSHA also explains in the preamble of the final rule how employers would evaluate practical situations under the requirements of the final standard when it overlaps with another OSHA requirement. In its explanation of the scope of the final rule, OSHA also provided additional guidance about the potential overlap with part 1926, subparts J, P, S, and Y. In addition, OSHA made a minor modification to 29 CFR part 1926, subpart V, to ensure that it provides clear guidance to employers about the interaction of that standard with the confined spaces in construction standard. OSHA is currently unaware of any other Federal agency standards that overlap or conflict with the final OSHA standard.
13. Alternatives to adopting the draft proposed standard developed by OSHA include adopting the draft proposed standard developed by the Advisory Committee for Construction Safety and Health, the industry consensus standard developed by the American National Standards Institute, or the existing OSHA general industry standard [for confined spaces]. Additional alternatives include modifying the OSHA draft proposed standard by removing provisions addressing hazardous-enclosed spaces, removing the requirement to classify spaces in the least hazardous category, revising requirements for atmospheric monitoring to allow periodic monitoring instead of continuous monitoring, and/or reducing or eliminating recordkeeping requirements. The Panel recommends that OSHA continue to consider these alternatives, and discuss and solicit comment on them in the proposed rule.	OSHA considered alternatives to drafting its own confined space standard for construction. The Agency considered the general industry standard for confined spaces, but found it to be unsuitable for the construction industry. OSHA believes that the general industry standard does not adequately address some problematic situations common on construction sites. These concerns include multiple subcontractors working within one space, and hazards created by a confined space built around employees. OSHA drafted the final standard to be similar to the general industry standard in terms of organization and most of the requirements. ANSI is presently considering whether it is feasible to begin drafting a confined-spaces standard for application specifically to construction. OSHA addressed major concerns of the SERs regarding the hazardous-enclosed space requirements in the draft proposed standard by removing that section completely from the proposal and final standard. As previously stated above, OSHA also simplified classification as either permit-required or non-permit required. Finally, OSHA reduced employers' recordkeeping requirements by minimizing the time necessary for employers to maintain documentation. For example, in § 1926.1205 of the final standard, an employer will only have to maintain entry permits for one year.

TABLE IV–21—OSHA RESPONSE TO RECOMMENDATIONS BY THE SMALL BUSINESS ADVOCACY REVIEW PANEL FOR THE PROPOSED STANDARD ON CONFINED SPACES IN CONSTRUCTION—Continued

Panel recommendation	OSHA's response
14. Most SERs indicated a preference for using the general industry standard for construction work, as opposed to the draft proposed standard. OSHA is concerned that not all construction employers are as familiar with the general industry standard as the SERs are, and that some employers might benefit from a standard designed to provide greater compliance flexibility. The Panel recommends that OSHA consider the alternative of adopting the general industry standard and, if this alternative is not adopted, discuss and solicit comment on this alternative in the proposed rule. If OSHA does not adopt a standard closer to the general industry standard, the Panel recommends that OSHA revise its comparative cost analysis of the general industry rule and the draft proposed standard to take account of SERs' concerns about the increased training, communication, and classification costs associated with the draft proposed standard. The Panel also recommends that OSHA solicit comment on how an alternative standard similar to the general industry standard could be adapted to the construction sector. In addition, the Panel recommends that OSHA analyze and solicit comment on the non-regulatory alternative of not issuing a final standard, relying instead on existing standards and improved outreach.	As stated before, the draft proposed confined-spaces standard for construction addresses some concerns that are unique to the construction industry. OSHA believes that the reorganization of the proposed standard and the elimination of the section on hazardous-enclosed spaces will make the final standard easier to read than the general industry standard for confined spaces, thereby expediting employer compliance. OSHA requested that the public submit comments regarding the degree of flexibility granted to employers in classifying confined spaces, as well as other alternatives to the proposed rule in general. In the final standard, OSHA adopted a classification system based on identifying permit-required spaces (*i.e.,* permit spaces). This system reflects the classification system used widely under the general industry standard. OSHA rejected the alternative of not issuing a final standard because the record demonstrates that the existing standards, even with improved outreach, would be inadequate to prevent the fatalities and injuries identified earlier in this analysis. The earlier discussion in this FEA under "Need For Regulation" includes additional information on the need for this new standard.
15. The SERs were confused by the variety of distinctions among confined spaces, and generally believed that the training required by these provisions negated any advantages that might arise from the flexibility of different types of confined spaces. The Panel recommends that OSHA examine and solicit comment on alternatives that reduce the number of types of confined spaces, and that OSHA consider alternatives that would allow employers the choice of using or ignoring these provisions.	In the proposed rule, the Agency reduced the number of classifications by removing the classification for hazardous-enclosed spaces. In the proposed rule, OSHA further clarified the four remaining categories by reorganizing the text of the proposed standard to ensure that all requirements for each classification type were available in one section. OSHA requested that the public submit comments regarding other alternatives to the proposed rule. In the final standard, OSHA further reduced the number of confined-space classifications by adopting the approach used in the general industry standard to designate permit-required spaces. The Agency believes that, because the final standard closely mirrors the general industry standard, there will be minimal additional costs for employers to train their employees on the final construction standard.
16. Many SERs viewed the requirements for hazardous-enclosed spaces as highly burdensome. The Panel recommends that OSHA remove this provision unless OSHA can (1) clarify exactly how the requirements of this provision are different from other existing requirements and practices; (2) develop a detailed cost analysis of this provision; (3) quantify the hazards associated with hazardous-enclosed spaces; and (4) explain how the hazardous-enclosed space provisions can serve to reduce these hazards. If OSHA retains this requirement or one like it, OSHA also should solicit comment on the need for the recordkeeping requirements in the provision. In addition, OSHA should solicit comment on removing this provision entirely.	As recommended by the Panel, OSHA removed the provisions for hazardous-enclosed spaces.
17. Most SERs were concerned that the provisions for controlling contractors would alter the existing relationship between contractors and subcontractors with little gain in reduced risk to employees. OSHA notes that the purpose of this provision was only to ensure that contractors share available information at multi-employer worksites. Some SERs agreed that information sharing would be helpful, but were concerned that the OSHA draft went far beyond this purpose. The Panel recommends that OSHA consider removing this provision or clarifying the purpose of this provision, and solicit comment in the proposal on the need for this provision.	As stated previously, § 1926.1203(h), and the note to that section, clarify the duties of the controlling contractor and explain that a controlling contractor will not have to enter a confined space to gather the specified information for the subcontractor.

OSHA received no significant comments in response to the Initial Regulatory Flexibility Analysis for the proposed rule, but it did receive two comments on whether elements of the proposed standard were feasible for small entities. First, the National Association of Home Builders (NAHB) claimed the proposed rule required controlling contractors to supervise all entries into permit spaces, and argued that it was not economically feasible for small home builders to do so (ID–219.2). In addition, NAHB claimed the information coordination duties of the proposed rule were not economically feasible for small home builders.

OSHA finds these arguments misguided. First, neither the proposal nor the final rule required controlling employers to supervise the entries of other employers. Nor did NAHB provide convincing evidence that the coordination duties placed on contractors were infeasible.

Among the evidence cited in the published study NAHB used to support this economic infeasibility conclusion is a profit rate (profit as a percentage of revenue) of 7.7 percent for NAHB builder members in 2006, which is significantly higher than the more conservative rate OSHA used in its calculations: 4.53 percent. If the actual profit rate is higher than OSHA's estimate, OSHA's impact estimates may *overstate* the effect of this rule on revenues and profits in the homebuilding industry. As previously demonstrated in Chapter 7 of this FEA, these potentially inflated estimates of revenue and profit impacts for the new single-family housing-construction industry (NAICS 236115; all affected firms) are well below the threshold of economic infeasibility at 0.04 percent and 0.99 percent, respectively (0.05 percent and 1.08 percent, respectively, for small entities).

As noted in Chapter 6 of this FEA, OSHA assigned typical unit-time estimates for the multi-employer (information-exchange) provisions of the final standard and demonstrated there, and in this chapter, that the costs incurred by home builders would not be excessive or unreasonable. Despite assertions by NAHB that the demands of coordinating subcontractors would be economically infeasible as prescribed by the multi-employer provisions of the rule, there is evidence (ID–211, Tr. pp. 123–127) to suggest that home builders often find that they must coordinate and communicate efficiently with subcontractors across construction sites of varied size and complexity. Therefore, OSHA believes that, based on the evidence in the record as a whole, the multi-employer information-exchange requirements of the final standard would not impose an unreasonable burden on home builders, and would not threaten the competitive stability of the industry or otherwise create conditions of economic infeasibility.

Another commenter asserted that the impact of the proposed rule on small businesses would be ''staggering'' and would drive some contractors out of business, arguing that several of the costs of the proposed standard were disproportionate to its benefits (ID–112). This commenter suggested that OSHA withdraw the proposed standard or that compliance with the general industry standard constitute compliance with the construction standard. OSHA revised the final rule by harmonizing it with the general industry standard to a substantial degree. Therefore, the final standard in large part reflects the general industry standard, tailored to address the unique characteristics of the construction industry. In revising several provisions of the final rule to reflect the general industry standard, OSHA sought to minimize the impact on small entities by minimizing the costs involved in distinguishing between the two rules and complying with both standards, as well as the costs involved in retraining employees on new procedures.

5. A Description, and an Estimate, of the Number of Small Entities to Which the Rule Will Apply, or an Explanation of Why no such Estimate is Available

OSHA completed an analysis of the economic impacts associated with this final rule, including an analysis of the type and number of small entities to which it would apply, as described previously in this section (See Tables IV–19 and IV–20). To determine the number of small entities potentially affected by this rulemaking, OSHA used the definitions of small entities developed by the Small Business Administration (SBA) for each industry.

For the construction industry generally, SBA defines small businesses using revenue-based criteria. For most of the affected construction industries, including those industries that mostly consist of general contractors, OSHA classified firms with annual revenues of less than $33.5 million as small businesses. For specialty contractors, such as structural-steel erection contractors, the Agency considered firms with annual revenues of less than $14 million to be small businesses. Based on the definitions of small entities developed by SBA for each industry, the final rule would potentially affect a total of 490,000 small entities, as shown in Table IV–4. Included in this number are an estimated 451,000 entities with fewer than 20 employees, as shown in Table IV–5.

6. A Description of the Projected Reporting, Recordkeeping, and Other Compliance Requirements of the Rule, Including an Estimate of the Classes of Small Entities That Will Be Subject to the Requirement, and the Type of Professional Skills Necessary for Preparation of the Report or Record

OSHA is issuing a standard that addresses the work practices employers must use and other requirements they must follow when performing construction work in confined spaces. Table IV–14 of this FEA shows the unit costs for these requirements.

Employers must keep records associated with work in confined spaces as specified by the final standard. Records include entry permits and verification documents. The final standard does not require regular reporting; however, employers must demonstrate compliance with the recordkeeping requirements as part of OSHA compliance inspections.

Other compliance requirements of the final standard include evaluating and classifying confined spaces, eliminating or isolating hazards, providing sufficient ventilation, conducting atmospheric monitoring, providing an attendant, providing respiratory protection, preventing unauthorized entry, planning and providing rescue capability, and providing training.

The preamble to the final standard provides a comprehensive description of, and further detail regarding, the provisions of the final rule. The preceding chapters of this FEA provide a description of the types of entities subject to the new and revised requirements, and the types of professional skills necessary for compliance with the requirements.

7. A Description of the Steps the Agency Took To Minimize any Significant Economic Impact on Small Entities Consistent With the Stated Objectives of the Applicable Statutes, Including a Statement of the Factual, Policy, and Legal Reasons for Selecting the Alternative Adopted in the Final Rule, and Why the Agency Rejected Each One of the Other Significant Alternatives to the Rule Considered by the Agency Which Affect the Impact on Small Entities

OSHA took a number of steps to minimize economic burdens on small entities. In response to the SERs' suggestion that the Agency harmonize the construction standard with the general industry standard to the greatest extent possible, the final standard in large part reflects the general industry standard, tailored to address the unique characteristics of the construction industry. In revising several provisions of the final rule to reflect the general industry standard, OSHA sought to minimize the impact on small entities by reducing the need to comply with different confined-space requirements for construction and general industry, and to train employees on new procedures. The vast majority of commenters believed that the classification system in the proposed rule would not contribute to worker safety, and would result in confusion among employers. Therefore, OSHA decided to adopt the system reflected in the general industry standard for classifying confined spaces as permit-required confined spaces.

In addition, OSHA did not include a proposed provision in the final rule that required an employer to summon an entry-rescue service whenever the employer initiated a non-entry rescue. OSHA also allows employers to use the alternative ventilation-only procedures under final § 1926.1203(e) if an employer is able to isolate all physical hazards in the space, which provides more flexibility to an employer than the general industry standard. Furthermore, OSHA allows employers to suspend a permit in certain circumstances, rather than cancelling and developing a new permit. Each of these options has the potential to significantly reduce the economic impact on employers, including small entities. The preamble for §§ 1926.1203(e) and 1926.1205(e) includes an in-depth explanation of the specific steps taken to minimize employer burden.

Another less stringent alternative would relieve employers of the requirements specified in the final standard for information exchange between host employers, controlling contractors, and entry employers on worksites; these requirements are absent from the general industry standard. While OSHA notes that host employers must share this information under the general industry standard, and believes that this exchange of information occurs as a matter of usual and customary practice on general industry and construction worksites alike, the general industry standard does not explicitly impose information-sharing requirements on controlling contractors. OSHA estimates that compliance with the information-exchange requirements of the final rule will result in compliance costs of about $9.3 million, and that the less-stringent alternative, reflected in the general industry standard, would reduce compliance costs by about $5.9 million. However, OSHA believes that, given the unique characteristics of the construction industry that include continually changing projects and multiple employers onsite, the specific information-exchange requirements contained in the final rule will contribute to an effective exchange of information about confined-space hazards and will, therefore, increase worker safety on construction sites. Another, less stringent, alternative would relieve employers of the requirement in the final standard to develop a written program for each permit-required entry, and would instead require that a copy of the standard be made available at the worksite. OSHA estimates that the requirement for a written program will result in compliance costs of about $1.3 million. OSHA believes that having a written program onsite maintains consistency with the general industry standard and provides site-specific information about the confined spaces. The proposed rule allowed employers to simply keep a copy of the standard at the worksite instead of a written program because the proposed standard provided specific and detailed requirements for each potential type of confined space. The final standard is not conducive to replacing a written program with a copy of the standard because it takes a more generic approach to confined-space requirements than the proposal; this approach is similar to the general industry standard, which also requires employers to maintain a written program on site.

9. Sensitivity Analysis

In this chapter, OSHA presents the results of two different types of sensitivity analysis to demonstrate how robust the estimates of net benefits are to changes in selected cost and benefit parameters. In the first set of sensitivity tests, OSHA makes a series of isolated changes to individual cost- and benefit-input parameters to determine their effects on the Agency's estimates of annualized costs, benefits, and net benefits. In the second set of tests—a so-called ''break-even analysis''—OSHA also investigates isolated changes to individual cost- and benefit-input parameters, but with the objective of determining the magnitude of the changes needed for annualized costs to equal annualized benefits. The Agency conducted these calculations for informational purposes only, and is not relying on these calculations to justify this final rule.

Effects of Isolated Changes to Specific Input Parameters

OSHA provides below a sensitivity analysis of several assumptions underlying the Agency's estimates of the annualized costs and benefits of the final rule. The calculations underlying the estimation of compliance costs, benefits, and economic impacts associated with this rulemaking are generally linear and additive. Accordingly, the changes in the costs or benefits will generally be proportional to variations in the relevant input parameters. For example, if the estimated time for supervisors to evaluate and classify confined spaces increased by 50 percent, the corresponding labor costs would also increase 50 percent.

OSHA evaluated a series of such changes in input parameters to test the extent to which the general conclusions of the economic analysis remained stable. On the whole, OSHA finds these conclusions to be robust, as even sizeable changes in the values of several input parameters did not greatly alter the estimates of the costs, benefits, or net benefits. Furthermore, this final rule produces significant positive net benefits regardless of the individual revisions to costs, benefits, or discount rate. Table IV–22 below summarizes the results of the individual sensitivity tests. In all the sensitivity tests, the parameters remained unchanged except for the one tested.

In the first sensitivity test on costs, when OSHA increased by 100 percent the estimated time for supervisors to evaluate and classify confined spaces, the estimated total costs of compliance increased by $0.7 million annually, or by 1 percent. In a second sensitivity test, OSHA increased by 100 percent the time estimated for information exchange on a multi-employer project. This test led to an increase in the estimated annualized compliance costs of $9.3 million, or of about 17 percent. In a third sensitivity test, OSHA increased by 100 percent its estimate of the time needed to issue entry permits and verify the safety of entries into confined spaces, which resulted in an increase in the estimated annualized compliance costs of $2.3 million, or of about 4 percent. Finally, in a fourth sensitivity test, when OSHA increased by 100 percent the estimate of the time devoted to training entrants and attendants, the estimated compliance costs rose by $1.5 million, or by about 3 percent.

In addition, OSHA examined the effect of a change in the discount rate on annualized costs and benefits. Changing the discount rate from 7 percent, used in the base case, to 3 percent lowered the estimated costs of the final rule from $60.3 million to $59.2 million per year (while leaving estimated annual benefits unaffected), thereby increasing the estimate of net benefits by $1 million.

OSHA also performed a sensitivity test on an input parameter used to estimate the benefits of the final rule. In particular, OSHA assumed that there were 100 injuries for every fatality instead of 150 injuries per fatality, the value used in the main analysis. As a result, the estimated benefits of the final rule fell by $15.6 million, or by about 17 percent.

In conclusion, these sensitivity tests demonstrate that even with relatively large variations in the input parameters, there are no large changes in the estimates of compliance costs or benefits.

TABLE IV–22—SENSITIVITY TESTS

Variable	OSHA's Best estimate	Change in variable	Change in annualized costs	Percentage change in annualized costs	Annualized costs	Net benefit
Cost Parameters						
OSHA's Best Estimate of Total Annualized Costs					$60.3 million	$33.3 million.
Supervisor Time to Evaluate and Classify Confined Spaces.	Average of 12 minutes per confined space.	Increase by 100 percent.	$0.7 million	1	$61 million	$32.6 million.
Time for Information Exchange on a Multi-employer Project.	Per project: 8 minutes of supervisor time for exchange information between host employer and controlling contractor, 20 minutes of supervisor time each for the controlling contractor, employee representative, and every entry employer, 5 minutes of supervisor time each for the controlling contractor and 10 percent of other (non-entry) employers on the work site, and 10 minutes of supervisor time each for the controlling contractor and two other employers on the work site for coordinated entries.	Increase by 100 percent.	$9.3 million	17	$69.6 million	$24 million.
Time to Issue Entry Permits and Verify Safety of Entries.	Per permit issued: 10 minutes of supervisor time and 5 minutes of clerical time. Per entry not requiring a permit: 5 minutes of supervisor time and 5 minutes of clerical time.	Increase by 100 percent.	$2.3 million	4	$62.6 million	$31 million.
Employee Training	Per project: 15 minutes of worker time and 1.5 minutes each of supervisor and clerical employee time for each entrant, 15 minutes of attendant time and 1.5 minutes each of supervisor and clerical employee time for each attendant.	Increase by 100 percent.	$1.5 million	3	$61.8 million	$31.8 million.
Discount Rate	7 percent	Change to 3 percent.	−$1 million	−2	$59.2 million	$34.3 million.
Benefit Parameter						
OSHA's Best Estimate of Total Annualized Benefits					$93.6 million	$33.3 million.
Number of injuries per fatality.	150	100	−$15.6 million	−17	$78 million	$17.7 million.

Break-Even Analysis

OSHA also performed sensitivity tests on two other parameters used to estimate the net costs and benefits of the proposed rule. However, for these tests, the Agency performed a break-even analysis that asked the extent to which the various cost and benefits inputs would have to vary for the costs to equal benefits.

In the first break-even test addressing cost estimates, OSHA examined how much costs would have to increase for costs to equal benefits. This point would occur when costs increased by $33.3 million, or 55 percent.

In a second break-even test, on benefits, OSHA examined the reduction needed in the rule's estimated aggregate benefits (in terms of avoided fatalities and injuries) for the costs to equal the benefits. The point would occur when OSHA's estimates of the number of avoided fatalities and injuries fell by 59 percent. The break-even point would, thus, require reducing the estimated benefits of the final rule by 2.18 fatalities and 326 injuries prevented annually (relative to OSHA's estimate of 5.2 fatalities and 780 injuries prevented annually).

In summary, according to these two break-even tests, there would have to be a fairly significant increase in costs or reduction in benefits for the rule to no longer produce positive net benefits. Further, OSHA notes that some of the other benefits of the rule are non-quantifiable, such as those benefits associated with making the general industry and construction provisions as compatible as possible. These benefits would increase the overall net benefits of the final rule.

10. References

ACCSH Confined Spaces Work Group (ACCSH, 1994). ''Work Group Report: Confined Spaces,'' submitted to the Advisory Committee on Construction Safety and Health, May 17, 1994. Available at: *https://www.osha.gov/doc/reference_documents.html*.

Ahluwalia, G. (Ahluwalia, 2003). ''Subcontracting and Channels of Distribution,'' *Housing Economics,* May 2003. (Attached to OSHA–2007–0026–0117.)

Ashford, N. A., 2006. ''Workers' Compensation,'' in *Environmental and Occupational Medicine,* Fourth Edition, W.N. Rom and S. Markowitz (Eds.), Lippincott-Raven Publishers, Philadelphia: pp. 1712–1719.

CONSAD Research Corporation (CONSAD, 2005). ''Rulemaking Support for the Proposed OSHA Confined Space Standard for Construction,'' prepared for the U.S. Department of Labor, Occupational Safety and Health Administration, Office of Regulatory Analysis, June 8, 2005. (OSHA–2007–0026–003.)

Dong, X., *et al.* (Dong, et al., 2011). ''Lifetime Risk of Occupational Injuries and Illnesses among Construction Workers,'' American Public Health Association, Washington, DC, October 31, 2011.

Hintermann, B., A. Alberini, and A. Markandya (Hinterman, Alberini, and Markandya, 2010). ''Estimating the Value of Safety with Labour Market Data: Are the Results Trustworthy?,'' *Applied Economics,* 42 (9): pp. 1085–1100, 2010.

IRS (Internal Revenue Service), 2012. Publication 525, ''Taxable and Nontaxable Income.'' Available at: *http://www.irs.gov/uac/Publication-525,-Taxable-and-Nontaxable-Income--1*.

IRS (Internal Revenue Service), 2013. Topic 751, ''Social Security and Medicare Withholding Rates.'' Available at: *http://www.irs.gov/taxtopics/tc751.html*.

Leigh, J. P., and J. P. Marcin, 2012. ''Workers' Compensation Benefits and Shifting Costs for Occupational Injury and Illness,'' *Journal of Occupational and Environmental Medicine,* April, 54(4): pp. 445–50.

NASI (National Academy of Social Insurance), 2012. ''Workers' Compensation: Benefits, Coverage, and Costs, 2010,'' August. Available at *http://www.nasi.org/research/2012/report-workers-compensation-benefits-coverage-costs-2010*.

NCCI (National Council on Compensation Insurance), 2013. ''ABCs of Experience Rating.'' Available at *https://www.ncci.com/NCCIMain/Education/ExperienceRating/Pages/default.aspx*.

Neuhauser, F.W., S.S. Seabury, and J. Mendeloff, 2013. ''The Impact of Experience Rating on Small Employers: Would Lowering the Threshold for Experience Rating Improve Safety?,'' Rand Working Papers WR–955. Newsletter discussion available at: *http://www.rand.org/jie/centers/workplace-health-safety/projects/experience-rating.html*. Full paper at: *http://www.rand.org/pubs/working_papers/WR955.html*.

Ruser, J.W. (Ruser, 2008). ''Examining Evidence on Whether BLS Undercounts Workplace Injuries and Illnesses,'' *Monthly Labor Review,* 131 (8): pp. 20–32, August 2008.

Small Business Advocacy Review Panel for the OSHA Confined Spaces in Construction Draft Standard (SBREFA Panel, 2003). ''Report of the Small Business Advocacy Review Panel on the Draft OSHA Standard for Confined Spaces in Construction,'' submitted to Mr. John Henshaw, Assistant Secretary for Occupational Safety and Health, U.S. Department of Labor, Occupational Safety and Health Administration, November 24, 2003. (Exhibit 2–1 in OSHA docket S107A.)

Seong, S.K., and J. Mendeloff, 2004. ''Assessing the Accuracy of OSHA's Projections of the Benefits of New Safety Standards,'' *American Journal of Industrial Medicine,* 45, 4: 2004.

Sunstein, C., 2004. ''Valuing Life: A Plea for Disaggregation,'' *Duke Law Journal,* 54: pp. 385–445.

Thaler, R., and S. Rosen, 1976. ''The Value of Saving a Life: Evidence from the Labor Market,'' in *Household Production and Consumption,* N E. Terleckyj (ed.), New York: Columbia University Press, 1976: pp. 265–298.

U.S. Bureau of Labor Statistics (BLS 2009A). Table A–1, ''Fatal Occupational Injuries by Industry, Event and Exposure, 2009.'' Available at: *http://www.bls.gov/iif/oshwc/cfoi/cftb0241.pdf*.

U.S. Bureau of Labor Statistics (BLS 2009B). Table 2, ''Number of Nonfatal Occupational Injuries and Illnesses by Case Type and Ownership for Selected Industries, 2009,'' News Release USDL 10–1451. Available at: *http://bls.gov/news.release/archives/osh2_11092010.pdf*.

U.S. Commerce Department, Bureau of Economic Analysis. ''GDP Price Deflator 2002 to 2009.'' Available at: *http://www.bea.gov/iTable/iTable.cfm?ReqID=9&step=1#reqid=9&step=3&isuri=1&903=13*, downloaded on 11/9/2010.

U.S. Census Bureau. ''Annual Value of Construction Put in Place 2002–2009.'' Available at: *http://www.census.gov/construction/c30/c30index.html*.

U.S. Environmental Protection Agency (EPA, 2000). ''Guidelines for Preparing Economic Analyses,'' *EPA 240–R–00–003:* September 2000. Available at: *http://yosemite1.epa.gov/ee/epa/eed.nsf/Webpages/Guidelines.html*; also available in OSHA Docket No. H–0054a, Exhibit 35–334.

U.S. Internal Revenue Service (IRS, 2013), 2010. ''Corporation Source Book,'' *Publication 1053.* Available at: < *http://www.irs.gov/uac/SOI-Tax-Stats-Corporation-Source-Book:-U.S.-Total-and-Sectors-Listing*> Accessed by OSHA on 4/19/2013.

U.S. Office of Management and Budget (OMB, 2003). ''To the Heads of Executive Agencies and Establishments; Subject: Regulatory Analysis,'' *Circular A–4:* September 17, 2003. Available at: *http://www.whitehouse.gov/sites/default/files/omb/assets/regulatory_matters_pdf/a-4.pdf*.

Urban Institute/Brookings, 2012. ''Historical Average Federal Tax Rates for All Households,'' Tax Policy Center, October. Available at: *http://www.taxpolicycenter.org/taxfacts/displayafact.cfm?Docid=456*.

Viscusi, K., and J. Aldy (Viscusi and Aldy, 2003). ''The Value of a Statistical Life: A Critical Review of Market Estimates Throughout the World,'' *The Journal of Risk and Uncertainty,* 27 (1): pp. 5–76, August 2003.

Viscusi, W. Kip, Wesley A. Magat, and Anne Forrest. ''Altruistic and Private Valuation of Risk Reduction.'' *Journal of Policy Analysis and Management* 7(2): pp. 227–245, 1988.

Workers Compensation Research Institute (WCRI, 1987). *Workplace Injuries—Economic and Noneconomic Consequences for Workers,* 3 (7): Cambridge, MA, July 1987.

C. Office of Management and Budget Review Under the Paperwork Reduction Act of 1995

The final Confined Spaces in Construction Standard contains collection of information requirements (paperwork) that are subject to review by the Office of Management and Budget (OMB) under the Paperwork Reduction Act of 1995 (PRA–95) (44 U.S.C. 3501 *et seq.*) In accordance with 44 U.S.C. 3506(c)(2) of the PRA–95, OSHA solicited public comments on the *Confined Spaces in Construction (29 CFR 1926, subpart AA)* Information Collection Request (ICR) (paperwork burden hour and cost analysis) for the proposed rule. The Department also submitted this ICR to OMB for review in accordance with 44 U.S.C. 3507(d) on November 28, 2007. On February 15, 2008, OMB authorized the Department of Labor to use OMB Control Number 1218–0258 in future paperwork submissions involving this rulemaking. OMB commented, ''This OMB action is not an approval to conduct or sponsor an information collection under the Paperwork Reduction Act of 1995.'' OMB also stated that ''OMB will review the associated collection requirements in parallel with the final regulation prior to approval.''

OSHA received no public comments on the proposed ICR. However, a number of comments received in response to the Notice of Proposed Rulemaking (NPRM), described earlier in this preamble, contained information relevant to the burden-hour and cost analysis that OSHA considered when it developed the revised ICR associated with this final rule.

In accordance with 44 U.S.C. 3507 of the PRA–95, OSHA requested OMB approval of the collection of information requirement described below. A copy of the ICR is available at *http://www.reginfo.gov*. OMB is preapproving the collection of information requirements under OMB Control Number 1218–0258 and they will take effect on the same date as other parts of this rule.

The Department of Labor notes that, under the PRA–95, a Federal agency cannot conduct or sponsor a collection of information unless OMB approves it and the collection of information displays a currently valid OMB control number. Also, notwithstanding any other provision of law, no employer shall be subject to penalty for failing to comply with a collection of information if the collection of information does not display a currently valid OMB control number.

The collection of information requirements in this final rule impose duties on employers to communicate, produce and maintain records, and take other measures to protect employees from confined-space hazards in construction. These provisions are necessary to protect the health and safety of employees who are engaged in construction work in confined spaces. Accordingly, each employer engaged in construction who has employees who enter a permit-required confined space (PRCS) must have, as applicable, the following information posted in accordance with the standard or on file and available at the job site: Danger signs and other means of notification of PRCSs; a written PRCS program; entry permits that document procedures necessary for safe permit-entry operations and that include atmospheric-testing and monitoring information and results; signed certifications and supporting documentation for entry under alternate procedures, including documentation of the hazard determinations and the methods used to protect employees from these hazards; written approval from a professional engineer for use of job-made hoisting systems when entering spaces under alternate procedures, certifications documenting reclassification of the space; a Safety Data Sheet or similar written information to provide to medical facilities treating exposed employees; and training records for employees. Entry employers must retain each canceled entry permit for at least 1 year to facilitate the review of the permit-required confined space program and maintain employee training records for the period of time the employee is employed by that employer. Employers must make all information required to be developed under the standard available for review by the affected employees and their authorized representatives, and provide access to documents required to be retained by the standard to OSHA for compliance purposes. Additionally, controlling contractors have responsibilities to obtain and disseminate information about the permit space, host employers have a duty to disclose known information about permit spaces, and each employer engaged in construction who has an employee enter a PRCS must share information with the controlling contractor and must ensure that its attendants, authorized entrants, supervisors and rescue teams or services communicate as required by the standard. An employer's failure to generate and disclose the information required in this standard will affect significantly the Agency's effort to control and reduce injuries and fatalities related to confined spaces in construction.

Table IV–23 below identifies and describes the collection of information requirements contained in the final rule. As discussed in Section II.B. of the preamble, OSHA is finalizing a Confined Spaces in Construction standard that more closely resembles the general industry standard than did the NPRM. OSHA's rationale for the need to collect information is set forth in the general discussion in the Background section of the preamble, and in the discussion of each of these specific provisions in Section III of the preamble. As noted in the preamble discussions of the specific sections of the standard, the new information collection requirements not contained in the NPRM include requirements for written PRCS programs, written approval for job-made hoisting systems used when entering spaces under alternate procedures, and consultation with affected employees and their authorized representatives in the development and implementation of the PRCS program. In addition, while the proposed rule required host employers to communicate directly with entry employers, OSHA assigned the controlling contractor that function in the final rule. Table IV–23 identifies the collection of information requirements contained in the final rule as follows:

TABLE IV–23—COLLECTION OF INFORMATION REQUIREMENTS OF THE FINAL STANDARD

29 CFR 1926.1203(b)(1) and (b)(2)	If the workplace contains a PRCS, employers must inform employees by posting a danger sign, and inform the employees' authorized representatives and controlling contractor in a manner other than posting, of the existence and location of, and the danger posed by, the PRCS.
29 CFR 1926.1203(d), 29 CFR 1926.1204, 29 CFR 1926.1211(a)(5), and 29 CFR 1926.1212(a).	If an employer decides that employees it directs will enter a PRCS, the employer must have and implement a written permit-space program at the construction site that complies with § 1926.1204 of this standard. The employer must make the written program available prior to, and during, entry operations for inspection by employees and their authorized representatives. Entry employers must document a number of necessary procedures, including: Safe PRCS entry operations; summoning rescue and emergency services (including the development of a rescue plan for employers who have in-house rescue teams), rescuing entrants from PRCSs, providing necessary emergency services to rescued employees, and preventing unauthorized personnel from attempting a rescue; coordinating entry operations; and for concluding entry. Employers must consult with affected employees and their authorized representatives on all aspects of the PRCS program.
29 CFR 1926.1203(e)(1)(v), (e)(2)(viii) and (e)(2)(ix).	Before entry under alternate procedures, employers must document the determinations and supporting data required by paragraphs § 1910.1204(e)(1)(i)–(e)(1)(iii) of this standard. The employer must make the documented determinations and supporting data available to each employee entering the space or to that employee's authorized representative. A job-made hoisting system is permissible if it is approved for personnel hoisting by a registered professional engineer, in writing, prior to use.

TABLE IV–23—COLLECTION OF INFORMATION REQUIREMENTS OF THE FINAL STANDARD—Continued

29 CFR 1926.1203(g)(3)	Entry employer(s) must document and certify the basis for determining the elimination or isolation of all hazards in a PRCS when reclassifying the space. The certification must be made available to each employee entering the space or to that employee's authorized representative.
29 CFR 1926.1203(h)(1)(i)–(h)(1)(iii), (h)(2)(i), (h)(5)(iii), and (i).	The host employer and controlling contractor must exchange PRCS information before and after entry operations.
29 CFR 1926.1203(h)(2)(ii), and (i)	The controlling contractor must provide PRCS information to non-entry employers before entry operations begin.
29 CFR 1926.1203(h)(2)(ii), (h)(3)(i)–(h)(3)(ii), (h)(5)(i)–(h)(5)(ii), and (i).	The controlling contractor and the entry employer(s) must exchange PRCS information before and after entry operations.
29 CFR 1926.1203(h)(4)(i), (h)(4)(ii), and (i).	The controlling contractor and entry employer(s) must each coordinate entry operations: When more than one entity performs PRCS entry at the same time; or when performing permit-space entry while at the same time any activities are performed that could foreseeably result in a hazard in the PRCS.
29 CFR 1926.1204(e)(6)	Employers must provide results of any testing conducted under § 1926.1204 to employees or employees' authorized representative.
29 CFR 1926.1204(m) and (n)	Entry employers must review entry operations when the measures taken under the permit-space program may not protect employees, and revise the program to correct deficiencies found to exist before subsequent entries are authorized. Entry employers must review the permit-space program, using the canceled permits retained under § 1926.1205(f) of this standard, within 1 year after each entry, and revise the program as necessary to protect employees participating in entry operations from permit-space hazards. Employers may perform a single annual review covering all entries performed during a 12-month period.
29 CFR 1926.1205(a) and (c), and 29 CFR 1926.1206.	Each entry employer must document the completion of measures required by § 1926.1204(c) of this standard by preparing an entry permit and making it available by posting or other equally effective means to authorized entrants or their authorized representatives before entry is authorized. Employers must identify on the permit specific information such as: The purpose of the entry, date and authorized duration of the permit, authorized entrants, means of detecting atmospheric hazards, attendants, entry supervisors, hazards of the PRCS, measures used to isolate the PRCS and to control permit-space hazards before entry, acceptable entry conditions, results of tests and monitoring performed under § 1926.1204(e) of this standard and the names or initials of the testers and an indication of when the tests were performed, rescue and emergency services (such as the equipment to use and the numbers to call) and the means to summon those services, communication procedures, equipment, any additional permits issued previously to authorize work in the permit space, and any other information necessary, given the circumstances of the particular confined space to ensure employee safety.
29 CFR 1926.1205(b) and 29 CFR 1926.1210(b).	Before entry begins, the entry supervisor identified on the permit must sign the entry permit, and verify, by checking that the appropriate entries have been made on the permit, that all tests specified by the permit have been conducted and that all procedures and equipment specified by the permit are in place before endorsing the permit and allowing entry to begin.
29 CFR 1926.1205(f)	Entry employers must retain each canceled entry permit for at least 1 year to facilitate the review of the permit-required confined space program required by § 1926.1204(n) of this standard. The employer must note on the permit any problems encountered during an entry operation and make appropriate revisions to the permit-space program.
29 CFR 1926.1207(d)	Employers must maintain training records containing each employee's name, the name of the trainers, and the dates of training to show completion of the training required by § 1926.1207(a) through (c) of this standard. The documentation must be available for inspection by employees and their authorized representatives for the period of time the employee is employed by that employer.
29 CFR 1926.1208(c) and (d)	Entry employers must ensure that authorized entrants: Communicate with the attendant as necessary to enable the attendant to assess entrant status and to enable the attendant to alert entrants of the need to evacuate the space as required by § 1926.1209(f) of this standard, and to alert the attendant whenever there is any warning sign or symptom of exposure to a dangerous situation, or the entrant detects a prohibited condition.
29 CFR 1926.1209(e), (f), (g), and (h)(1)–(h)(3).	Entry employers must ensure that attendants: Communicate with authorized entrants and order them to evacuate the permit space under specified conditions; summon PRCS rescue services as soon as necessary; warn unauthorized persons to stay away from, or to exit, PRCSs; and informs authorized entrants and entry supervisors of any unauthorized PRCS entry.
29 CFR 1926.1210(d) and 29 CFR 1926.1211(c).	Entry employers must ensure that each entry supervisor verifies that rescue services are available, the means for summoning them are operable, and the employer will be notified as soon as the services become unavailable. If the employer uses non-entry rescue, the employer must confirm, prior to entry, that emergency assistance will be available in the event that non-entry rescue fails.
29 CFR 1926.1211(a)(1) and (a)(2)	Employers who designate rescue and emergency services must evaluate a prospective rescuer's ability to respond to a rescue summons in a timely manner, considering the hazard(s) identified, and evaluate a prospective rescue service's ability to function proficiently with rescue-related tasks and equipment while rescuing entrants from the particular PRCS identified.
29 CFR 1926.1211(a)(4)	Employers who designate rescue and emergency services must inform each rescue team or service of the hazards they may confront when called on to perform rescue at the site.
29 CFR 1926.1211(d)	If an injured entrant is exposed to a substance for which the employer must keep a Safety Data Sheet or other similar written information at the worksite, the employer must make that SDS or written information available to the medical facility treating the exposed entrant.
29 CFR 1926.1212(b)	Employers must make available to each affected employee and his/her authorized representatives all information they must develop under this standard.
29 CFR 1926.1213	Employers must disclose to the Secretary of Labor or the Secretary's designee all documents this standard requires them to retain.

The final rule imposes a program adjustment of 654,514 new burden hours to 30,066 construction-employment establishments after the effective date of the final standard.

Title of Collection: Confined Spaces in Construction (29 CFR 1926 subpart AA).

OMB Control Number: 1218–0258.

Affected Public: Businesses or other for-profits.

Total Estimated Number of Respondents: 30,066.

Total Estimated Number of Responses: 4,093,825.

Total Estimated Annual Time Burden: 654,514 hours.

Total Estimated Annual Other Costs Burden: $1,017,859.

D. Federalism

OSHA reviewed this final rule in accordance with the most recent Executive Order (E.O.) on Federalism (E.O. 13132, 64 FR 43255 (Aug. 10, 1999)). This E.O. requires that Federal agencies, to the extent possible, refrain from limiting State policy options, consult with States prior to taking any actions that would restrict State policy options, and take such actions only when clear constitutional authority exists and the problem is national in scope. E.O. 13132 provides for preemption of State law only with the expressed consent of Congress. Federal agencies must limit any such preemption to the extent possible.

Under Section 18 of the OSH Act, Congress expressly provides that States may adopt, with Federal approval, a plan for the development and enforcement of occupational safety and health standards; States that obtain Federal approval for such a plan are referred to as ''State-Plan States'' (29 U.S.C. 667). Occupational safety and health standards developed by State-Plan States must be at least as effective in providing safe and healthful employment and places of employment as the Federal standards. While OSHA promulgated this final rule to protect employees in every State, Section 18(c)(2) of the Act permits State-Plan States and Territories to develop and enforce their own standards for confined spaces work provided that those requirements are at least as effective in providing safe and healthful employment and places of employment as the requirements in this final rule.

In summary, this final rule complies with E.O. 13132. In States without OSHA-approved State Plans, this final rule limits State policy options in the same manner as every standard promulgated by OSHA. In States with OSHA-approved State Plans, this rulemaking does not significantly limit State policy options.

E. State-Plan States

When Federal OSHA promulgates a new standard or more stringent amendment to an existing standard, the 27 states and U.S. Territories with their own OSHA-approved occupational safety and health plans must amend their standards to reflect the new standard or amendment, or show OSHA why such action is unnecessary, for example, because an existing state standard covering this area is ''at least as effective'' as the new Federal standard or amendment (29 CFR 1953.5(a)). The state standard must be at least as effective as the final Federal rule and must be completed within 6 months of the promulgation date of the final Federal rule. When OSHA promulgates a new standard or amendment that does not impose additional or more stringent requirements than an existing standard, State-Plan States do not have to amend their standards, although the Agency may encourage them to do so.

The 21 states and 1 U.S. Territory with OSHA-approved occupational safety and health plans covering private employers and state and local government employees are: Alaska, Arizona, California, Hawaii, Indiana, Iowa, Kentucky, Maryland, Michigan, Minnesota, Nevada, New Mexico, North Carolina, Oregon, Puerto Rico, South Carolina, Tennessee, Utah, Vermont, Virginia, Washington, and Wyoming. In addition, four states and one U.S. Territory have OSHA-approved State Plans that apply to state and local government employees only: Connecticut, Illinois, New Jersey, New York, and the Virgin Islands.

The requirements in this final rule are more stringent than all or most State plans for the work they cover. However, as discussed previously in this preamble, OSHA believes that State-Plan States that have standards applicable to construction work in confined spaces that are similar to 29 CFR 1910.146, the general industry standard for confined spaces, will not have to make major changes to their existing rules to ensure that these rules are at least as effective as this final rule. OSHA believes that the record warrants these changes so as to provide construction employees with the same level of protection afforded to them by this final rule. Therefore, states and territories with OSHA-approved State Plans must adopt comparable amendments to their standards within 6 months of the promulgation date of this rule unless they demonstrate that such amendments are not necessary because their existing standards are at least as effective in protecting workers as this final rule. Each State Plan State's existing requirements will continue to be in effect until that State adopts the required revisions.

F. Unfunded Mandates Reform Act

OSHA reviewed this final rule according to the Unfunded Mandates Reform Act of 1995 (UMRA) (2 U.S.C. 1501 *et seq.*) and E.O. 13132 (64 FR 43255 (Aug. 10, 1999)). As discussed in the Final Economic and Regulatory Flexibility Analysis for this rulemaking, OSHA estimates that compliance with the rule will require expenditures of less than $100 million per year by all affected employers. Therefore, this rule is not a significant regulatory action within the meaning of Section 202 of UMRA (2 U.S.C. 1532).

OSHA standards do not apply to state or local governments except in states that elect voluntarily to adopt a State Plan approved by the Agency. Consequently, this final rule does not meet the definition of a ''Federal intergovernmental mandate'' (2 U.S.C. 658(5)).

Therefore, for the purposes of UMRA, the Agency certifies that this final rule does not mandate that state, local, or Tribal governments adopt new, unfunded regulatory obligations or increase expenditures by the private sector of more than $100 million in any year.

G. Consultation and Coordination With Indian Tribal Governments

OSHA reviewed this final rule in accordance with Executive Order 13175, (65 FR 67249 (Nov. 9, 2000)) and determined that it does not have ''tribal implications'' as defined in that order. The final rule does not have substantial direct effects on one or more Indian tribes, on the relationship between the Federal government and Indian tribes, or on the distribution of power and responsibilities between the Federal government and Indian tribes.

H. Applicability of Existing Consensus Standards

Section 6(b)(8) of the Occupational Safety and Health Act of 1970 (29 U.S.C. 655(b(8)) requires OSHA to explain why the rule adopted will better effectuate the purposes of the Act than relevant national consensus standards. The American National Standards Institute (ANSI) Z117.1 consensus standard (''Safety Requirements for Confined Spaces'') contains provisions addressing safety in confined spaces. The Agency consulted this standard in developing its proposed rule for confined spaces in construction, as well as in developing its general industry confined spaces standard. The Summary and Explanation section of this rule discusses OSHA's consideration of the requirements contained in ANSI Z–117.1 and other ANSI standards.

The Agency did not adopt the ANSI standard as the OSHA confined spaces in construction standard for several reasons. First, the Agency believes that the ANSI standard concentrates on confined spaces with oxygen-deficient atmospheres, or with potential overexposures to air contaminants, without adequately addressing the full range of hazards that can occur in a confined space. In this regard, OSHA concurs with the findings it published in the preamble to the general industry confined spaces standard (58 FR 4464). After reviewing relevant publications by the National Institute for Occupational Safety and Health, the ANSI Z117.1 standards (both the 1989 and the 1977 editions), and the relevant guidelines developed by other organizations, the Agency decided to diverge from the approach used by those standards-development organizations because their documents do not provide sufficient guidance for employers to distinguish among the several types of confined space hazards they may encounter. Second, OSHA concludes that the structure and organization of the ANSI standard is not sufficiently user-friendly for small businesses, especially those that rarely deal with confined spaces. Third, OSHA finds that the ANSI standard does not adequately address construction-specific hazards, particularly where multiple employers are working in or around permit spaces. Fourth, OSHA notes that, in most instances, the wording of the provisions in these ANSI standards needed revision to improve enforceability, clarity, and ease of use. For example, much of the information in the consensus standard is presented as suggestions or non-mandatory guidance rather than enforceable imperative commands. Finally, most commenters expressed a preference for a rule that was similar to the general industry confined spaces standard. Agency incorporation of consensus standards can often facilitate rulemaking by avoiding duplicative Agency efforts and preventing potential confusion in the affected industries, but the widespread use of OSHA's general industry confined spaces standard suggests that, in this area, the Agency will be better able to facilitate worker safety and health by basing the new construction standard on the general industry standard rather than incorporating the ANSI standard.

List of Subjects in 29 CFR Part 1926

Confined space, Construction industry, Occupational safety and health, Permit space, Safety.

Authority and Signature

David Michaels, Ph.D., MPH, Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, 200 Constitution Ave. NW., Washington, DC 20210, authorized the preparation of this document. OSHA is issuing this final rule under the following authorities: 29 U.S.C. 653, 655, 657; 40 U.S.C. 3701 *et seq.;* 5 U.S.C. 553; Secretary of Labor's Order No. 1–2012 (77 FR 3912, Jan. 25, 2012); and 29 CFR part 1911.

Signed at Washington, DC, on April 8, 2015.

David Michaels,

Assistant Secretary of Labor for Occupational Safety and Health.

Amendments to Standards

For the reasons stated in the preamble of this rule, the Agency is amending 29 CFR part 1926 as follows:

PART 1926—[AMENDED]

Subpart C—General Safety and Health Provisions

■ 1. The authority citation for subpart C of 29 CFR part 1926 is revised to read as follows:

Authority: 40 U.S.C. 3701 *et seq.;* 29 U.S.C. 653, 655, 657; Secretary of Labor's Order No. 12–71 (36 FR 8754), 8–76 (41 FR 25059), 9–83 (48 FR 35736), 6–96 (62 FR 111), 5–2007 (72 FR 31160), or 1–2012 (77 FR 3912) as applicable; and 29 CFR part 1911.

§ 1926.21 [Amended]

■ 2. In § 1926.21, paragraph (b)(6) is removed.

Subpart V—Electric Power Transmission and Distribution

■ 3. The authority citation for subpart V of part 1926 continues to read as follows:

Authority: 40 U.S.C. 3701 *et seq.;* 29 U.S.C. 653, 655, 657; Secretary of Labor's Order No. 1–2012 (77 FR 3912); and 29 CFR part 1911.

■ 4. Amend § 1926.953 by revising paragraphs (a) and (g) and the note at the end of the section to read as follows:

§ 1926.953 Enclosed spaces.

(a) *General.* This section covers enclosed spaces that may be entered by employees. It does not apply to vented vaults if the employer makes a determination that the ventilation system is operating to protect employees before they enter the space. This section applies to routine entry into enclosed spaces. If, after the employer takes the precautions given in this section and in § 1926.965, the hazards remaining in the enclosed space endanger the life of an entrant or could interfere with an entrant's escape from the space, then entry into the enclosed space must meet the permit space entry requirements of subpart AA of this part. For routine entries where the hazards remaining in the enclosed space do not endanger the life of an entrant or interfere with an entrant's escape from the space, this section applies in lieu of the permit-space entry requirements contained in §§ 1926.1204 through 926.1211.

* * * * *

(g) *Hazardous atmosphere.* Employees may not enter any enclosed space while it contains a hazardous atmosphere, unless the entry conforms to the confined spaces in construction standard in subpart AA of this part.

* * * * *

Note to § 1926.953.: Entries into enclosed spaces conducted in accordance with the permit space entry requirements of subpart AA of this part are considered as complying with this section.

■ 5. Amend § 1926.968 by adding a note to the definition for ''Enclosed spaces'' to read as follows:

§ 1926.968 Definitions.

* * * * *

Enclosed space. * * *

Note to the definition of ''Enclosed space''. The Occupational Safety and Health Administration does not consider spaces that are enclosed but not designed for employee entry under normal operating conditions to be enclosed spaces for the purposes of this subpart. Similarly, the Occupational Safety and Health Administration does not consider spaces that are enclosed and that are expected to contain a hazardous atmosphere to be enclosed spaces for the purposes of this subpart. Such spaces meet the definition of permit spaces in subpart AA of this part, and entry into them must conform to that standard.

* * * * *

■ 6. Subpart AA is added to read as follows:

Subpart AA—Confined Spaces in Construction

Sec.
1926.1200 [Reserved]
1926.1201 Scope.
1926.1202 Definitions.
1926.1203 General requirements.
1926.1204 Permit-required confined space program.
1926.1205 Permitting process.
1926.1206 Entry permit.
1926.1207 Training.
1926.1208 Duties of authorized entrants.
1926.1209 Duties of attendants.
1926.1210 Duties of entry supervisors.
1926.1211 Rescue and emergency services.
1926.1212 Employee participation.
1926.1213 Provision of documents to Secretary.

Authority: 40 U.S.C. 3701 *et seq.;* 29 U.S.C. 653, 655, 657; Secretary of Labor's Order No. 1–2012 (77 FR 3912); and 29 CFR part 1911.

§ 1926.1200 [Reserved]

§ 1926.1201 Scope.

(a) This standard sets forth requirements for practices and procedures to protect employees engaged in construction activities at a worksite with one or more confined spaces, subject to the exceptions in paragraph (b) of this section.

Note to paragraph (a). Examples of locations where confined spaces may occur include, but are not limited to, the following: Bins; boilers; pits (such as elevator, escalator, pump, valve or other equipment); manholes (such as sewer, storm drain, electrical, communication, or other utility); tanks (such as fuel, chemical, water, or other liquid, solid or gas); incinerators; scrubbers; concrete pier columns; sewers; transformer vaults; heating, ventilation, and air-conditioning (HVAC) ducts; storm drains; water mains; precast concrete and other pre-formed manhole units; drilled shafts; enclosed beams; vessels; digesters; lift stations; cesspools; silos; air receivers; sludge gates; air preheaters; step up transformers; turbines; chillers; bag houses; and/or mixers/reactors.

(b) *Exceptions.* This standard does not apply to:

(1) Construction work regulated by subpart P of this part (Excavations).

(2) Construction work regulated by subpart S of this part (Underground Construction, Caissons, Cofferdams and Compressed Air).

(3) Construction work regulated by subpart Y of this part (Diving).

(c) Where this standard applies and there is a provision that addresses a confined space hazard in another applicable OSHA standard, the employer must comply with both that requirement and the applicable provisions of this standard.

§ 1926.1202 Definitions.

The following terms are defined for the purposes of this subpart only:

Acceptable entry conditions means the conditions that must exist in a permit space, before an employee may enter that space, to ensure that employees can safely enter into, and safely work within, the space.

Attendant means an individual stationed outside one or more permit spaces who assesses the status of authorized entrants and who must perform the duties specified in § 1926.1209.

Authorized entrant means an employee who is authorized by the entry supervisor to enter a permit space.

Barrier means a physical obstruction that blocks or limits access.

Blanking or *blinding* means the absolute closure of a pipe, line, or duct by the fastening of a solid plate (such as a spectacle blind or a skillet blind) that completely covers the bore and that is capable of withstanding the maximum pressure of the pipe, line, or duct with no leakage beyond the plate.

Competent person means one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has the authorization to take prompt corrective measures to eliminate them.

Confined space means a space that:

(1) Is large enough and so configured that an employee can bodily enter it;

(2) Has limited or restricted means for entry and exit; and

(3) Is not designed for continuous employee occupancy.

Control means the action taken to reduce the level of any hazard inside a confined space using engineering methods (for example, by ventilation), and then using these methods to maintain the reduced hazard level. Control also refers to the engineering methods used for this purpose. Personal protective equipment is not a control.

Controlling Contractor is the employer that has overall responsibility for construction at the worksite.

Note to the definition of ''Controlling Contractor''. If the controlling contractor owns or manages the property, then it is both a controlling employer and a host employer.

Double block and bleed means the closure of a line, duct, or pipe by closing and locking or tagging two in-line valves and by opening and locking or tagging a drain or vent valve in the line between the two closed valves.

Early-warning system means the method used to alert authorized entrants and attendants that an engulfment hazard may be developing. Examples of early-warning systems include, but are not limited to: Alarms activated by remote sensors; and lookouts with equipment for immediately communicating with the authorized entrants and attendants.

Emergency means any occurrence (including any failure of power, hazard control or monitoring equipment) or event, internal or external, to the permit space that could endanger entrants.

Engulfment means the surrounding and effective capture of a person by a liquid or finely divided (flowable) solid substance that can be aspirated to cause death by filling or plugging the respiratory system or that can exert enough force on the body to cause death by strangulation, constriction, crushing, or suffocation.

Entry means the action by which any part of a person passes through an opening into a permit-required confined space. Entry includes ensuing work activities in that space and is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space, whether or not such action is intentional or any work activities are actually performed in the space.

Entry Employer means any employer who decides that an employee it directs will enter a permit space.

Note to the definition of ''Entry Employer''. An employer cannot avoid the duties of the standard merely by refusing to decide whether its employees will enter a permit space, and OSHA will consider the failure to so decide to be an implicit decision to allow employees to enter those spaces if they are working in the proximity of the space.

Entry permit (permit) means the written or printed document that is provided by the employer who designated the space a permit space to allow and control entry into a permit space and that contains the information specified in § 1926.1206.

Entry rescue occurs when a rescue service enters a permit space to rescue one or more employees.

Entry supervisor means the qualified person (such as the employer, foreman, or crew chief) responsible for determining if acceptable entry conditions are present at a permit space where entry is planned, for authorizing entry and overseeing entry operations, and for terminating entry as required by this standard.

Note to the definition of ''Entry supervisor''. An entry supervisor also may serve as an attendant or as an authorized entrant, as long as that person is trained and equipped as required by this standard for each role he or she fills. Also, the duties of entry supervisor may be passed from one individual to another during the course of an entry operation.

Hazard means a physical hazard or hazardous atmosphere. See definitions below.

Hazardous atmosphere means an atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue (that is, escape unaided from a permit space), injury, or acute illness from one or more of the following causes:

(1) Flammable gas, vapor, or mist in excess of 10 percent of its lower flammable limit (LFL);

(2) Airborne combustible dust at a concentration that meets or exceeds its LFL;

Note to paragraph (2) of the definition of ''Hazardous atmosphere''. This concentration may be approximated as a condition in which the combustible dust obscures vision at a distance of 5 feet (1.52 meters) or less.

(3) Atmospheric oxygen concentration below 19.5 percent or above 23.5 percent;

(4) Atmospheric concentration of any substance for which a dose or a permissible exposure limit is published in subpart D of this part (Occupational Health and Environmental Control), or in subpart Z of this part (Toxic and Hazardous Substances), and which could result in employee exposure in excess of its dose or permissible exposure limit;

Note to paragraph (4) of the definition of "Hazardous atmosphere". An atmospheric concentration of any substance that is not capable of causing death, incapacitation, impairment of ability to self-rescue, injury, or acute illness due to its health effects is not covered by this definition.

(5) Any other atmospheric condition that is immediately dangerous to life or health.

Note to paragraph (5) of the definition of "Hazardous atmosphere". For air contaminants for which OSHA has not determined a dose or permissible exposure limit, other sources of information, such as Safety Data Sheets that comply with the Hazard Communication Standard, § 1926.59, published information, and internal documents can provide guidance in establishing acceptable atmospheric conditions.

Host employer means the employer that owns or manages the property where the construction work is taking place.

Note to the definition of "Host employer". If the owner of the property on which the construction activity occurs has contracted with an entity for the general management of that property, and has transferred to that entity the information specified in § 1926.1203(h)(1), OSHA will treat the contracted management entity as the host employer for as long as that entity manages the property. Otherwise, OSHA will treat the owner of the property as the host employer. In no case will there be more than one host employer.

Hot work means operations capable of providing a source of ignition (for example, riveting, welding, cutting, burning, and heating).

Immediately dangerous to life or health (IDLH) means any condition that would interfere with an individual's ability to escape unaided from a permit space and that poses a threat to life or that would cause irreversible adverse health effects.

Note to the definition of "Immediately dangerous to life or health". Some materials—hydrogen fluoride gas and cadmium vapor, for example—may produce immediate transient effects that, even if severe, may pass without medical attention, but are followed by sudden, possibly fatal collapse 12–72 hours after exposure. The victim "feels normal" after recovery from transient effects until collapse. Such materials in hazardous quantities are considered to be "immediately" dangerous to life or health.

Inerting means displacing the atmosphere in a permit space by a noncombustible gas (such as nitrogen) to such an extent that the resulting atmosphere is noncombustible.

Note to the definition of "Intering". This procedure produces an IDLH oxygen-deficient atmosphere.

Isolate or isolation means the process by which employees in a confined space are completely protected against the release of energy and material into the space, and contact with a physical hazard, by such means as: Blanking or blinding; misaligning or removing sections of lines, pipes, or ducts; a double block and bleed system; lockout or tagout of all sources of energy; blocking or disconnecting all mechanical linkages; or placement of barriers to eliminate the potential for employee contact with a physical hazard.

Limited or restricted means for entry or exit means a condition that has a potential to impede an employee's movement into or out of a confined space. Such conditions include, but are not limited to, trip hazards, poor illumination, slippery floors, inclining surfaces and ladders.

Line breaking means the intentional opening of a pipe, line, or duct that is or has been carrying flammable, corrosive, or toxic material, an inert gas, or any fluid at a volume, pressure, or temperature capable of causing injury.

Lockout means the placement of a lockout device on an energy isolating device, in accordance with an established procedure, ensuring that the energy isolating device and the equipment being controlled cannot be operated until the lockout device is removed.

Lower flammable limit or lower explosive limit means the minimum concentration of a substance in air needed for an ignition source to cause a flame or explosion.

Monitor or *monitoring* means the process used to identify and evaluate the hazards after an authorized entrant enters the space. This is a process of checking for changes that is performed in a periodic or continuous manner after the completion of the initial testing or evaluation of that space.

Non-entry rescue occurs when a rescue service, usually the attendant, retrieves employees in a permit space without entering the permit space.

Non-permit confined space means a confined space that meets the definition of a confined space but does not meet the requirements for a permit-required confined space, as defined in this subpart.

Oxygen deficient atmosphere means an atmosphere containing less than 19.5 percent oxygen by volume.

Oxygen enriched atmosphere means an atmosphere containing more than 23.5 percent oxygen by volume.

Permit-required confined space (permit space) means a confined space that has one or more of the following characteristics:

(1) Contains or has a potential to contain a hazardous atmosphere;

(2) Contains a material that has the potential for engulfing an entrant;

(3) Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or

(4) Contains any other recognized serious safety or health hazard.

Permit-required confined space program (permit space program) means the employer's overall program for controlling, and, where appropriate, for protecting employees from, permit space hazards and for regulating employee entry into permit spaces.

Physical hazard means an existing or potential hazard that can cause death or serious physical damage. Examples include, but are not limited to: Explosives (as defined by paragraph (n) of § 1926.914, definition of "explosive"); mechanical, electrical, hydraulic and pneumatic energy; radiation; temperature extremes; engulfment; noise; and inwardly converging surfaces. Physical hazard also includes chemicals that can cause death or serious physical damage through skin or eye contact (rather than through inhalation).

Prohibited condition means any condition in a permit space that is not allowed by the permit during the period when entry is authorized. A hazardous atmosphere is a prohibited condition unless the employer can demonstrate that personal protective equipment (PPE) will provide effective protection for each employee in the permit space and provides the appropriate PPE to each employee.

Qualified person means one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated his ability to solve or resolve problems relating to the subject matter, the work, or the project.

Representative permit space means a mock-up of a confined space that has entrance openings that are similar to, and is of similar size, configuration, and accessibility to, the permit space that authorized entrants enter.

Rescue means retrieving, and providing medical assistance to, one or more employees who are in a permit space.

Rescue service means the personnel designated to rescue employees from permit spaces.

Retrieval system means the equipment (including a retrieval line, chest or full body harness, wristlets or anklets, if appropriate, and a lifting device or anchor) used for non-entry rescue of persons from permit spaces.

Serious physical damage means an impairment or illness in which a body part is made functionally useless or is substantially reduced in efficiency. Such impairment or illness may be permanent or temporary and includes, but is not limited to, loss of consciousness, disorientation, or other immediate and substantial reduction in mental efficiency. Injuries involving such impairment would usually require treatment by a physician or other licensed health-care professional.

Tagout means:

(1) Placement of a tagout device on a circuit or equipment that has been deenergized, in accordance with an established procedure, to indicate that the circuit or equipment being controlled may not be operated until the tagout device is removed; and

(2) The employer ensures that:

(i) Tagout provides equivalent protection to lockout; or

(ii) That lockout is infeasible and the employer has relieved, disconnected, restrained and otherwise rendered safe stored (residual) energy.

Test or testing means the process by which the hazards that may confront entrants of a permit space are identified and evaluated. Testing includes specifying the tests that are to be performed in the permit space.

Note to the definition of "Test or testing". Testing enables employers both to devise and implement adequate control measures for the protection of authorized entrants and to determine if acceptable entry conditions are present immediately prior to, and during, entry.

Ventilate or *ventilation* means controlling a hazardous atmosphere using continuous forced-air mechanical systems that meet the requirements of § 1926.57 (Ventilation).

§ 1926.1203 General requirements.

(a) Before it begins work at a worksite, each employer must ensure that a competent person identifies all confined spaces in which one or more of the employees it directs may work, and identifies each space that is a permit space, through consideration and evaluation of the elements of that space, including testing as necessary.

(b) If the workplace contains one or more permit spaces, the employer who identifies, or who receives notice of, a permit space must:

(1) Inform exposed employees by posting danger signs or by any other equally effective means, of the existence and location of, and the danger posed by, each permit space; and

Note to paragraph (b)(1). A sign reading "DANGER—PERMIT-REQUIRED CONFINED SPACE, DO NOT ENTER" or using other similar language would satisfy the requirement for a sign.

(2) Inform, in a timely manner and in a manner other than posting, its employees' authorized representatives and the controlling contractor of the existence and location of, and the danger posed by, each permit space.

(c) Each employer who identifies, or receives notice of, a permit space and has not authorized employees it directs to work in that space must take effective measures to prevent those employees from entering that permit space, in addition to complying with all other applicable requirements of this standard.

(d) If any employer decides that employees it directs will enter a permit space, that employer must have a written permit space program that complies with § 1926.1204 implemented at the construction site. The written program must be made available prior to and during entry operations for inspection by employees and their authorized representatives.

(e) An employer may use the alternate procedures specified in paragraph (e)(2) of this section for entering a permit space only under the conditions set forth in paragraph (e)(1) of this section.

(1) An employer whose employees enter a permit space need not comply with §§ 1926.1204 through 1206 and §§ 1926.1208 through 1211, provided that all of the following conditions are met:

(i) The employer can demonstrate that all physical hazards in the space are eliminated or isolated through engineering controls so that the only hazard posed by the permit space is an actual or potential hazardous atmosphere;

(ii) The employer can demonstrate that continuous forced air ventilation alone is sufficient to maintain that permit space safe for entry, and that, in the event the ventilation system stops working, entrants can exit the space safely;

(iii) The employer develops monitoring and inspection data that supports the demonstrations required by paragraphs (e)(1)(i) and (ii) of this section;

(iv) If an initial entry of the permit space is necessary to obtain the data required by paragraph (e)(1)(iii) of this section, the entry is performed in compliance with §§ 1926.1204 through 1926.1211;

(v) The determinations and supporting data required by paragraphs (e)(1)(i), (ii), and (iii) of this section are documented by the employer and are made available to each employee who enters the permit space under the terms of paragraph (e) of this section or to that employee's authorized representative; and

(vi) Entry into the permit space under the terms of paragraph (e)(1) of this section is performed in accordance with the requirements of paragraph (e)(2) of this section.

Note to paragraph (e)(1). See paragraph (g) of this section for reclassification of a permit space after all hazards within the space have been eliminated.

(2) The following requirements apply to entry into permit spaces that meet the conditions set forth in paragraph (e)(1) of this section:

(i) Any conditions making it unsafe to remove an entrance cover must be eliminated before the cover is removed.

(ii) When entrance covers are removed, the opening must be immediately guarded by a railing, temporary cover, or other temporary barrier that will prevent an accidental fall through the opening and that will protect each employee working in the space from foreign objects entering the space.

(iii) Before an employee enters the space, the internal atmosphere must be tested, with a calibrated direct-reading instrument, for oxygen content, for flammable gases and vapors, and for potential toxic air contaminants, in that order. Any employee who enters the space, or that employee's authorized representative, must be provided an opportunity to observe the pre-entry testing required by this paragraph.

(iv) No hazardous atmosphere is permitted within the space whenever any employee is inside the space.

(v) Continuous forced air ventilation must be used, as follows:

(A) An employee must not enter the space until the forced air ventilation has eliminated any hazardous atmosphere;

(B) The forced air ventilation must be so directed as to ventilate the immediate areas where an employee is or will be present within the space and must continue until all employees have left the space;

(C) The air supply for the forced air ventilation must be from a clean source and must not increase the hazards in the space.

(vi) The atmosphere within the space must be continuously monitored unless the entry employer can demonstrate that equipment for continuous monitoring is not commercially available or periodic monitoring is sufficient. If continuous monitoring is used, the employer must ensure that the monitoring equipment has an alarm that will notify all entrants if a specified atmospheric threshold is achieved, or that an employee will check the monitor with sufficient frequency to ensure that entrants have adequate time to escape. If continuous monitoring is not used, periodic monitoring is required. All monitoring must ensure that the continuous forced air ventilation is preventing the accumulation of a hazardous atmosphere. Any employee who enters the space, or that employee's authorized representative, must be provided with an opportunity to observe the testing required by this paragraph (e)(2)(vi).

(vii) If a hazard is detected during entry:

(A) Each employee must leave the space immediately;

(B) The space must be evaluated to determine how the hazard developed; and

(C) The employer must implement measures to protect employees from the hazard before any subsequent entry takes place.

(viii) The employer must ensure a safe method of entering and exiting the space. If a hoisting system is used, it must be designed and manufactured for personnel hoisting; however, a job-made hoisting system is permissible if it is approved for personnel hoisting by a registered professional engineer, in writing, prior to use.

(ix) The employer must verify that the space is safe for entry and that the pre-entry measures required by paragraph (e)(2) of this section have been taken, through a written certification that contains the date, the location of the space, and the signature of the person providing the certification. The certification must be made before entry and must be made available to each employee entering the space or to that employee's authorized representative.

(f) When there are changes in the use or configuration of a non-permit confined space that might increase the hazards to entrants, or some indication that the initial evaluation of the space may not have been adequate, each entry employer must have a competent person reevaluate that space and, if necessary, reclassify it as a permit-required confined space.

(g) A space classified by an employer as a permit-required confined space may only be reclassified as a non-permit confined space when a competent person determines that all of the applicable requirements in paragraphs (g)(1) through (4) of this section have been met:

(1) If the permit space poses no actual or potential atmospheric hazards and if all hazards within the space are eliminated or isolated without entry into the space (unless the employer can demonstrate that doing so without entry is infeasible), the permit space may be reclassified as a non-permit confined space for as long as the non-atmospheric hazards remain eliminated or isolated;

(2) The entry employer must eliminate or isolate the hazards without entering the space, unless it can demonstrate that this is infeasible. If it is necessary to enter the permit space to eliminate or isolate hazards, such entry must be performed under §§ 1926.1204 through 1926.1211. If testing and inspection during that entry demonstrate that the hazards within the permit space have been eliminated or isolated, the permit space may be reclassified as a non-permit confined space for as long as the hazards remain eliminated or isolated;

Note to paragraph (g)(2). Control of atmospheric hazards through forced air ventilation does not constitute elimination or isolation of the hazards. Paragraph (e) of this section covers permit space entry where the employer can demonstrate that forced air ventilation alone will control all hazards in the space.

(3) The entry employer must document the basis for determining that all hazards in a permit space have been eliminated or isolated, through a certification that contains the date, the location of the space, and the signature of the person making the determination. The certification must be made available to each employee entering the space or to that employee's authorized representative; and

(4) If hazards arise within a permit space that has been reclassified as a non-permit space under paragraph (g) of this section, each employee in the space must exit the space. The entry employer must then reevaluate the space and reclassify it as a permit space as appropriate in accordance with all other applicable provisions of this standard.

(h) *Permit space entry communication and coordination.* (1) Before entry operations begin, the host employer must provide the following information, if it has it, to the controlling contractor:

(i) The location of each known permit space;

(ii) The hazards or potential hazards in each space or the reason it is a permit space; and

(iii) Any precautions that the host employer or any previous controlling contractor or entry employer implemented for the protection of employees in the permit space.

(2) Before entry operations begin, the controlling contractor must:

(i) Obtain the host employer's information about the permit space hazards and previous entry operations; and

(ii) Provide the following information to each entity entering a permit space and any other entity at the worksite whose activities could foreseeably result in a hazard in the permit space:

(A) The information received from the host employer;

(B) Any additional information the controlling contractor has about the subjects listed in paragraph (h)(1) of this section; and

(C) The precautions that the host employer, controlling contractor, or other entry employers implemented for the protection of employees in the permit spaces.

(3) Before entry operations begin, each entry employer must:

(i) Obtain all of the controlling contractor's information regarding permit space hazards and entry operations; and

(ii) Inform the controlling contractor of the permit space program that the entry employer will follow, including any hazards likely to be confronted or created in each permit space.

(4) The controlling contractor and entry employer(s) must coordinate entry operations when:

(i) More than one entity performs permit space entry at the same time; or

(ii) Permit space entry is performed at the same time that any activities that could foreseeably result in a hazard in the permit space are performed.

(5) After entry operations:

(i) The controlling contractor must debrief each entity that entered a permit space regarding the permit space program followed and any hazards confronted or created in the permit space(s) during entry operations;

(ii) The entry employer must inform the controlling contractor in a timely manner of the permit space program followed and of any hazards confronted or created in the permit space(s) during entry operations; and

(iii) The controlling contractor must apprise the host employer of the information exchanged with the entry entities pursuant to this subparagraph.

Note to paragraph (h). Unless a host employer or controlling contractor has or will have employees in a confined space, it is not required to enter any confined space to collect the information specified in this paragraph (h).

(i) If there is no controlling contractor present at the worksite, the requirements for, and role of, controlling contactors in this section must be fulfilled by the host employer or other employer who arranges to have employees of another employer perform work that involves permit space entry.

§ 1926.1204 Permit-required confined space program.

Each entry employer must:

(a) Implement the measures necessary to prevent unauthorized entry;

(b) Identify and evaluate the hazards of permit spaces before employees enter them;

(c) Develop and implement the means, procedures, and practices necessary for safe permit space entry operations, including, but not limited to, the following:

(1) Specifying acceptable entry conditions;

(2) Providing each authorized entrant or that employee's authorized representative with the opportunity to observe any monitoring or testing of permit spaces;

(3) Isolating the permit space and physical hazard(s) within the space;

(4) Purging, inerting, flushing, or ventilating the permit space as necessary to eliminate or control atmospheric hazards;

Note to paragraph (c)(4). When an employer is unable to reduce the atmosphere below 10 percent LFL, the employer may only enter if the employer inerts the space so as to render the entire atmosphere in the space non-combustible, and the employees use PPE to address any other atmospheric hazards (such as oxygen deficiency), and the employer eliminates or isolates all physical hazards in the space.

(5) Determining that, in the event the ventilation system stops working, the monitoring procedures will detect an increase in atmospheric hazard levels in sufficient time for the entrants to safely exit the permit space;

(6) Providing pedestrian, vehicle, or other barriers as necessary to protect entrants from external hazards;

(7) Verifying that conditions in the permit space are acceptable for entry throughout the duration of an authorized entry, and ensuring that employees are not allowed to enter into, or remain in, a permit space with a hazardous atmosphere unless the employer can demonstrate that personal protective equipment (PPE) will provide effective protection for each employee in the permit space and provides the appropriate PPE to each employee; and

(8) Eliminating any conditions (for example, high pressure) that could make it unsafe to remove an entrance cover.

(d) Provide the following equipment (specified in paragraphs (d)(1) through (9) of this section) at no cost to each employee, maintain that equipment properly, and ensure that each employee uses that equipment properly:

(1) Testing and monitoring equipment needed to comply with paragraph (e) of this section;

(2) Ventilating equipment needed to obtain acceptable entry conditions;

(3) Communications equipment necessary for compliance with §§ 1926.1208(c) and 1926.1209(e), including any necessary electronic communication equipment for attendants assessing entrants' status in multiple spaces;

(4) Personal protective equipment insofar as feasible engineering and work-practice controls do not adequately protect employees;

Note to paragraph (d)(4). The requirements of subpart E of this part and other PPE requirements continue to apply to the use of PPE in a permit space. For example, if employees use respirators, then the respirator requirements in § 1926.103 (Respiratory protection) must be met.

(5) Lighting equipment that meets the minimum illumination requirements in § 1926.56, that is approved for the ignitable or combustible properties of the specific gas, vapor, dust, or fiber that will be present, and that is sufficient to enable employees to see well enough to work safely and to exit the space quickly in an emergency;

(6) Barriers and shields as required by paragraph (c)(4) of this section;

(7) Equipment, such as ladders, needed for safe ingress and egress by authorized entrants;

(8) Rescue and emergency equipment needed to comply with paragraph (i) of this section, except to the extent that the equipment is provided by rescue services; and

(9) Any other equipment necessary for safe entry into, safe exit from, and rescue from, permit spaces.

(e) Evaluate permit space conditions in accordance with the following paragraphs (e)(1) through (6) of this section when entry operations are conducted:

(1) Test conditions in the permit space to determine if acceptable entry conditions exist before changes to the space's natural ventilation are made, and before entry is authorized to begin, except that, if an employer demonstrates that isolation of the space is infeasible because the space is large or is part of a continuous system (such as a sewer), the employer must:

(i) Perform pre-entry testing to the extent feasible before entry is authorized; and,

(ii) If entry is authorized, continuously monitor entry conditions in the areas where authorized entrants are working, except that employers may use periodic monitoring in accordance with paragraph (e)(2) of this section for monitoring an atmospheric hazard if they can demonstrate that equipment for continuously monitoring that hazard is not commercially available;

(iii) Provide an early-warning system that continuously monitors for non-isolated engulfment hazards. The system must alert authorized entrants and attendants in sufficient time for the authorized entrants to safely exit the space.

(2) Continuously monitor atmospheric hazards unless the employer can demonstrate that the equipment for continuously monitoring a hazard is not commercially available or that periodic monitoring is of sufficient frequency to ensure that the atmospheric hazard is being controlled at safe levels. If continuous monitoring is not used, periodic monitoring is required with sufficient frequency to ensure that acceptable entry conditions are being maintained during the course of entry operations;

(3) When testing for atmospheric hazards, test first for oxygen, then for combustible gases and vapors, and then for toxic gases and vapors;

(4) Provide each authorized entrant or that employee's authorized representative an opportunity to observe the pre-entry and any subsequent testing or monitoring of permit spaces;

(5) Reevaluate the permit space in the presence of any authorized entrant or that employee's authorized representative who requests that the employer conduct such reevaluation because there is some indication that the evaluation of that space may not have been adequate; and

(6) Immediately provide each authorized entrant or that employee's authorized representative with the results of any testing conducted in accordance with this section.

(f) Provide at least one attendant outside the permit space into which entry is authorized for the duration of entry operations:

(1) Attendants may be assigned to more than one permit space provided the duties described in § 1926.1209 can be effectively performed for each permit space.

(2) Attendants may be stationed at any location outside the permit space as long as the duties described in § 1926.1209 can be effectively performed for each permit space to which the attendant is assigned.

(g) If multiple spaces are to be assigned to a single attendant, include in the permit program the means and procedures to enable the attendant to respond to an emergency affecting one or more of those permit spaces without distraction from the attendant's responsibilities under § 1926.1209;

(h) Designate each person who is to have an active role (as, for example, authorized entrants, attendants, entry supervisors, or persons who test or monitor the atmosphere in a permit space) in entry operations, identify the duties of each such employee, and provide each such employee with the training required by § 1926.1207;

(i) Develop and implement procedures for summoning rescue and emergency services (including procedures for summoning emergency assistance in the event of a failed non-entry rescue), for rescuing entrants from permit spaces, for providing necessary emergency services to rescued employees, and for preventing unauthorized personnel from attempting a rescue;

(j) Develop and implement a system for the preparation, issuance, use, and cancellation of entry permits as required by this standard, including the safe termination of entry operations under both planned and emergency conditions;

(k) Develop and implement procedures to coordinate entry operations, in consultation with the controlling contractor, when employees of more than one employer are working simultaneously in a permit space or elsewhere on the worksite where their activities could, either alone or in conjunction with the activities within a permit space, foreseeably result in a hazard within the confined space, so that employees of one employer do not endanger the employees of any other employer;

(l) Develop and implement procedures (such as closing off a permit space and canceling the permit) necessary for concluding the entry after entry operations have been completed;

(m) Review entry operations when the measures taken under the permit space program may not protect employees and revise the program to correct deficiencies found to exist before subsequent entries are authorized; and

Note to paragraph (m). Examples of circumstances requiring the review of the permit space program include, but are not limited to: Any unauthorized entry of a permit space, the detection of a permit space hazard not covered by the permit, the detection of a condition prohibited by the permit, the occurrence of an injury or near-miss during entry, a change in the use or configuration of a permit space, and employee complaints about the effectiveness of the program.

(n) Review the permit space program, using the canceled permits retained under § 1926.1205(f), within 1 year after each entry and revise the program as necessary to ensure that employees participating in entry operations are protected from permit space hazards.

Note to paragraph (n). Employers may perform a single annual review covering all entries performed during a 12-month period. If no entry is performed during a 12-month period, no review is necessary.

§ 1926.1205 Permitting process.

(a) Before entry is authorized, each entry employer must document the completion of measures required by § 1926.1204(c) by preparing an entry permit.

(b) Before entry begins, the entry supervisor identified on the permit must sign the entry permit to authorize entry.

(c) The completed permit must be made available at the time of entry to all authorized entrants or their authorized representatives, by posting it at the entry portal or by any other equally effective means, so that the entrants can confirm that pre-entry preparations have been completed.

(d) The duration of the permit may not exceed the time required to complete the assigned task or job identified on the permit in accordance with § 1926.1206(b).

(e) The entry supervisor must terminate entry and take the following action when any of the following apply:

(1) Cancel the entry permit when the entry operations covered by the entry permit have been completed; or

(2) Suspend or cancel the entry permit and fully reassess the space before allowing reentry when a condition that is not allowed under the entry permit arises in or near the permit space and that condition is temporary in nature and does not change the configuration of the space or create any new hazards within it; and

(3) Cancel the entry permit when a condition that is not allowed under the entry permit arises in or near the permit space and that condition is not covered by paragraph (e)(2) of this section.

(f) The entry employer must retain each canceled entry permit for at least 1 year to facilitate the review of the permit-required confined space program required by § 1926.1204(n). Any problems encountered during an entry operation must be noted on the pertinent permit so that appropriate revisions to the permit space program can be made.

§ 1926.1206 Entry permit.

The entry permit that documents compliance with this section and authorizes entry to a permit space must identify:

(a) The permit space to be entered;

(b) The purpose of the entry;

(c) The date and the authorized duration of the entry permit;

(d) The authorized entrants within the permit space, by name or by such other means (for example, through the use of rosters or tracking systems) as will enable the attendant to determine quickly and accurately, for the duration of the permit, which authorized entrants are inside the permit space;

Note to paragraph (d). This requirement may be met by inserting a reference on the entry permit as to the means used, such as a roster or tracking system, to keep track of the authorized entrants within the permit space.

(e) Means of detecting an increase in atmospheric hazard levels in the event the ventilation system stops working;

(f) Each person, by name, currently serving as an attendant;

(g) The individual, by name, currently serving as entry supervisor, and the signature or initials of each entry supervisor who authorizes entry;

(h) The hazards of the permit space to be entered;

(i) The measures used to isolate the permit space and to eliminate or control permit space hazards before entry;

Note to paragraph (i). Those measures can include, but are not limited to, the lockout or tagging of equipment and procedures for purging, inerting, ventilating, and flushing permit spaces.

(j) The acceptable entry conditions;

(k) The results of tests and monitoring performed under § 1926.1204(e), accompanied by the names or initials of the testers and by an indication of when the tests were performed;

(l) The rescue and emergency services that can be summoned and the means (such as the equipment to use and the numbers to call) for summoning those services;

(m) The communication procedures used by authorized entrants and attendants to maintain contact during the entry;

(n) Equipment, such as personal protective equipment, testing equipment, communications equipment, alarm systems, and rescue equipment, to be provided for compliance with this standard;

(o) Any other information necessary, given the circumstances of the particular confined space, to ensure employee safety; and

(p) Any additional permits, such as for hot work, that have been issued to authorize work in the permit space.

§ 1926.1207 Training.

(a) The employer must provide training to each employee whose work is regulated by this standard, at no cost to the employee, and ensure that the employee possesses the understanding, knowledge, and skills necessary for the safe performance of the duties assigned under this standard. This training must result in an understanding of the hazards in the permit space and the methods used to isolate, control or in other ways protect employees from these hazards, and for those employees not authorized to perform entry rescues, in the dangers of attempting such rescues.

(b) Training required by this section must be provided to each affected employee:

(1) In both a language and vocabulary that the employee can understand;

(2) Before the employee is first assigned duties under this standard;

(3) Before there is a change in assigned duties;

(4) Whenever there is a change in permit space entry operations that presents a hazard about which an employee has not previously been trained; and

(5) Whenever there is any evidence of a deviation from the permit space entry procedures required by § 1926.1204(c) or there are inadequacies in the employee's knowledge or use of these procedures.

(c) The training must establish employee proficiency in the duties required by this standard and must introduce new or revised procedures, as necessary, for compliance with this standard.

(d) The employer must maintain training records to show that the training required by paragraphs (a) through (c) of this section has been accomplished. The training records must contain each employee's name, the name of the trainers, and the dates of training. The documentation must be available for inspection by employees and their authorized representatives, for the period of time the employee is employed by that employer.

§ 1926.1208 Duties of authorized entrants.

The entry employer must ensure that all authorized entrants:

(a) Are familiar with and understand the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure;

(b) Properly use equipment as required by § 1926.1204(d);

(c) Communicate with the attendant as necessary to enable the attendant to assess entrant status and to enable the attendant to alert entrants of the need to evacuate the space as required by § 1926.1209(f);

(d) Alert the attendant whenever:

(1) There is any warning sign or symptom of exposure to a dangerous situation; or

(2) The entrant detects a prohibited condition; and

(e) Exit from the permit space as quickly as possible whenever:

(1) An order to evacuate is given by the attendant or the entry supervisor;

(2) There is any warning sign or symptom of exposure to a dangerous situation;

(3) The entrant detects a prohibited condition; or

(4) An evacuation alarm is activated.

§ 1926.1209 Duties of attendants.

The entry employer must ensure that each attendant:

(a) Is familiar with and understands the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure;

(b) Is aware of possible behavioral effects of hazard exposure in authorized entrants;

(c) Continuously maintains an accurate count of authorized entrants in the permit space and ensures that the means used to identify authorized entrants under § 1926.1206(d) accurately identifies who is in the permit space;

(d) Remains outside the permit space during entry operations until relieved by another attendant;

Note to paragraph (d). Once an attendant has been relieved by another attendant, the relieved attendant may enter a permit space to attempt a rescue when the employer's permit space program allows attendant entry for rescue and the attendant has been trained and equipped for rescue operations as required by § 1926.1211(a).

(e) Communicates with authorized entrants as necessary to assess entrant status and to alert entrants of the need to evacuate the space under § 1926.1208(e);

(f) Assesses activities and conditions inside and outside the space to determine if it is safe for entrants to remain in the space and orders the authorized entrants to evacuate the permit space immediately under any of the following conditions:

(1) If there is a prohibited condition;

(2) If the behavioral effects of hazard exposure are apparent in an authorized entrant;

(3) If there is a situation outside the space that could endanger the authorized entrants; or

(4) If the attendant cannot effectively and safely perform all the duties required under this section;

(g) Summons rescue and other emergency services as soon as the attendant determines that authorized entrants may need assistance to escape from permit space hazards;

(h) Takes the following actions when unauthorized persons approach or enter a permit space while entry is underway:

(1) Warns the unauthorized persons that they must stay away from the permit space;

(2) Advises the unauthorized persons that they must exit immediately if they have entered the permit space; and

(3) Informs the authorized entrants and the entry supervisor if unauthorized persons have entered the permit space;

(i) Performs non-entry rescues as specified by the employer's rescue procedure; and

(j) Performs no duties that might interfere with the attendant's primary duty to assess and protect the authorized entrants.

§ 1926.1210 Duties of entry supervisors.

The entry employer must ensure that each entry supervisor:

(a) Is familiar with and understands the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure;

(b) Verifies, by checking that the appropriate entries have been made on the permit, that all tests specified by the permit have been conducted and that all procedures and equipment specified by the permit are in place before endorsing the permit and allowing entry to begin;

(c) Terminates the entry and cancels or suspends the permit as required by § 1926.1205(e);

(d) Verifies that rescue services are available and that the means for summoning them are operable, and that the employer will be notified as soon as the services become unavailable;

(e) Removes unauthorized individuals who enter or who attempt to enter the permit space during entry operations; and

(f) Determines, whenever responsibility for a permit space entry operation is transferred, and at intervals dictated by the hazards and operations performed within the space, that entry operations remain consistent with terms of the entry permit and that acceptable entry conditions are maintained.

§ 1926.1211 Rescue and emergency services.

(a) An employer who designates rescue and emergency services, pursuant to § 1926.1204(i), must:

(1) Evaluate a prospective rescuer's ability to respond to a rescue summons in a timely manner, considering the hazard(s) identified;

Note to paragraph (a)(1). What will be considered timely will vary according to the specific hazards involved in each entry. For example, § 1926.103 (Respiratory protection) requires that employers provide a standby person or persons capable of immediate action to rescue employee(s) wearing respiratory protection while in work areas defined as IDLH atmospheres.

(2) Evaluate a prospective rescue service's ability, in terms of proficiency with rescue-related tasks and equipment, to function appropriately while rescuing entrants from the particular permit space or types of permit spaces identified;

(3) Select a rescue team or service from those evaluated that:

(i) Has the capability to reach the victim(s) within a time frame that is appropriate for the permit space hazard(s) identified;

(ii) Is equipped for, and proficient in, performing the needed rescue services;

(iii) Agrees to notify the employer immediately in the event that the rescue service becomes unavailable;

(4) Inform each rescue team or service of the hazards they may confront when called on to perform rescue at the site; and

(5) Provide the rescue team or service selected with access to all permit spaces from which rescue may be necessary so that the rescue team or service can develop appropriate rescue plans and practice rescue operations.

(b) An employer whose employees have been designated to provide permit space rescue and/or emergency services must take the following measures and provide all equipment and training at no cost to those employees:

(1) Provide each affected employee with the personal protective equipment (PPE) needed to conduct permit space rescues safely and train each affected employee so the employee is proficient in the use of that PPE;

(2) Train each affected employee to perform assigned rescue duties. The employer must ensure that such employees successfully complete the training required and establish proficiency as authorized entrants, as provided by §§ 1926.1207 and 1926.1208;

(3) Train each affected employee in basic first aid and cardiopulmonary resuscitation (CPR). The employer must ensure that at least one member of the rescue team or service holding a current certification in basic first aid and CPR is available; and

(4) Ensure that affected employees practice making permit space rescues before attempting an actual rescue, and at least once every 12 months, by means of simulated rescue operations in which they remove dummies, manikins, or actual persons from the actual permit spaces or from representative permit spaces, except practice rescue is not required where the affected employees properly performed a rescue operation during the last 12 months in the same permit space the authorized entrant will enter, or in a similar permit space. Representative permit spaces must, with respect to opening size, configuration, and accessibility, simulate the types of permit spaces from which rescue is to be performed.

(c) Non-entry rescue is required unless the retrieval equipment would increase the overall risk of entry or would not contribute to the rescue of the entrant. The employer must designate an entry rescue service whenever non-entry rescue is not selected. Whenever non-entry rescue is selected, the entry employer must ensure that retrieval systems or methods are used whenever an authorized entrant enters a permit space, and must confirm, prior to entry, that emergency assistance would be available in the event that non-entry rescue fails. Retrieval systems must meet the following requirements:

(1) Each authorized entrant must use a chest or full body harness, with a retrieval line attached at the center of the entrant's back near shoulder level, above the entrant's head, or at another point which the employer can establish presents a profile small enough for the successful removal of the entrant. Wristlets or anklets may be used in lieu of the chest or full body harness if the employer can demonstrate that the use of a chest or full body harness is infeasible or creates a greater hazard and that the use of wristlets or anklets is the safest and most effective alternative.

(2) The other end of the retrieval line must be attached to a mechanical device or fixed point outside the permit space in such a manner that rescue can begin as soon as the rescuer becomes aware that rescue is necessary. A mechanical device must be available to retrieve personnel from vertical type permit spaces more than 5 feet (1.52 meters) deep.

(3) Equipment that is unsuitable for retrieval must not be used, including, but not limited to, retrieval lines that have a reasonable probability of becoming entangled with the retrieval lines used by other authorized entrants, or retrieval lines that will not work due to the internal configuration of the permit space.

(d) If an injured entrant is exposed to a substance for which a Safety Data Sheet (SDS) or other similar written information is required to be kept at the worksite, that SDS or written information must be made available to the medical facility treating the exposed entrant.

§ 1926.1212 Employee participation.

(a) Employers must consult with affected employees and their authorized representatives on the development and implementation of all aspects of the permit space program required by § 1926.1203.

(b) Employers must make available to each affected employee and his/her authorized representatives all information required to be developed by this standard.

§ 1926.1213 Provision of documents to Secretary.

For each document required to be retained in this standard, the retaining employer must make the document available on request to the Secretary of Labor or the Secretary's designee.

[FR Doc. 2015–08843 Filed 5–1–15; 8:45 am]

BILLING CODE 4510–26–P

OSHA® POCKET GUIDE

Occupational Safety and Health Administration

www.osha.gov

Worker Safety Series

Protecting Yourself from Noise in Construction

OSHA 3498-12N 2011

If you are a construction worker, this pocket guide is written for you. Small contractors should also find this information helpful. You are encouraged to go to the references in this document and to the OSHA website for more information.

OSHA®
Occupational Safety and
Health Administration

Contents

Why is job site noise control important to me? 2
How does hearing damage happen? 3
How do I know if my tools or job site are too noisy? 5
- Sound Level Meter and Noise Dosimeter 5
- 2-3 Foot Rule and Noise Indicator 6
- Sound Level Chart 7

What can be done about job site noise levels? 8
- Plan Ahead 8
- Noise Control at the Job Site 9
- Noise Hazard Control Process 9
- Maintain and Retrofit Equipment 10

What can be done if engineering and administrative controls are not enough? 12
- Proper Selection and Use of Hearing Protection 12
- Regular Hearing Screenings 13
- Hearing Protective Devices 14

My job site is too noisy. What can I do? 16
Am I protected if I call OSHA? 17
Additional OSHA Assistance 18
OSHA Regional Offices 21
Appendix: More Information on Noise Protection 23

OSHA®
Occupational Safety and Health Administration

Why is job site noise control important to me?

Exposure to high levels of noise can cause permanent hearing loss. Neither surgery nor a hearing aid can help correct this type of hearing loss. Construction sites have many noisy operations and can be a significant source of noise exposure.

Loud noise can also reduce work productivity and contribute to workplace accidents by making it difficult to hear warning signals. Hearing loss from loud noise limits your ability to hear high frequencies, understand speech, and reduces your ability to communicate, which can lead to social isolation. Hearing loss can affect your quality of life by interfering with your ability to enjoy socializing with friends, playing with your children or grandchildren, or participating in other activities.

Damage to your hearing **can be prevented**, but once permanent noise-induced hearing loss occurs, it **cannot be cured** or reversed. Hearing loss usually occurs gradually, so you may not realize it is happening until it is too late.

Noise can also **affect your body in other ways**. A recent study found that workers persistently exposed to excessive occupational noise may be two-to-three times more likely to suffer from serious heart disease than workers who were not exposed.[1]

---

[1]Gan, W. et al., Exposure to Occupational Noise and Cardiovascular Disease in the United States: NHANES 1999-2004, Occup Environ Med doi: 10.1136/oem.2010.055269.

You may have hearing loss if:

- You have a hard time hearing people in groups or meetings or if there is background noise.
- People sound as if they are mumbling.
- You have to ask people to repeat what they say.
- You have trouble understanding others on the telephone.
- You have ringing or noises in one or both ears.
- You have trouble hearing back-up alarms or the ringing of a cell phone.

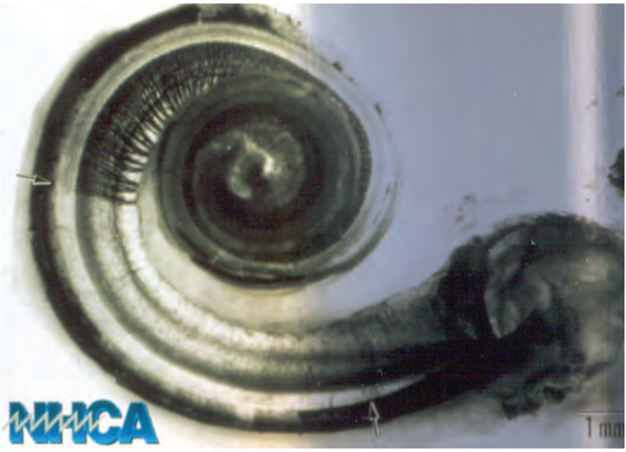
How does hearing damage happen?

A one-time exposure to a sudden powerful noise, such as an explosion, may damage your hearing instantly. Prolonged exposures to loud noise can lead to a gradual, but permanent, loss of hearing.

Damage can occur within the ear at noise levels similar to that of running a lawn mower for eight hours. At first, this may cause a temporary loss of hearing that may last as long as 14-16 hours. With repeated exposure to high noise levels and periodic exposures to very high noise levels (e.g., with the use of nail guns), as is common at most construction job sites, your hearing may not fully recover. More often, the loss of hearing occurs slowly over time from exposure to moderate levels of noise. When that happens, the hearing loss becomes permanent. This is why workplace noise is sometimes referred to as a stealth long-term hazard – because it is a painless, gradual process.

Hearing loss occurs when cilia, tiny hair cells that line the inner ear, are damaged. At first, the damage happens to the cilia that receive the higher frequencies. Gradually, noise damages more of the ear and affects how speech is heard. If you hear muffled or distorted speech sounds, that may be an indication that a substantial hearing loss has already occurred.

Healthy inner ear lined with cilia, tiny hair cells that help you hear.



Inner ear showing damage to the cilia.

Graphics courtesy of National Hearing Conservation Association

In addition to hearing loss, you also may experience ringing in the ears. This is called *tinnitus*, and can occur even without other apparent hearing loss.

How do I know if my tools or job site are too noisy?

Sound intensity is measured in decibels. When decibels are adjusted for how the ear senses sound, the sound level intensity is measured as dBA. Decibels are measured on a logarithmic scale, which means that a small increase in the number of decibels results in a huge change in the amount of noise and the potential damage to a person's hearing. So, if the level increases by 3 dBA this doubles the amount of the noise and reduces the recommended amount of exposure time by half.

Sound Level Meter and Noise Dosimeter

Safety and health inspectors measure sound or noise levels using a device called a *sound level meter*. The microphone is positioned at the user's ear level. Equipment that is determined to be loud can be labeled with a hazardous noise sticker.

OSHA uses *noise dosimeters* to document the average noise exposure over your working day or of a particular task for part of your workday.

OSHA recommends that workplace noise levels be kept below 85 dBA as an 8-hour time-weighted average. As the noise level increases, it damages your hearing more quickly.

Sound level meter

Dosimeter

Images courtesy of Casella CEL Inc., Amherst, NH.

Research indicates that your hearing can be damaged by regular 8-hour exposures to 85 dBA. When noise is as loud as 100 dBA (like a jackhammer or stud welder), it can take repeated exposures of as little as 1 hour per day to damage your hearing.

The National Institute for Occupational Safety and Health (NIOSH) has recommended that all worker exposures to noise should be controlled below a level equivalent to 85 dBA for eight hours to minimize occupational noise-induced hearing loss. NIOSH has found that significant noise-induced hearing loss occurs at the exposure levels equivalent to the OSHA PEL based on updated information obtained from literature reviews. NIOSH also recommends a 3 dBA exchange rate so that every increase by 3 dBA represents a doubling of the amount of the noise and halves the recommended amount of exposure time.

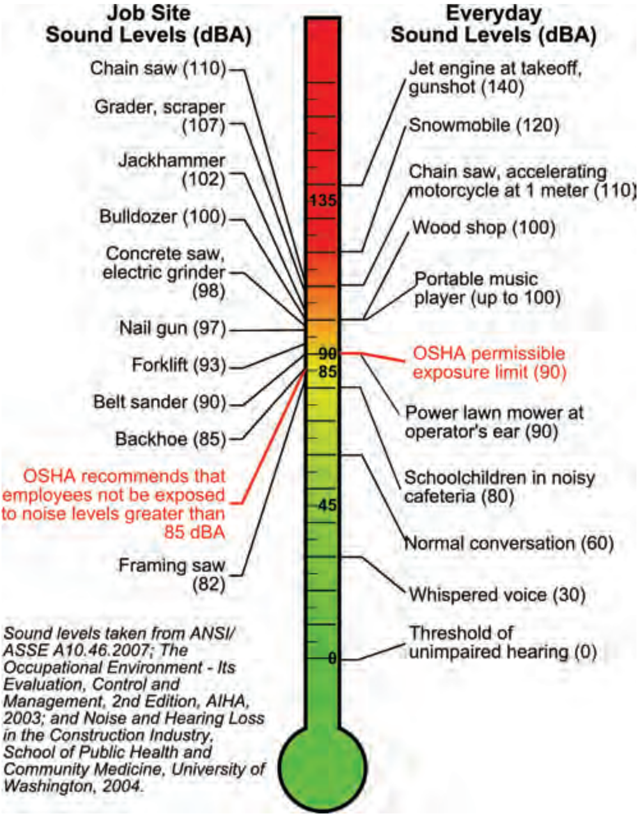
2-3 Foot Rule and Noise Indicator

When a sound level meter is not available, you should use the 2-to-3 foot rule: Stand about an arm's length away from your coworker: If you have to raise your voice to be heard 2-3 feet away, you should assume that the sound level is at or above 85 dBA.

A *personal noise indicator* is a warning device. It indicates if your immediate exposure is less than or greater than 85 dBA. It flashes green if the sound level is under 85 dBA and red when above 85 dBA.

Sound Level Chart

Equipment and daily activities at construction job sites can expose workers to high levels of noise. Sound levels on the chart below are listed in decibels (dBA) – the larger the number, the higher the volume or decibel level. How loud the noise is (volume), how long the noise lasts, and how close you are to the noise are all important in determining the hazard.



What can be done about job site noise levels?

Plan Ahead

One of the best ways to reduce exposure to hazardous noise on a work site is by planning for potential exposure before activities start. When jobs produce high noise levels, there are ways to reduce your exposure other than or in addition to hearing protectors.

For instance, your employer or supervisor can buy materials to build sound barriers or schedule noisy activities during hours when fewer people are working. Your employer can also rent or buy quieter equipment.

Your employer should hold daily or weekly safety meetings to discuss ways to limit high noise levels and other hazards. During safety meetings, the general contractor can ask sub-contractors to describe the planned tasks for the day or week where hazardous noise might be generated, as well as what equipment will be used; you can use these opportunities to talk about ways to limit exposure.

Even changes in the noise level that seem small (e.g., 3 dBA) are actually significant reductions in the noise.

Here are some specific ways to limit exposure:

- Plan to make or use prefabricated noise barriers.
- Ask your employer to buy or rent quieter equipment/tools.
- Limit the hours you work in hazardous noise areas.

- Identify equipment and work areas where signs can be posted to make other workers aware of high noise areas.
- Use hearing protection to supplement noise reduction.

Noise Control at the Job Site

The work site is where workers can have the most impact by working with employers to identify hazardous equipment, conduct hazard assessments, and apply the control process explained below. Employer support for providing supplies (acoustical insulation, extension cords, pre-fabricated noise barriers), hand tools, and sufficient set-up time are essential.

Noise Hazard Control Process

The easiest way to help lower noise levels at your work site is to remember a three-step noise hazard control process:

Reduce It: Reduce the noise by using the quietest equipment available. For example, choose a smaller, quieter generator.

Move It: Move the equipment farther away with the use of extension cords, additional welding leads, and air hoses (following current OSHA standards). Noise levels go down as we increase our distance from a noisy object. Move the generator farther away or face it in a direction that is away from where most people are working. If you are not required to be in a high noise area, move to a quieter area.

Block It: Block the noise by building temporary barriers of plywood or other on-site materials to keep the noise from reaching workers. Place a five-sided, oversized wooden box over the generator. Add fire-resistant acoustical absorbing material (foam) inside the box. If the generator sits on soil or sand, that will help absorb some of the noise.

Photo courtesy of Build It Smart

Building a plywood barrier

Maintain and Retrofit Equipment

Proper maintenance of equipment and tools can result in lower noise levels. Changing seals, lubricating parts, using sharp blades and bits, installing mufflers, and replacing faulty or worn equipment or parts can reduce the noise levels significantly on the job site.

Do you know of equipment on your job site that could benefit from regular maintenance to reduce noise levels? Your employer should ensure that there is a regular maintenance program and that everyone follows the maintenance schedule.

With some ingenuity, even older, noisier equipment can be modified by adding mufflers, new seals, or insulated panels. Employees can use noise reduction equipment accessories when made available by the employer. Employers can look for ways to reduce the sound intensity of tools in their current inventory.

Employers can reduce job site noise levels by following OSHA recommendations:

- Identify major noise sources and possible control solutions.
- Plan ahead and limit worker exposure as much as possible.
- Perform regular maintenance.

Reminder

OSHA currently allows your employer to rely on any combination of (1) hearing protective devices with a hearing conservation program, (2) engineering controls, and (3) administrative controls to effectively reduce worker exposures below 90 dBA.

OSHA also recommends that your employer provide – and that you use – hearing protective devices any time site exposures meet or exceed 85 dBA.

What can be done if engineering and administrative controls are not enough?

Proper Selection and Use of Hearing Protection

If other control strategies to reduce noise levels can't be used or fail to reduce noise levels below OSHA's permissible exposure limits (PELs), wear a hearing protective device (29 CFR 1926.52). There are many different types of hearing protection. Each type is designed for certain noise conditions. They include the types listed in the following table. But remember – unless you wear them properly and wear them all the time in high noise areas, the devices will not be effective.

Convenience and comfort are important for frequent use of hearing protective devices. Earmuffs and foam earplugs in most cases offer the most noise reduction. However, preformed plugs or canal caps may be more convenient where construction work generates moderate daily average noise levels. There is no one device that is the best type for all situations.

Your employer is responsible for selecting, fitting, and maintaining hearing protective devices and must provide them to you at no cost and train you in their use (29 CFR 1926.101).

If you are not provided hearing protection for high noise work tasks, ask for it. If the employer refuses to provide hearing protectors, you can request an OSHA inspection.

Contractors and workers should consider the following when selecting and wearing protective gear: the noise level of the task, communication needs, convenience, comfort, hygiene, noise reduction of the hearing protective devices, and hearing ability.

Each type of hearing protection has manufacturer's directions for use and maintenance. Follow these directions and replace or fix the devices when they appear worn, dirty, or broken. Always wear hearing protection to protect yourself from high noise exposures, both on the work site and at home.

Neither portable music player headphones nor hearing aids are substitutes for hearing protective devices.

Regular Hearing Screenings

If you are routinely exposed to hazardous levels of noise, your employer should provide yearly hearing tests to monitor your hearing loss over time. If your employer does not provide these tests, you should have your hearing tested by an audiologist. The initial test (baseline) will be used as the reference test. Future tests should be compared to the baseline to see if you need to do more to protect your hearing.

These hearing tests can detect small shifts in hearing ability that have taken place since previous tests. When changes in hearing ability are detected, a retest is common to determine whether the change is permanent or temporary. Tests are relatively inexpensive and take about 20-30 minutes to conduct and get results.

Hearing Protective Devices

Type	Features	Concerns
Roll down foam 	Fits many differently shaped ear canals. Provides good protection for most noisy environments. Convenient, disposable.	Must be inserted properly to get the highest possible protection. If the plug doesn't make a good seal, it won't protect your hearing.
Reusable earplugs 	Many have flanges and handles. Come in different sizes. Come with cords, convenient to carry. Reusable. Washable.	Preformed so may not fit as wide a variety of ear canals as foam plugs. May require a different size for each ear. Must keep them clean.
Custom molded 	Molded to user's ear. Always comfortable. Long-term wear. Best for difficult-to-fit ears.	Must be made by a licensed hearing protection provider.
Canal caps 	On a band, can be worn under chin, over head, or behind neck. Can be put on and taken off quickly.	Not as comfortable as other devices. Not as much protection as other devices.
Earmuffs 	Easy to use and wear. Fit most people. Easy to keep clean.	Can be hot and heavy. May be more difficult to get a good fit with glasses and/or may interfere with other protective gear.
New Types **Flat** **Attenuated** **Communication**	Flat reduction of noise over all frequencies. Have a baffle to reduce impact noise. Radio Communication while still reducing noise.	Can be expensive. Must be custom fitted.

Photos: NIOSH; Howard Leight; Aearo Technologies, a 3M Company; Bilsom; WorkSafe BC; Northern Safety and Industrial.

Remember:
The best hearing protective device is the one you'll actually wear.

When looking at your hearing test, levels greater than 25 dBA indicate impairment. Furthermore, losses in the higher frequencies (3000, 4000, 6000 hertz) are more significant and you should discuss them with your audiologist.

You also can do daily monitoring of your hearing with a simple self-test. This works best if you drive yourself to work. When you reach your job site and are turning off the car engine, turn the radio on so it is just barely loud enough to hear (talk radio stations work well for this exercise) and go on with your day. When you return at the end of the work shift, check to see if you can still hear the radio with the power on, but the engine off. If you can't hear the radio, think about what may have damaged your hearing and how you could better protect your hearing.

Remember the 3 steps to noise control:

Reduce it: Use the quietest equipment available.

Move it: Locate noisy equipment away from workers.

Block it: Erect temporary barriers to block noise from reaching workers.

YOU ONLY HAVE ONE SET OF EARS – PROTECT THEM

My job site is too noisy. What can I do?

First, if you feel comfortable, speak with your supervisor. If you are a union member, raise the issue with your union representative. You can also call or write OSHA.

How do I file a complaint with OSHA?

- Mail, e-mail, or fax the nearest OSHA office (visit www.osha.gov or call 1-800-321-OSHA (6742) for the address of the nearest OSHA office) and request an inspection.
- File a complaint by phone – call (800) 321-OSHA (6742); the teletypewriter (TTY) number is (877) 889-5627.
- File online from OSHA's home page: www.osha.gov/as/opa/worker/complain.html.

Most online and phone complaints may be resolved informally over the phone with your employer. **Written complaints that are signed by a worker or representative and filed with OSHA are more likely to result in an OSHA inspection.**

Complete the OSHA complaint form, then fax or mail it back. Include your name, address, and telephone number so that we can contact you. All complaints are kept confidential.

Am I protected if I call OSHA?

The Occupational Safety and Health Act (OSH Act) prohibits employers from discriminating against their employees for using their rights under the OSH Act. These rights include filing an OSHA complaint, participating in an inspection or talking to the inspector or raising a safety and health issue with the employer.

If you believe that your employer has discriminated against you because you exercised your safety and health rights, contact your local OSHA office right away. Under the OSH Act, you only have **30 days** to report discrimination.

Call 1-800-321-OSHA (6742) and ask to be connected to your local office.

Discrimination can include:
- Firing or laying off
- Denying benefits
- Blacklisting
- Intimidation
- Denying overtime or promotion
- Reducing pay or hours
- Disciplining

Additional OSHA Assistance

Compliance Assistance Specialists
OSHA has compliance assistance specialists throughout the nation who can provide information to employers and workers about OSHA standards, short educational programs on specific hazards or OSHA rights and responsibilities, and information on additional compliance assistance resources. Contact your local OSHA office for more information.

OSHA Consultation Service for Small Employers
The OSHA Consultation Service provides **free assistance** to small employers to help them identify and correct hazards, and to improve their injury and illness prevention program. Most of these services are delivered on site by state government agencies or universities using well-trained professional staff.

Consultation services are available to private sector employers. Priority is given to small employers with the most hazardous operations or in the most high-hazard industries. These programs are largely funded by OSHA and are delivered at no cost to employers who request help. Consultation services are separate from enforcement activities. To request such services, an employer can phone or write to the OSHA Consultation Program. See the Small Business section of OSHA's website for contact information for the consultation offices in every state.

- **Safety and Health Achievement Recognition Program**

Under the consultation program, certain exemplary employers may request participation in OSHA's Safety and Health Achievement Recognition Program (SHARP). Eligibility for participation includes, but is not limited to, receiving a full-service, comprehensive consultation visit, correcting all identified hazards, and developing an effective injury and illness prevention program.

OSHA Educational Materials

OSHA has many types of educational materials available in print or online, including:

- **Brochures/booklets** cover a wide variety of job hazards and other topics;
- **Fact Sheets** and **QuickFacts** contain basic background information on safety and health hazards;
- **Guidance documents** provide detailed examinations of specific safety and health issues;
- **Online Safety and Health Topics Pages**;
- **Posters**;
- **QuickCards™** are small, laminated cards that provide brief workers' rights and safety and health information; and
- ***QuickTakes*** is OSHA's free, twice-monthly online newsletter. To sign up for QuickTakes visit OSHA's website at www.osha.gov and click on QuickTakes at the top of the page.

To view materials available online or for a listing of free publications, visit OSHA's website at www.osha.gov. You can also call 1-800-321-OSHA (6742) to order publications, to ask questions or to get more information.

NIOSH Health Hazard Evaluation:
Getting Help on Health Hazards

The National Institute for Occupational Safety and Health (NIOSH) is a federal agency that conducts scientific and medical research on workers' safety and health. At no cost to employers or workers, NIOSH can help identify and correct potential health hazards in the workplace through its Health Hazard Evaluation (HHE) program.

Workers, union representatives and employers can request a NIOSH Health Hazard Evaluation.

An HHE is often requested when there is a higher than expected rate of a disease or injury in a group of workers. These situations may be the result of an unknown cause, a new hazard, or a mixture of sources.

To request a NIOSH Health Hazard Evaluation, or find out more about the program:

- Call the NIOSH toll-free Information Service at 1-800-CDC-INFO (1-800-232-4636); or
- Go online at www.cdc.gov/niosh/hhe/Request.html.

OSHA Regional Offices

Region I
Boston Regional Office
(CT*, ME, MA, NH, RI, VT*)
JFK Federal Building, Room E340
Boston, MA 02203
(617) 565-9860 (617) 565-9827 Fax

Region II
New York Regional Office
(NJ*, NY*, PR*, VI*)
201 Varick Street, Room 670
New York, NY 10014
(212) 337-2378 (212) 337-2371 Fax

Region III
Philadelphia Regional Office
(DE, DC, MD*, PA, VA*, WV)
The Curtis Center
170 S. Independence Mall West
Suite 740 West
Philadelphia, PA 19106-3309
(215) 861-4900 (215) 861-4904 Fax

Region IV
Atlanta Regional Office
(AL, FL, GA, KY*, MS, NC*, SC*, TN*)
61 Forsyth Street, SW, Room 6T50
Atlanta, GA 30303
(678) 237-0400 (678) 237-0447 Fax

Region V
Chicago Regional Office
(IL*, IN*, MI*, MN*, OH, WI)
230 South Dearborn Street
Room 3244
Chicago, IL 60604
(312) 353-2220 (312) 353-7774 Fax

Region VI
Dallas Regional Office
(AR, LA, NM*, OK, TX)
525 Griffin Street, Room 602
Dallas, TX 75202
(972) 850-4145 (972) 850-4149 Fax
(972) 850-4150 FSO Fax

Region VII
Kansas City Regional Office
(IA*, KS, MO, NE)
Two Pershing Square Building
2300 Main Street, Suite 1010
Kansas City, MO 64108-2416
(816) 283-8745 (816) 283-0547 Fax

Region VIII
Denver Regional Office
(CO, MT, ND, SD, UT*, WY*)
1999 Broadway, Suite 1690
Denver, CO 80202
(720) 264-6550 (720) 264-6585 Fax

Region IX
San Francisco Regional Office
(AZ*, CA*, HI*, NV*, and American Samoa, Guam and the Northern Mariana Islands)
90 7th Street, Suite 18100
San Francisco, CA 94103
(415) 625-2547 (415) 625-2534 Fax

Region X
Seattle Regional Office
(AK*, ID, OR*, WA*)
300 Fifth Avenue, Suite 1280
Seattle, WA 98104-2397
(206) 757-6700 (206) 757-6705 Fax

*These states and territories operate their own OSHA-approved job safety and health plans and cover state and local government employees as well as private sector employees. The Connecticut, Illinois, New Jersey, New York and Virgin Islands programs cover public employees only. (Private sector workers in these states are covered by Federal OSHA). States with approved programs must have standards that are identical to, or at least as effective as, the Federal OSHA standards.

Note: To get contact information for OSHA area offices, OSHA-approved state plans and OSHA consultation projects, please visit us online at www.osha.gov or call us at 1-800-321-OSHA (6742).

Appendix: More Information on Noise Protection

Here are some online references on noise control and hearing conservation:

Construction Noise in British Columbia, **by the Workers' Compensation Board:**
http://hearingconservation.healthandsafety centre.org/pdfs/hearing/ ConstructionNoise.pdf

eLCOSH, the Electronic Library of Construction Occupational Safety and Health:
http://www.elcosh.org/en/browse/49/noise.html

How Loud Is Too Loud? **A guide you can download with decibel levels:**
http://www.nidcd.nih.gov/health/hearing/pages/sound-ruler.aspx

Laborers' Health and Safety Fund of North America (LHSFNA):
http://www.lhsfna.org/noise

National Institute for Occupational Safety and Health (NIOSH) ***Noise Meter:***
http://www.cdc.gov/niosh/topics/noise/noisemeter.html

NIOSH ***Power Tools*** **Database:**
http://wwwn.cdc.gov/niosh-sound-vibration

OSHA's ***Field Operations Manual:***
http://www.osha.gov/OshDoc/Directive_pdf/CPL_02-00-148.pdf

OSHA ***Hearing Conservation for the Hearing-Impaired Worker:***
http://www.osha.gov/dts/shib/shib122705.html

OSHA ***Noise and Hearing Conservation eTool:***
http://www.osha.gov/dts/osta/otm/noise/index.html

OSHA ***Noise and Hearing Conservation Safety and Health Topics Page:***
http://www.osha.gov/SLTC/noisehearing conservation/index.html

Standards for States with OSHA-approved State Plans:
http://www.osha.gov/dcsp/osp/statestandards.html

The personal hearing protection devices chart on page 14 was adapted from *Toolbox Talks: Hearing Conservation in the Shipbuilding Industry,* developed through the Alliance Program, an OSHA Cooperative Program:
http://www.shipbuilders.org/Portals/Shipbuilders/PP PDFs/Tool Box Talk series - hearing conservation in Shipbuilding - FINAL - 042409.pdf

What Causes Tinnitus?:
http://www.nidcd.nih.gov/health/hearing/tinnitus.htm#2

OSHA®

www.osha.gov

(800) 321-OSHA (6742)

If you have questions, call OSHA. We can help.

For more information:

OSHA® Occupational Safety and Health Administration

U.S. Department of Labor

www.osha.gov (800) 321-OSHA (6742)

OSHA® FactSheet

Subpart CC – Cranes and Derricks in Construction: Assembly/Disassembly

This fact sheet explains the assembly and disassembly requirements of subpart CC – Cranes and Derricks in Construction, as specified in 29 CFR 1926.1403-1926.1406 and 192.1412. These provisions are effective November 8, 2010.

Procedures

Under this standard, employers must comply with all manufacturer prohibitions regarding assembly and disassembly. However, the standard generally allows employers to choose between the manufacturer's procedures or their own (see exception below for synthetic slings procedures). Employer procedures must be developed by a "qualified person" and must satisfy a number of specified requirements, such as providing adequate support and stability for all parts of the equipment, and positioning employees involved to minimize exposure to any unintended movement or collapse.

Assembly/Disassembly responsibilities

- The rule requires the work to be directed by an A/D (Assembly/Disassembly) director. The A/D director must meet the criteria for both a "competent person" and a "qualified person," which are defined terms in this rule, or must be a "competent person" assisted by a "qualified person."
- The A/D director must understand the applicable procedures.
- The A/D director must review the procedures immediately prior to beginning work unless he or she understands the procedures and has used them before for that equipment type and configuration.
- The A/D director must ensure that each member of the crew understands his or her tasks, the hazards of the tasks, and any hazardous positions or locations to avoid.
- The A/D director must verify all capacities of any equipment used, including rigging, lifting lugs, etc.
- The A/D director must also address hazards associated with the operation, including 12 specified areas of concern: site and ground conditions, blocking material, proper location of blocking, verifying assist crane loads, boom & jib pick points, center of gravity, stability upon pin removal, snagging, struck by counterweights, boom hoist brake failure, loss of backward stability, and wind speed and weather.

Inspection

- Upon completion of assembly, but before use, the equipment must be inspected by a "qualified person" to ensure that it is configured in accordance with the manufacturer equipment criteria. If these criteria are unavailable, the employer's "qualified person," with the assistance of a registered professional engineer if necessary, must develop the appropriate configuration criteria and ensure that these criteria are met.

Assembly/Disassembly, continued.

General requirements

- A crew member who moves out of the operator's view to a location where the crew member could be injured by movement of the equipment (or load) MUST inform the operator before going to that location. The operator must not move the equipment until that crew member informs the operator that he or she has relocated to a safe position.
- Employees must never be under the boom or jib when pins (or similar devices) are being removed, unless it is required by site constraints and the A/D director has implemented procedures that minimize the risk of unintended movement and the duration and extent of exposure under the boom.
- Component weights must be readily available for all components to be assembled.
- All rigging must be done by a "qualified rigger."
- Pins may not be removed during disassembly when the pendants are in tension.
- Booms supported only by cantilevering must not exceed manufacturer limitations or RPE limitations, as applicable.
- Component selection and equipment configuration that affects the capacity or safe operation of the equipment must be in accordance with manufacturer requirements and limits or RPE requirements and limits, as applicable.

Synthetic slings

- The employer must follow manufacturer procedures when using synthetic slings during assembly or disassembly rigging (even when the employer has developed its own A/D procedure as an alternative to the manufacturer's other procedures.)
- Synthetic slings must be protected from abrasive, sharp or acute edges, and configurations that might reduce the sling's rated capacity.

Outriggers and stabilizers

When outriggers or stabilizers are used or are necessary in light of the load to be handled and the operating radius:

- Outriggers and stabilizers must be fully extended or, if permitted by manufacturer procedures, deployed as specified in the load chart.
- Outriggers must be set to remove equipment weight from the wheels, except for locomotive cranes.
- Outrigger floats, if used, must be attached to the outriggers; stabilizer floats, if used, must be attached to the stabilizers.
- Each outrigger or stabilizer must be visible to the operator or to a signal person during extension and setting.
- Outrigger and stabilizer blocking must be placed under the float/pad of the jack or, if there is no jack, under the outer bearing surface of the outrigger or stabilizer beam. Blocking must also be sufficient to sustain the loads and maintain stability and must be properly placed.

Tower cranes

- Tower cranes are subject to additional requirements for erecting, climbing and dismantling, including a pre-erection inspection (29 CFR 1926.1435).

For more complete information:

OSHA® Occupational Safety and Health Administration

U.S. Department of Labor

www.osha.gov

(800) 321-OSHA

OSHA® FactSheet

Subpart CC – Cranes and Derricks in Construction: Qualified Rigger

This fact sheet describes the qualified rigger requirements of subpart CC – Cranes and Derricks in Construction, as specified in 29 CFR 1926.1401, 1926.1404, and 1926.1425. These provisions are effective November 8, 2010.

When is a *qualified rigger* required?

Employers must use *qualified riggers* during hoisting activities for assembly and disassembly work (1926.1404(r)(1)). Additionally, *qualified riggers* are required whenever workers are within the fall zone and hooking, unhooking, or guiding a load, or doing the initial connection of a load to a component or structure (1926.1425(c)).

Who can be a *qualified rigger*?

A *qualified rigger* is a rigger who meets the criteria for a qualified person. Employers must determine whether a person is qualified to perform specific rigging tasks. Each *qualified rigger* may have different credentials or experience. A *qualified rigger* is a person that:

- possesses a recognized degree, certificate, or professional standing, or
- has extensive knowledge, training, and experience, and
- can successfully demonstrate the ability to solve problems related to rigging loads.

The person designated as the *qualified rigger* must have the ability to properly rig the load for a particular job. It does not mean that a rigger must be qualified to do every type of rigging job.

Each load that requires rigging has unique properties that can range from the simple to the complex. For example, a rigger may have extensive experience in rigging structural components and other equipment to support specific construction activities. Such experience may have been gained over many years. However, this experience does not automatically qualify the rigger to rig unstable, unusually heavy, or eccentric loads that may require a tandem lift, multiple-lifts, or use of custom rigging equipment. In essence, employers must make sure the person can do the rigging work needed for the exact types of loads and lifts for a particular job with the equipment and rigging that will be used for that job.

Do *qualified riggers* have to be trained or certified by an accredited organization or assessed by a third party?

No. Riggers do not have to be certified by an accredited organization or assessed by a third party. Employers may choose to use a third party entity to assess the qualifications of the rigger candidate, but they are not required to do so.

Does a certified operator also meet the requirements of a *qualified rigger*?

A certified operator does not necessarily meet the requirements of a *qualified rigger*. Determining whether a person is a *qualified rigger* is based on the nature of the load, lift, and equipment used to hoist that load plus that person's knowledge and experience. A certified/qualified operator may meet the requirements of a *qualified rigger*, depending on the operator's knowledge and experience with rigging.

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

For more complete information:

OSHA® Occupational Safety and Health Administration

U.S. Department of Labor

www.osha.gov

(800) 321-OSHA

DOC 10/2010

OSHA® FactSheet

Subpart CC – Cranes and Derricks in Construction: Signal Person Qualification

This fact sheet describes the signal person qualification requirements of subpart CC – Cranes and Derricks in Construction, as specified in 29 CFR 1926.1419 and 1926.1428. Other requirements related to signal persons can be found at 29 CFR 1926.1404, 1926.1430, 1926.1431, and 1926.1441. These provisions are effective November 8, 2010.

When is a signal person required?

A signal person is required when:

- The point of operation is not in full view of the operator (1926.1419(a)).
- The operator's view is obstructed in the direction the equipment is traveling.
- Either the operator or the person handling the load determines that a signal person is needed because of site-specific safety concerns.

What does a signal person need to know?

The signal person is considered qualified if he or she:

- Knows and understands the type of signals used at the worksite.
- Is competent in using these signals.
- Understands the operations and limitations of the equipment, including the crane dynamics involved in swinging, raising, lowering and stopping loads and in boom deflection from hoisting loads.
- Knows and understands the relevant signal person qualification requirements specified in subpart CC (1926.1419-1926.1422; 1926.1428).
- Passes an oral or written test and a practical test.

How does a signal person become qualified?

Employers must use one of the following options to ensure that a signal person is qualified (see 1926.1428).

1. *Third party qualified evaluator.* The signal person has documentation from a third party qualified evaluator showing that he or she meets the qualification requirements.
2. *Employer's qualified evaluator* (not a third party). The *employer's qualified evaluator* assesses the individual, determines the individual meets the qualification requirements, and provides documentation of that determination. This assessment may not be relied on by other employers.

Refer to 1926.1401 for definitions of qualified evaluators.

How will an employer show that a signal person is appropriately qualified?

Employers must make the documentation of the signal person's qualifications available at the worksite, either in paper form or electronically. The documentation must specify each type of signaling (e.g., hand signals, radio signals, etc.) for which the signal person is qualified under the requirements of the standard.

When are signal persons required to be qualified?

The qualification requirements for signal persons go into effect on November 8, 2010.

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

For more complete information:

OSHA® Occupational Safety and Health Administration

U.S. Department of Labor

www.osha.gov

(800) 321-OSHA

DOC 10/2010

OSHA® FactSheet

Subpart CC – Cranes and Derricks in Construction: Signal Person Qualification

This fact sheet describes the signal person qualification requirements of subpart CC – Cranes and Derricks in Construction, as specified in 29 CFR 1926.1419 and 1926.1428. Other requirements related to signal persons can be found at 29 CFR 1926.1404, 1926.1430, 1926.1431, and 1926.1441. These provisions are effective November 8, 2010.

When is a signal person required?

A signal person is required when:

- The point of operation is not in full view of the operator (1926.1419(a)).
- The operator's view is obstructed in the direction the equipment is traveling.
- Either the operator or the person handling the load determines that a signal person is needed because of site-specific safety concerns.

What does a signal person need to know?

The signal person is considered qualified if he or she:

- Knows and understands the type of signals used at the worksite.
- Is competent in using these signals.
- Understands the operations and limitations of the equipment, including the crane dynamics involved in swinging, raising, lowering and stopping loads and in boom deflection from hoisting loads.
- Knows and understands the relevant signal person qualification requirements specified in subpart CC (1926.1419-1926.1422; 1926.1428).
- Passes an oral or written test and a practical test.

How does a signal person become qualified?

Employers must use one of the following options to ensure that a signal person is qualified (see 1926.1428).

1. *Third party qualified evaluator.* The signal person has documentation from a third party qualified evaluator showing that he or she meets the qualification requirements.
2. *Employer's qualified evaluator* (not a third party). The *employer's qualified evaluator* assesses the individual, determines the individual meets the qualification requirements, and provides documentation of that determination. This assessment may not be relied on by other employers.

Refer to 1926.1401 for definitions of qualified evaluators.

How will an employer show that a signal person is appropriately qualified?

Employers must make the documentation of the signal person's qualifications available at the worksite, either in paper form or electronically. The documentation must specify each type of signaling (e.g., hand signals, radio signals, etc.) for which the signal person is qualified under the requirements of the standard.

When are signal persons required to be qualified?

The qualification requirements for signal persons go into effect on November 8, 2010.

For more complete information:

OSHA® Occupational Safety and Health Administration

U.S. Department of Labor

www.osha.gov

(800) 321-OSHA

DOC 10/2010

OSHA® FactSheet

Reducing Falls during Residential Construction: Erecting Exterior and Interior Walls

Every year, residential construction workers experience fatal injuries due to falls. Erecting walls presents several challenges when it comes to protecting workers from falls. This fact sheet highlights some of the hazards of erecting interior and exterior walls, and details some practical methods that employers can use to protect workers who erect walls. The fall protection methods in this fact sheet may not be suitable in all situations. Employers are responsible for ensuring compliance with applicable OSHA requirements.

Risks While Erecting Exterior and Interior Walls

Workers can be exposed to serious fall hazards while framing and erecting walls – particularly if the structure being built has multiple stories. Openings in walls (such as windows and doors) and floor openings present potential hazards, as workers can fall through them. The use of effective fall protection can prevent a serious fall.

The employer must provide a training program for each worker who might be exposed to fall hazards. The program must enable each worker to recognize fall hazards and each worker must be trained in the procedures to follow to minimize these hazards. For fall protection training requirements, refer to 29 CFR 1926.503. In all cases, employers must evaluate the hazards and take steps to reduce the risk of falls.

Reducing Risks:

Planning

Planning for the use of fall protection equipment can help employers protect workers from falls. Before beginning the job, identify fall protection needs. Once appropriate fall protection systems have been identified, have those systems in place before the workers report to the job.

Assembling Walls

Using pre-fabricated wall panels can reduce the amount of time workers are exposed to fall hazards while working at heights. Many employers build walls on site, however. Workers then use the installed floor of the structure as a work platform to frame the wall sections. In either case, employers must determine if fall protection is required and then implement procedures to protect workers. This requirement applies when erecting both interior (e.g., around stairwell openings) and exterior walls.

Lifting Walls into Place

Employers must protect workers from falling while they are raising walls. Once a wall segment is framed it can be lifted into place using a lifting device such as a forklift or wall jack. If a lifting device cannot be used at a particular worksite, steps can be taken to address the fall hazards, as well as the stress and strain hazards that can be present when workers raise walls by hand.

Using the Right Equipment

Employers generally must ensure that workers use fall protection meeting OSHA requirements whenever they work 6 feet or more above a lower level (29 CFR 1926.501(b)(13)). There are guardrail systems and personal fall arrest systems available that can provide workers the flexibility they need during wall construction. Employers also may choose to use scaffolds for wall erection work. (Note: OSHA's fall protection requirements for residential construction work performed on scaffolds are in Subpart L, not in 29 CFR 1926.501(b)(13)).

Guardrails

Guardrail systems can protect workers framing walls around the perimeter and at floor openings. Framed exterior walls typically include openings for windows and doors. Workers can apply sheathing to the frame, and install guardrails across window and door openings, before raising wall sections so that the openings are protected when the walls are set into place.

OSHA generally requires the top rail height to be 42 inches + 3 inches above the walking/working level. A midrail is also required between the top rail and the walking/working surface when there is no wall or parapet at least 21 inches high. For additional requirements for guardrails, refer to 29 CFR 1926.502(b).

During multi-story construction many employers provide fall protection by installing guardrails on exterior wall sections prior to erecting them into place. This ensures perimeter protection before workers begin activities on each additional floor.

Personal Fall Arrest System (PFAS)

A PFAS is a tool available to workers who are framing and erecting walls. In fact, a PFAS is the system of choice for many workers who work at heights. However, a malfunction in any component of a PFAS could be disastrous for a worker. Always follow the manufacturer's instructions on selecting, installing and using PFAS components correctly. Certain anchorage assemblies rotate or offer extension arms to improve mobility and prevent lifelines from contacting the floor surface.

Personal Fall Arrest System

A PFAS is designed to safely stop a fall before the worker strikes a lower level. The system includes three major components:

A. An ***anchorage*** to which the other components of the PFAS are rigged.

B. A full body ***harness*** worn by the worker.

C. A connector, such as a ***lanyard or lifeline***, linking the harness to the anchorage. A rip-stitch lanyard, or deceleration device, is typically a part of the system.

For more information on the requirements for a PFAS, refer to 29 CFR 1926.502(d).

Remember that workers must use full-body harnesses in fall arrest systems. Body belts can cause serious injury during a fall, and OSHA prohibits their use as part of fall arrest systems.

Attaching Anchors

OSHA requires that anchors for a PFAS either be able to hold at least 5,000 pounds per worker or maintain a safety factor of at least two (twice the impact load) and be used under the supervision of a qualified person. Always follow the manufacturer's instructions or consult a qualified person when installing anchors to ensure that they are strong enough to hold the sudden weight of a falling worker. There are anchorages available on the market that can meet OSHA's strength requirements if they are installed in accord with the manufacturer's instructions, with the right number of properly-sized nails or screws.

Fall Restraint

Fall restraint systems prevent falls by keeping the worker from reaching a fall hazard. While fall restraint systems are not mentioned in OSHA's fall protection rules, OSHA will accept a properly used fall restraint system in place of a personal fall arrest system when the restraint system is rigged so that the worker cannot get to the fall hazard. In effect, (if properly used) the system tethers a worker in a manner that will not allow a fall of any distance. A fall restraint system is comprised of a body belt or body harness, an anchorage, connectors, and other necessary equipment. Other components typically include a lanyard, and may also include a lifeline and other devices. Note: A self-retracting lanyard is not appropriate for a fall restraint system unless the worker cannot reach the fall hazard when the lanyard is fully extended.

Always follow the manufacturer's instructions or consult a qualified person to ensure proper installation of anchor points. OSHA recommends that fall restraint systems have the capacity to withstand 3,000 pounds of force or twice the maximum expected force that is needed to restrain the worker from exposure to the fall hazard. As a result, fall restraint may be a viable way to provide fall protection in situations in which the employer has concerns about the adequacy of available anchorage points for fall arrest equipment.

Scaffolds

When site conditions permit, employers can use scaffolds to provide a platform for workers erecting and securing walls. Scaffolds can be particularly useful for workers sheathing exterior walls in situations in which sheathing was not completed before the wall was set in place. Always follow the manufacturer's instructions or consult a qualified person to ensure that scaffold systems are used safely. The employer must ensure that employees on scaffold systems 10 feet or more above a lower level are protected from falls. For other requirements for scaffolds, refer to 29 CFR 1926 Subpart L – Scaffolds.

Written Fall Protection Plans

When working at heights of 6 feet or greater, if the employer does not use ladders, scaffolds, aerial lifts or fall restraint systems and can demonstrate that it is not feasible or would create a greater hazard to use conventional fall protection equipment (guardrails, safety nets or a PFAS), the employer must develop a written site-specific fall protection plan in accord with 29 CFR 1926.502(k). The plan must be prepared by a qualified person. This person could be the owner, the supervisor, or any other worker who has extensive knowledge, training and experience with fall protection and is able to solve problems relating to fall protection.

The site-specific fall protection plan must document, for each location, why the use of conventional fall protection equipment is not feasible or will create a greater hazard. The plan must also describe the alternative methods that the employer will use so that workers are protected from falls. Workers and their supervisors must be trained on the proper use of those other fall protection methods.

OSHA Standard:

29 CFR 1926 Subpart M – Fall Protection
Available online at:
www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10922.

OSHA Residential Fall Protection Web Page:
www.osha.gov/doc/topics/residentialprotection/index.html.

OSHA Compliance Guidance:

Compliance Guidance for Residential Construction – STD 03-11-002 (dated 12/16/2010)
Available online at:
www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=DIRECTIVES&p_id=4755.

State Plan Guidance: Twenty-seven states or territories currently operate their own OSHA-approved state plans. State plan workplace health and safety standards must be at least as effective as comparable Federal OSHA standards. State plans have the option of promulgating more stringent standards and, therefore, may have additional requirements for residential construction. For more information on state plans and their requirements, please visit:
www.osha.gov/dcsp/osp/statestandards.html.

Help for Employers: OSHA's On-site Consultation Program offers free and confidential advice to small and medium-sized businesses in all states across the country, with priority given to high-hazard worksites. On-site consultation services are separate from enforcement and do not result in penalties or citations. Consultants from state agencies or universities work with employers to identify workplace hazards, provide advice on compliance with OSHA standards, and assist in establishing safety and health management programs. To locate the OSHA Consultation Program nearest you, call 1-800-321-OSHA (6742) or visit:
www.osha.gov/dcsp/smallbusiness/consult.html.

Almost every OSHA area office has a compliance assistance specialist to assist employers in complying with OSHA standards. To find the compliance assistance specialist nearest you, call 1-800-321-OSHA (6742) or visit:
www.osha.gov/html/RAmap.html.

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

For assistance, contact us. We can help. It's confidential.

OSHA® Occupational Safety and Health Administration

U.S. Department of Labor
www.osha.gov (800) 321-OSHA (6742)

DOC FS-3554 05/2012

OSHA® FactSheet

Fall Protection in Residential Construction

The United States Department of Labor's Occupational Safety and Health Administration (OSHA) has issued a directive rescinding the Interim Fall Protection Compliance Guidelines for Residential Construction (STD 03-00-001).

Before issuance of this new directive, STD 03-00-001 allowed employers engaged in certain residential construction activities to use specified alternative methods of fall protection (e.g., slide guards or safety monitor systems) rather than the conventional fall protection (guardrails, safety nets, or personal fall arrest systems) required by the residential construction fall protection standard (29 CFR 1926.501(b)(13)). Employers could use the alternative measures described in STD 03-00-001 without first proving that the use of conventional fall protection was infeasible or created a greater hazard and without a written fall protection plan.

With the issuance of the new directive, all residential construction employers must comply with 29 CFR 1926.501(b)(13).

- Residential construction employers generally must ensure that employees working six feet or more above lower levels use guardrails, safety nets, or personal fall arrest systems. A personal fall arrest system may consist of a full body harness, a deceleration device, a lanyard, and an anchor point. (See the definition of "personal fall arrest system" in 29 CFR 1926.500.)
  - Other fall protection measures may be used to the extent allowed under other provisions of 29 CFR 1926.501(b) addressing specific types of work. For example, 1926.501(b)(10) permits the use of warning lines and safety monitoring systems during the performance of roofing work on low-sloped roofs.
  - OSHA allows the use of an effective fall restraint system in lieu of a personal fall arrest system. To be effective, a fall restraint system must be rigged to prevent a worker from reaching a fall hazard and falling over the edge. A fall restraint system may consist of a full body harness or body belt that is connected to an anchor point at the center of a roof by a lanyard of a length that will not allow a worker to physically reach the edge of the roof.
- If the employer can demonstrate that use of conventional fall protection methods is infeasible or creates a greater hazard, it must ensure that a qualified person:
  - Creates a written, site-specific fall protection plan in compliance with 29 CFR 1926.502(k); *and*
  - Documents, in that plan, the reasons why conventional fall protection systems are infeasible or why their use would create a greater hazard.

The new directive interprets "residential construction" as construction work that satisfies both of the following elements:

- The end-use of the structure being built must be as a home, i.e., a dwelling.
- The structure being built must be constructed using traditional wood frame construction materials and methods. The limited use of structural steel in a predominantly wood-framed home, such as a steel I-beam to help support wood framing, does not disqualify a structure from being considered residential construction.
  - Traditional wood frame construction materials and methods will be characterized by:
    - *Framing materials:* Wood (or equivalent cold-formed sheet metal stud) framing, not steel or concrete; wooden floor joists and roof structures.
    - *Exterior wall structure*: Wood (or equivalent cold-formed sheet metal stud) framing or masonry brick or block.
    - *Methods*: Traditional wood frame construction techniques.

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

For more complete information:

OSHA® Occupational Safety and Health Administration

U.S. Department of Labor

www.osha.gov

(800) 321-OSHA

12/2010

OSHA® FactSheet

Reducing Falls during Residential Construction: Floor Joist Installation and Decking

Installing floor joists and decking can be a dangerous task if precautions are not taken to prevent falls. It is important to protect workers engaged in "leading edge" work to ensure that they do not fall through openings to lower levels. This fact sheet highlights some of the risks associated with installing floor joists and decking, and details various methods that employers can use to protect workers performing these tasks. The fall protection methods in this fact sheet may not be suitable in all situations. Employers are responsible for ensuring compliance with applicable OSHA requirements.

Risks While Installing Floor Joists and Decking

Floor joists are typically set directly over foundation walls or framed walls. If workers stand on the joists or walls without fall protection, they can fall through to lower levels. Fall hazards are likely to be present if the structure being built has multiple stories. The use of effective fall protection can prevent a serious fall.

The employer must provide a training program for each worker who might be exposed to fall hazards. The program must enable each worker to recognize fall hazards and train each worker in the procedures to follow to minimize these hazards. For fall protection training requirements, refer to 29 CFR 1926.503. In all cases, employers must evaluate the hazards and take steps to reduce the risk of falls.

Reducing Risks:

Planning

Planning for the use of fall protection equipment can help employers protect workers from falls. Before beginning the job, identify fall protection needs. Once appropriate fall protection systems have been identified, have those systems in place before the workers report to the job.

Using the Right Equipment

Employers generally must ensure that workers use fall protection meeting OSHA requirements whenever they work 6 feet or more above a lower level (29 CFR 1926.501(b)(13)). There are guardrail systems and personal fall arrest systems available that can provide workers the flexibility they need during floor joist and decking installation. Some systems are more efficient than others because, in many cases, the employer can use the same system for both tasks. Employers may also choose to use scaffolds or ladders for floor joist installation and decking.

Note: OSHA's fall protection requirements for residential construction work performed on scaffolds and ladders are specified in Subpart L and Subpart X, respectively, not in 29 CFR 1926.501(b)(13).

Scaffolds

Scaffolds, erected on the inside or outside of the house, can be used while workers install floor joists. Engineered bracket scaffold systems and job-built scaffold systems can provide workers with stable work platforms when they install floor joists and possibly while they attach some of the decking. These types of scaffolds can be adjusted to a comfortable work height. Always follow the manufacturer's instructions or consult a qualified person to ensure that scaffold systems are used safely. Employers must ensure that employees on scaffold systems 10 feet or more above a lower level are protected from falls.

Mobile scaffolds can be an effective method for lifting workers up while providing protection from falls. For work on the first floor of a residence, mobile scaffolds can be placed on the cured concrete basement floor. From the elevated platforms, workers can install primary beams and floor joists, and they may also be able to tack some of the decking into place. For complete requirements for scaffolds, refer to 29 CFR 1926 Subpart L - Scaffolds.

Ladders (A-frame and platform)

Workers can use A-frame and platform ladders to install floor joists and decking. Platform ladders can provide workers a stable work base and give them more flexibility while maneuvering and positioning floor joists into place. Always follow the manufacturer's instructions about the safe use of, and load limits for, ladders. For requirements for ladders, refer to 29 CFR 1926 Subpart X – Stairways and Ladders.

Personal Fall Arrest System (PFAS)

Once the first row of subfloor has been secured, a PFAS can be used. Strap anchors and specially made leading edge retractable lifeline systems are options to consider.

Personal Fall Arrest System

A PFAS is designed to safely stop a fall before the worker strikes a lower level. The system includes three major components:

A. An ***anchorage*** to which the other components of the PFAS are rigged.

B. A full body ***harness*** worn by the worker.

C. A connector, such as a ***lanyard or lifeline***, linking the harness to the anchorage. A rip-stitch lanyard, or deceleration device, is typically a part of the system.

For more information on the requirements for a PFAS, refer to 29 CFR 1926.502(d).

Remember that workers must use full-body harnesses in fall arrest systems. Body belts can cause serious injury during a fall, and OSHA prohibits their use as part of fall arrest systems.

Attaching Anchors

OSHA requires that anchors for a PFAS either be able to hold at least 5,000 pounds per worker or maintain a safety factor of at least two (twice the impact load) and be used under the supervision of a qualified person. Always follow the manufacturer's instructions or consult a qualified person when installing anchors to ensure that they are strong enough to hold the sudden weight of a falling worker. There are anchorages available on the market that can meet OSHA's strength requirements if they are installed in accord with the manufacturer's instructions, with the right number of properly-sized nails or screws.

Fall Restraint

Fall restraint systems prevent falls by keeping the worker from reaching a fall hazard. While fall restraint systems are not mentioned in OSHA's fall protection rules, OSHA will accept a properly used fall restraint system in place of a personal fall arrest system when the restraint system is rigged so that the worker cannot get to the fall hazard. In effect, (if properly used) the system tethers a worker in a manner that will not allow a fall of any distance. A fall restraint system is comprised of a body belt or body harness, an anchorage, connectors, and other necessary equipment. Other components typically include a lanyard, and may also include a lifeline and other devices. Note: A self-retracting lanyard is not appropriate for a fall restraint system unless the worker cannot reach the fall hazard when the lanyard is fully extended.

Always follow the manufacturer's instructions or consult a qualified person to ensure proper installation of anchor points. OSHA recommends that fall restraint systems have the capacity to withstand 3,000 pounds of force or twice the maximum expected force that is needed to restrain the worker from exposure to the fall hazard.

As a result, fall restraint may be a viable way to provide fall protection in situations in which the employer has concerns about the adequacy of available anchorage points for fall arrest equipment.

Guardrails

Guardrails can be used to protect workers from falling through walls, floor openings or window openings that are 6 feet or higher above a lower level. During multi-story construction, many employers provide fall protection by installing guardrails to exterior wall sections prior to erecting them into place. This ensures perimeter protection before workers begin activities on each floor. Placing joists and adding subfloors can be accomplished while workers are protected from falls.

Written Fall Protection Plans

When working at heights of 6 feet or greater, if the employer does not use ladders, scaffolds, aerial lifts or fall restraint systems and can demonstrate that it is not feasible or would create a greater hazard to use conventional fall protection equipment (guardrails, safety nets or a PFAS), the employer must develop a written site-specific fall protection plan in accord with 29 CFR 1926.502(k). The plan must be prepared by a qualified person. This person could be the owner, the supervisor, or any other worker who has extensive knowledge, training and experience with fall protection and is able to solve problems relating to fall protection.

The site-specific fall protection plan must document, for each location, why the use of conventional fall protection equipment is not feasible or will create a greater hazard. The plan must also describe the alternative methods that the employer will use so that workers are protected from falls. Workers and their supervisors must be trained on the proper use of those other fall protection methods.

OSHA Standard:

29 CFR 1926 Subpart M – Fall Protection
Available online at:
www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10922.

OSHA Residential Fall Protection Web Page:
www.osha.gov/doc/topics/residentialprotection/index.html.

OSHA Compliance Guidance:

Compliance Guidance for Residential Construction – STD 03-11-002 (dated 12/16/2010)
Available online at:
www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=DIRECTIVES&p_id=4755.

State Plan Guidance: Twenty-seven states or territories currently operate their own OSHA-approved state plans. State plan workplace health and safety standards must be at least as effective as comparable Federal OSHA standards. State plans have the option of promulgating more stringent standards and, therefore, may have additional requirements for residential construction. For more information on state plans and their requirements, please visit: www.osha.gov/dcsp/osp/statestandards.html.

Help for Employers: OSHA's On-site Consultation Program offers free and confidential advice to small and medium-sized businesses in all states across the country, with priority given to high-hazard worksites. On-site consultation services are separate from enforcement and do not result in penalties or citations. Consultants from state agencies or universities work with employers to identify workplace hazards, provide advice on compliance with OSHA standards, and assist in establishing safety and health management programs. To locate the OSHA Consultation Program nearest you, call 1-800-321-OSHA (6742) or visit: www.osha.gov/dcsp/smallbusiness/consult.html.

Almost every OSHA area office has a compliance assistance specialist to assist employers in complying with OSHA standards. To find the compliance assistance specialist nearest you, call 1-800-321-OSHA (6742) or visit: www.osha.gov/html/RAmap.html.

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

For assistance, contact us. We can help. It's confidential.

OSHA® Occupational Safety and Health Administration

U.S. Department of Labor
www.osha.gov (800) 321-OSHA (6742)

DOC FS-3555 05/2012

OSHA FactSheet

Protecting Workers from Lead Hazards

Cleaning up after a flood requires hundreds of workers to renovate and repair, or tear down and dispose of, damaged or destroyed structures and materials. Repair, renovation and demolition operations often generate dangerous airborne concentrations of lead, a metal that can cause damage to the nervous system, kidneys, blood forming organs, and reproductive system if inhaled or ingested in dangerous quantities. The Occupational Safety and Health Administration (OSHA) has developed regulations designed to protect workers involved in construction activities from the hazards of lead exposure.

How You Can Become Exposed to Lead

Lead is an ingredient in thousands of products widely used throughout industry, including lead-based paints, lead solder, electrical fittings and conduits, tank linings, plumbing fixtures, and many metal alloys. Although many uses of lead have been banned, lead-based paints continue to be used on bridges, railways, ships, and other steel structures because of its rust- and corrosion-inhibiting properties. Also, many homes were painted with lead-containing paints. Significant lead exposures can also occur when paint is removed from surfaces previously covered with lead-based paint.

Operations that can generate lead dust and fumes include:

- Demolition of structures;
- Flame-torch cutting;
- Welding;
- Use of heat guns, sanders, scrapers, or grinders to remove lead paint; and
- Abrasive blasting of steel structures

OSHA has regulations governing construction worker exposure to lead. Employers of construction workers engaged in the repair, renovation, removal, demolition, and salvage of flood-damaged structures and materials are responsible for the development and implementation of a worker protection program in accordance with Title 29 Code of Federal Regulations (CFR), Part 1926.62. This program is essential to minimize worker risk of lead exposure. Construction projects vary in their scope and potential for exposing workers to lead and other hazards. Many projects involve only limited exposure, such as the removal of paint from a few interior residential surfaces, while others may involve substantial exposures. Employers must be in compliance with OSHA's lead standard at all times. A copy of the standard and a brochure — Lead in Construction (OSHA 3142) — describing how to comply with it, are available from OSHA Publications, P.O. Box 37535, Washington, D.C. 20013-7535, (202) 693-1888(phone), or (202) 693-2498(fax); or visit OSHA's website at www.osha.gov.

Major Elements of OSHA's Lead Standard

- A permissible exposure limit (PEL) of 50 micrograms of lead per cubic meter of air, as averaged over an 8-hour period.
- Requirements that employers use engineering controls and work practices, where feasible, to reduce worker exposure.
- Requirements that employees observe good personal hygiene practices, such as washing hands before eating and taking a shower before leaving the worksite.
- Requirements that employees be provided with protective clothing and, where necessary, with respiratory protection accordance with 29 CFR 1910.134.

- A requirement that employees exposed to high levels of lead be enrolled in a medical surveillance program.

Additional Information

For more information on this, and other health-related issues impacting workers, visit OSHA's Web site at www.osha.gov.

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

For more complete information:

OSHA Occupational Safety and Health Administration

U.S. Department of Labor

www.osha.gov

(800) 321-OSHA

DSTM 11/2005

OSHA® FactSheet

Subpart CC – Cranes and Derricks in Construction: Operator Qualification and Certification

This fact sheet explains the operator qualification and certification requirements of subpart CC – Cranes and Derricks in Construction, as specified in 29 CFR 1926.1427. State or local government licensing is effective November 8, 2010. Other certification and qualification is effective November 10, 2014.

Who needs to be certified or qualified?

Any person engaged in a construction activity who is operating a crane covered by the new cranes and derricks rule, except:

- sideboom cranes*
- derricks*
- equipment with a rated hoisting/lifting capacity of 2,000 pounds or less*

*Operators of the listed equipment must meet the criteria for minimum expertise described in the applicable section in subpart CC.

Are operators of digger derricks required to be qualified or certified?

Yes, unless the digger derrick is being used to auger holes for poles carrying electric or telecommunication lines, place or remove the poles, or handle associated materials to be installed on or removed from the poles.

What is required in the testing for certification?

Certification has two parts:

1. A written examination that includes the safe operating procedures for the particular type of equipment the applicant will be operating and technical understanding of the subject matter criteria required in 1926.1427(j).
2. A practical exam showing the applicant has the skills needed to safely operate the equipment, Including, among other skills, the ability to properly use load chart information and recognize items required in the shift inspection.

Does an operator need more than one certification?

With respect to certification from an accredited testing organization, an operator must be certified for the *type* and *capacity* of crane he or she is going to operate. Each accredited testing organization develops its own categories for crane type and capacity.

How is an operator certified or qualified?

There are 4 ways that an equipment operator can be qualified or certified and meet OSHA requirements.

1. A certificate from an accredited crane operator testing organization
2. Qualification from the employer through an audited employer program
3. Qualification by the US Military (only applies to employees of Department of Defense or Armed Forces and does not include private contractors)
4. *Licensing by a state or local government (if that licensing meets the minimum requirements set forth by OSHA)

*When a state or local government requires a crane operator license, the crane operator must be licensed accordingly to meet OSHA requirements.

For more complete information:

OSHA® Occupational Safety and Health Administration

U.S. Department of Labor

www.osha.gov

(800) 321-OSHA

Operator Qualification and Certification, continued.

Accredited crane operator testing organization. The testing organization must be accredited by a nationally recognized accrediting agency and test according to the criteria listed at §§ 1926.1427(j)(1) and (j)(2). This certification is portable from employer to employer. The testing organization must have its accreditation reviewed every 3 years. The certificate must note the type and capacity of equipment for which the operator is tested and certified. The certificate is valid for 5 years.

Audited employer program. An employer may provide a crane operator testing program under the oversight of an independent auditor. An accredited crane operator testing organization must certify the auditor to evaluate the administration of written and practical tests. The auditor must conduct audits of the employer's program according to nationally recognized auditing standards. Crane operator qualification under an employer program is only valid while the operator is an employee of the employer and operating a crane for the employer. The qualification is valid up to 5 years.

U.S. Military. This qualification applies only to civilian employees of the Department of Defense or Armed Services and is not portable. This qualification does not include employees of private contractors.

Licensing by a government entity. This license is obtained from a government entity, such as a city or state that has a required certification program. When this license meets the minimum requirements of 1926.1427(e)(2) and (j), OSHA requires a crane operator to have this license when operating in the applicable city, county, or state. This license is not portable outside the boundaries of the government entity that issues the license, and is valid for a maximum of 5 years.

OSHA® FactSheet

CONTROL SILICA DUST
Breathe Easier

CONTROL OF SILICA DUST IN CONSTRUCTION
Handheld Power Saws

Using a handheld power saw (also called a cut-off saw) to cut masonry, concrete, stone, or other silica-containing materials can generate *respirable crystalline silica* dust. When inhaled, the small particles of silica can irreversibly damage the lungs. This fact sheet describes dust controls that can be used to minimize the amount of dust that gets into the air when using handheld power saws with an integrated water delivery system as listed in Table 1 of the Respirable Crystalline Silica Standard for Construction, 29 CFR 1926.1153. This fact sheet does not apply to handheld saws used to cut fiber-cement board.

Engineering Control Method: Water applied continuously to the saw blade

Wet Cutting

Many handheld power saws come equipped with an integrated water delivery system designed to cool the blade by directing a continuous stream of water onto the blade where it wets the material being cut and reduces the amount of dust generated when cutting. Water can be supplied to the saw by either a pressurized container or by a constant water supply such as a hose connected to a faucet or construction site water supply. Water flow rates must be sufficient to minimize release of visible dust.

Photo courtesy of OSHA

A construction worker using a handheld power saw with an integrated water delivery system.

The saw must be operated and maintained in accordance with manufacturer's instructions to minimize dust emissions. Focus on the following areas:

- **Check** that hoses are securely connected and are not cracked or broken.
- **Adjust** nozzles so that water goes to the blade and wets the cutting area.
- **Inspect** the saw blade before use to be sure it is in good condition and does not show excessive wear.
- **Maintain** and operating the saw's dust-control equipment based on the manufacturer's instructions.

Clean up any slurry produced to prevent the slurry from drying and releasing silica dust into the air. Wet slurry can be cleaned up using, for example, shovels or a wet vacuum equipped with a HEPA filter.

Wet Cutting Indoors or in Enclosed Areas

Wet cutting indoors or in enclosed areas may not reliably keep silica exposures low, so extra ventilation or a means of exhaust may be needed to reduce visible airborne dust. Extra ventilation can be supplied by using:

- Exhaust trunks
- Portable exhaust fans
- Air ducts
- Other means of mechanical ventilation

Ensure air flow is not impeded by the movements of employees during work, or by the opening or closing of doors and windows. Position the ventilation to move contaminated air away from the workers' breathing zones.

Electrical Safety. Where water is used to control dust, electrical safety is a particular concern. Use ground-fault circuit interrupters (GFCIs) and watertight, sealable electrical connectors for electric tools and equipment on construction sites.

Respiratory Protection

In addition to using wet cutting methods, respiratory protection with a minimum Assigned Protection Factor **(APF) of 10** is required on Table 1 when wet cutting with handheld masonry saws **indoors or in an enclosed** area, or used outdoors for **more than four hours** per shift.

When respirators are required, employers must put in place a written respiratory protection program in accordance with OSHA's Respiratory Protection standard 29 CFR 1910.134.

Additional Information

For more information, visit www.osha.gov/silica and see the OSHA Fact Sheet on the Crystalline Silica Rule for Construction, and the Small Entity Compliance Guide for the Respirable Crystalline Silica Standard for Construction.

OSHA can provide compliance assistance through a variety of programs, including technical assistance about effective safety and health programs, workplace consultations, and training and education. OSHA's On-Site Consultation Program offers free, confidential occupational safety and health services to small and medium-sized businesses in all states and several territories across the country, with priority given to high-hazard worksites. On-Site consultation services are separate from enforcement and do not result in penalties or citations. To locate the OSHA On-Site Consultation Program nearest you, visit www.osha.gov/consultation.

Workers' Rights

Workers have the right to:

- Working conditions that do not pose a risk of serious harm.
- Receive information and training (in a language and vocabulary the worker understands) about workplace hazards, methods to prevent them, and the OSHA standards that apply to their workplace.
- Review records of work-related injuries and illnesses.
- File a complaint asking OSHA to inspect their workplace if they believe there is a serious hazard or that their employer is not following OSHA's rules. OSHA will keep all identities confidential.
- Exercise their rights under the law without retaliation, including reporting an injury or raising health and safety concerns with their employer or OSHA. If a worker has been retaliated against for using their rights, they must file a complaint with OSHA as soon as possible, but no later than 30 days.

For additional information, see OSHA's Workers page.

How to Contact OSHA

Under the Occupational Safety and Health Act of 1970, employers are responsible for providing safe and healthful workplaces for their employees. OSHA's role is to ensure these conditions for America's working men and women by setting and enforcing standards, and providing training, education and assistance. For more information, visit www.osha.gov or call OSHA at 1-800-321-OSHA (6742), TTY 1-877-889-5627.

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

U.S. Department of Labor

OSHA® Occupational Safety and Health Administration

DSG FS-3627 12/2017

OSHA FactSheet

CONTROL SILICA DUST
Breathe Easier

CONTROL OF SILICA DUST IN CONSTRUCTION

Jackhammers or Handheld Powered Chipping Tools

The use of a jackhammer or handheld power chipping tools to break or demolish concrete, stone, masonry or other silica-containing materials can generate *respirable crystalline silica* dust. When inhaled over time, the small particles of silica can irreversibly damage the lungs. This fact sheet describes dust controls that can be used to minimize the amount of airborne dust when using jackhammers or handheld powered chipping tools as listed in Table 1 of the Respirable Crystalline Silica Standard for Construction, 29 CFR 1926.1153.

Engineering Control Method: Water applied continuously to the impact point ***OR*** Shroud with Vacuum Dust Collection System

Two methods for controlling dust when using jackhammers or powered chipping tools are: (1) continuously feed water to the point of impact; or (2) use a shroud or cowling with a vacuum dust collection system.

Wet Methods

When jackhammering, wetting must occur with a continuous stream or spray of water at the point where the jackhammer's tip strikes the surface material. Employers may use manual spraying or water- spray systems. Under either approach, water must be applied at a flow rate sufficient to minimize the release of visible dust.

Manual Spraying. One option for applying water when jackhammering is to have one worker direct a stream or spray of water at the impact point while another worker operates the jackhammer or powered chipping tool. A portable sprayer with a nozzle can be used for this job.

Electrical Safety. Where water is used to control dust, electrical safety is a particular concern. Use ground-fault circuit interrupters (GFCIs) and watertight, sealable electrical connectors for electric tools and equipment on construction sites.


Photo courtesy of OSHA

One worker applies water using a portable sprayer to suppress dust while the other jackhammers.

Only wetting the surface is not sufficient. Continuous water application either streamed or sprayed at the point where the jackhammer or handheld powered chipping tool breaks the surface is necessary because as the tool breaks through the surface, dry materials below are disturbed, which can produce dust.

Water-Spray Systems. Spray nozzles aimed at the tip of the tool on jackhammers and handheld powered chipping tools can lower silica exposures. Existing equipment can be retrofitted. The

National Institute for Occupational Safety and Health (NIOSH) has developed designs for a water-spray retrofit system for jackhammers. See NIOSH's design at: www.cdc.gov/niosh/docs/wp-solutions/2008-127/pdfs/2008-127.pdf.

Employers are responsible for keeping equipment in good working condition to minimize dust. Workers must receive training on how to use dust suppression equipment.

- ***Dust and debris can clog spray nozzles.*** Check the nozzle frequently. Observe the water spray to be sure it is directed at the point of impact. Clean or change if the nozzle is dripping or spurting.
- ***Take steps to provide consistent water flow.*** Make sure there is an adequate supply of water. Prevent kinked hoses, heavy equipment, or other vehicle traffic from running over hoses, and identify other potential blockages and impediments that could cause a drop in water pressure.
- ***The spray angle is critical.*** Check the water-spray angle frequently. Make sure the spray is focused on the breakpoint and the spray is wetting the dust before it spreads away from the tip of the hammer.

Photo courtesy of NIOSH

A worker chips concrete with a jackhammer using a water-spray attachment to control dust.

Clean up any slurry produced to prevent the slurry from drying and releasing silica dust into the air. Wet slurry can be cleaned up using, for example, shovels or a wet vacuum equipped with a HEPA filter.

Vacuum Dust Collection System (VDCS)

Employers may use commercially available VDCSs for jackhammers and handheld powered chipping tools to reduce silica exposure. A VDCS includes a:

- hood or shroud for the tool that is recommended by the manufacturer;
- vacuum meeting the specifications recommended by the tool manufacturer, with enough suction to capture dust at the cutting point;
- dust collector equipped with a filter efficiency of 99 percent or greater and a filter-cleaning mechanism; and
- vacuum exhaust hose capable of providing the airflow recommended by the tool manufacturer. A 1.5″ to 2″ diameter vacuum exhaust hose is typically adequate.

Photo courtesy of Stanley Black and Decker

Jackhammer equipped with VDCS. Shroud around hammer connects to the vacuum on the right.

The tool and VDCS must be operated and maintained in accordance with manufacturers' instructions to minimize dust emissions. Focus on the following areas:

- **Keep** the vacuum hose clear and free of debris, kinks and tight bends.
- **Change** vacuum-collection bags as needed or at least as often as the manufacturer recommends. Do not over fill the bag.
- **Set** a regular schedule for maintenance and filter cleaning of the VDCS.
- **Avoid** exposure to dust when changing vacuum bags and cleaning or replacing air filters.

Indoors or in Enclosed Areas

When jackhammers or chipping tools are used indoors or in an enclosed area, wet methods or a VDCS may not reliably keep exposure low. Extra ventilation may be needed to reduce visible airborne dust. Extra ventilation can be supplied by using:

- Exhaust trunks
- Portable exhaust fans
- Air ducts
- Other means of mechanical ventilation

Ensure that air flow is not impeded by the movements of employees during work, or by the opening or closing of doors and windows.

Position the ventilation to move contaminated air away from the workers' breathing zones.

Use of Compressed Air. Unless there is a ventilation system that effectively captures the dust cloud, do not use compressed air or blowers to clean surfaces, clothing or filters because it can increase exposure to silica. Instead, clean with a HEPA filter-equipped vacuum or by wet methods.

Respiratory Protection

In addition to using wet methods or a VDCS, the use of respiratory protection with a minimum Assigned Protection Factor **(APF) of 10** is required whenever jackhammers or handheld powered chipping tools are used **indoors or in an enclosed** area. APF 10 respirators are also required when jackhammers or handheld powered chipping tools are used outdoors for **more than 4 hours** per shift.

When respirators are required, employers must put in place a written respiratory protection program in accordance with OSHA's Respiratory Protection standard 29 CFR 1910.134.

Additional Information

For more information, visit www.osha.gov/silica and see the OSHA Fact Sheet on the Crystalline Silica Rule for Construction, and the Small Entity Compliance Guide for the Respirable Crystalline Silica Standard for Construction.

OSHA can provide compliance assistance through a variety of programs, including technical assistance about effective safety and health programs, workplace consultations, and training and education. OSHA's On-Site Consultation Program offers free, confidential occupational safety and health services to small and medium-sized businesses in all states and several territories across the country, with priority given to high-hazard worksites. On-Site consultation services are separate from enforcement and do not result in penalties or citations. To locate the OSHA On-Site Consultation Program nearest you, visit www.osha.gov/consultation.

Workers' Rights

Workers have the right to:

- Working conditions that do not pose a risk of serious harm.
- Receive information and training (in a language and vocabulary the worker understands) about workplace hazards, methods to prevent them, and the OSHA standards that apply to their workplace.
- Review records of work-related injuries and illnesses.
- File a complaint asking OSHA to inspect their workplace if they believe there is a serious hazard or that their employer is not following OSHA's rules. OSHA will keep all identities confidential.
- Exercise their rights under the law without retaliation, including reporting an injury or raising health and safety concerns with their employer or OSHA. If a worker has been retaliated against for using their rights, they must file a complaint with OSHA as soon as possible, but no later than 30 days.

For additional information, see OSHA's Workers page.

How to Contact OSHA

Under the Occupational Safety and Health Act of 1970, employers are responsible for providing safe and healthful workplaces for their employees. OSHA's role is to ensure these conditions for America's working men and women by setting and enforcing standards, and providing training, education and assistance. For more information, visit www.osha.gov or call OSHA at 1-800-321-OSHA (6742), TTY 1-877-889-5627.

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

U.S. Department of Labor

OSHA® **Occupational Safety and Health Administration**

DSG FS-3629 12/2017

OSHA® FactSheet

CONTROL SILICA DUST
Breathe Easier

CONTROL OF SILICA DUST IN CONSTRUCTION

Handheld and Stand-Mounted Drills

The use of handheld and stand-mounted drills, impact and rotary hammer drills, and similar tools used to drill holes in concrete, masonry, or other silica-containing materials can generate *respirable crystalline silica* dust. When inhaled over time, the small particles of silica can irreversibly damage the lungs. This fact sheet describes dust controls that can be used to minimize the amount of airborne dust when using handheld and stand-mounted drills as listed in Table 1 of the Respirable Crystalline Silica Standard for Construction, 29 CFR 1926.1153.

Engineering Control Method: Vacuum Dust Collection System

Vacuum Dust Collection System (VDCS)

When using handheld or stand mounted drills to drill into concrete or other materials that contain crystalline silica, reduce exposure to silica dust by enclosing the drill in a commercially available shroud or cowling with a vacuum attached to capture the silica dust as it is generated around the drill bit.

A VDCS is commercially available in a variety of designs that include a dust collection device (shroud or cowling), vacuum, hose, filter, and filter-cleaning mechanism. These systems are typically available integrated into the tools or as add-on systems.

The VDCS must be equipped with a:

- Shroud or cowling sized to fit around the drill bit that is compatible with the manufacturer's vacuum system;
- Vacuum that is rated to provide the airflow recommended by the tool manufacturer or greater to remove dust at the drilling point; and
- Air filter with a 99 percent or greater efficiency and a filter cleaning mechanism.

The drill and VDCS must be operated and maintained in accordance with the manufacturer's instructions to minimize dust emissions. Focus on the following areas:

- **Keep** the vacuum hose clear and free of debris, kinks and tight bends.
- **Activate** any non-automatic filter-cleaning mechanism as needed to reduce dust buildup on the filter.
- **Change** vacuum-collection bags as needed.
- **Set** a schedule for filter cleaning and maintenance.
- **Avoid** exposure to dust when changing vacuum bags and cleaning or replacing air filters.

When necessary to clean the dust and debris from the drilled holes, a HEPA-filtered vacuum system must be used to capture the dust.

Photo courtesy of OSHA

Worker drilling into concrete with a rotary hammer equipped with a shroud and dust collection system.

Indoors or in Enclosed Areas

Using a VDCS indoors or in enclosed areas may not reliably keep silica exposures low, so extra ventilation may be needed to reduce visible airborne dust. Extra ventilation can be supplied by using:

- Exhaust trunks
- Portable exhaust fans
- Air ducts
- Other means of mechanical ventilation

Ensure air flow is not impeded by the movements of employees during work, or by the opening or closing of doors and windows. Position the ventilation to move contaminated air away from the workers' breathing zones.

Compressed Air. Unless there is a ventilation system that effectively captures the dust cloud, do not use compressed air or blowers to clean surfaces, clothing or filters because it can increase exposure to silica. Instead, clean with a HEPA-filter equipped vacuum or by wet methods.

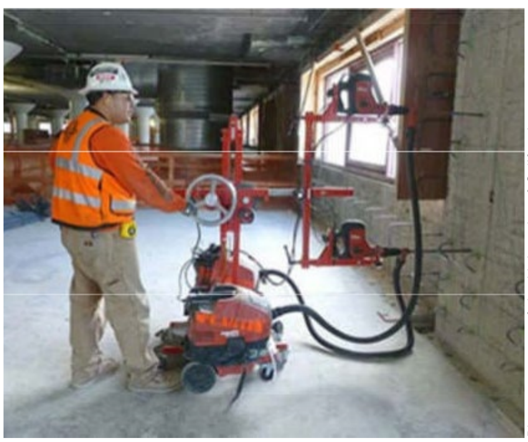


Photo courtesy of the University of California, Berkeley (D. Rempel)

Worker drilling horizontal holes in a concrete wall using two stand-mounted drills equipped with two dust collectors. Note that the shrouds around drill bits, black hose, and dust collector are attached conveniently to the stand.

Respiratory Protection

When properly used, a VDCS can reduce airborne dust levels to below the permissible exposure limit (PEL) of 50 μg/m^3, calculated as an 8-hour time-weighted average. Therefore, respiratory protection is not required when using drills equipped with a VDCS and a filter cleaning mechanism as specified earlier.

Additional Information

For more information, visit www.osha.gov/silica and see the OSHA Fact Sheet on the Crystalline Silica Rule for Construction, and the Small Entity Compliance Guide for the Respirable Crystalline Silica Standard for Construction.

OSHA can provide compliance assistance through a variety of programs, including technical assistance about effective safety and health programs, workplace consultations, and training and education. OSHA's On-Site Consultation Program offers free, confidential occupational safety and health services to small and medium-sized businesses in all states and several territories across the country, with priority given to high-hazard worksites. On-Site consultation services are separate from enforcement and do not result in penalties or citations. To locate the OSHA On-Site Consultation Program nearest you, visit www.osha.gov/consultation.

How to Contact OSHA

Under the Occupational Safety and Health Act of 1970, employers are responsible for providing safe and healthful workplaces for their employees. OSHA's role is to ensure these conditions for America's working men and women by setting and enforcing standards, and providing training, education and assistance. For more information, visit www.osha.gov or call OSHA at 1-800-321-OSHA (6742), TTY 1-877-889-5627.

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

U.S. Department of Labor

Occupational Safety and Health Administration

DSG FS-3630 12/2017

OSHA FactSheet

CONTROL SILICA DUST
Breathe Easier

CONTROL OF SILICA DUST IN CONSTRUCTION

Stationary Masonry Saws

Using a stationary masonry saw to cut bricks, concrete blocks, pavers, or other silica-containing materials can generate *respirable crystalline silica* dust. When inhaled over time, the small particles of silica can irreversibly damage the lungs. This fact sheet describes dust controls that can be used to minimize the amount of airborne dust when using stationary masonry saws as listed in Table 1 of the Respirable Crystalline Silica Standard for Construction, 29 CFR 1926.1153.

Engineering Control Method: Water applied continuously to the saw blade

Wet Cutting

When using a stationary masonry saw, wet cutting with an integrated water delivery system that continuously feeds water to the blade is an effective way to reduce exposure to silica dust. Many stationary masonry saws come equipped with a water basin that holds several gallons of water. A pump recirculates the water through a nozzle that directs a continuous stream onto the blade where it wets the material being cut and reduces the amount of dust generated.

Photo courtesy of OSHA

A worker cutting masonry block on a stationary masonry saw that continuously feeds water to the blade.

The saw must be operated and maintained in accordance with the manufacturer's instructions to minimize dust emissions. Focus on the following areas:

- **Check** that hoses are securely connected and are not cracked or broken.
- **Ensuring** that water flows at the rates recommended by the manufacturer. Water flow rates must be sufficient to minimize the release of visible dust.
- **Adjust** nozzles so that water goes to the blade and wets the cutting area.
- **Rinsing or replacing** water filters at recommended intervals.
- **Replace** basin water when it gets gritty or begins to silt up with dust.
- **Inspect** the saw blade before use to be sure it is in good condition and does not show excessive wear.

Indoors or in Enclosed Areas

Wet cutting indoors or in enclosed areas may not reliably keep silica exposures low, so extra ventilation or a means of exhaust may be needed to reduce visible airborne dust. Extra ventilation can be supplied by using:

- Exhaust trunks
- Portable exhaust fans
- Air ducts
- Other means of mechanical ventilation

Ensure air flow is not impeded by the movements of employees during work, or by the opening or closing of doors and windows. Position the ventilation to move contaminated air away from the workers' breathing zones.

Electrical Safety. Where water is used to control dust, electrical safety is a particular concern. Use ground-fault circuit interrupters (GFCIs) and watertight, sealable electrical connectors for electric tools and equipment on construction sites.

Vacuum Dust Collection System (VDCS)

Some stationary masonry saws come equipped with a VDCS to capture the dust generated when sawing. For situations in which wet methods are not feasible, employers using a VDCS to control the dust must conduct an exposure assessment and may need to take additional action.

Respiratory Protection

When properly used, wet methods can effectively control silica dust. Therefore, Table 1 in the silica standard does not require use of respiratory protection when using wet methods for stationary masonry saws.

For stationary saws used with a VDCS by employers not utilizing Table 1 control methods, respiratory protection may be required if exposure monitoring results indicate employee exposures above the permissible exposure limit (PEL) of 50 $\mu g/m^3$, calculated as an 8-hour time-weighted average. When using VDCS in these conditions, employers must put in place a written respiratory protection program in accordance with OSHA's Respiratory Protection standard 29 CFR 1910.134.

Additional Information

For more information, visit www.osha.gov/silica and see the OSHA Fact Sheet on the Crystalline Silica Rule for Construction, and the Small Entity Compliance Guide for the Respirable Crystalline Silica Standard for Construction.

OSHA can provide compliance assistance through a variety of programs, including technical assistance about effective safety and health programs, workplace consultations, and training and education. OSHA's On-Site Consultation Program offers free, confidential occupational safety and health services to small and medium-sized businesses in all states and several territories across the country, with priority given to high-hazard worksites. On-Site consultation services are separate from enforcement and do not result in penalties or citations. To locate the OSHA On-Site Consultation Program nearest you, visit www.osha.gov/consultation.

How to Contact OSHA

Under the Occupational Safety and Health Act of 1970, employers are responsible for providing safe and healthful workplaces for their employees. OSHA's role is to ensure these conditions for America's working men and women by setting and enforcing standards, and providing training, education and assistance. For more information, visit www.osha.gov or call OSHA at 1-800-321-OSHA (6742), TTY 1-877-889-5627.

U.S. Department of Labor

OSHA® Occupational Safety and Health Administration

DSG FS-3631 12/2017

OSHA® FactSheet

CONTROL SILICA DUST
Breathe Easier

CONTROL OF SILICA DUST IN CONSTRUCTION

Handheld Grinders for Mortar Removal (Tuckpointing)

The use of a handheld grinder to remove mortar when tuckpointing can generate *respirable crystalline silica* dust. When inhaled, the small particles of silica can irreversibly damage the lungs. This fact sheet describes control measures to minimize the amount of airborne dust when using handheld grinders to remove mortar between brick, stone, and concrete blocks as listed in Table 1 of the Respirable Crystalline Silica Standard for Construction, 29 CFR 1926.1153.

Engineering Control Method: Vacuum Dust Collection System

Vacuum Dust Collection System (VDCS)

A VDCS can be used to capture the dust generated when removing mortar with a handheld grinder. Employers can comply with Table 1 in the silica standard by using a:

- Commercially available shroud on the grinding wheel designed to fit the grinder and wheel size.
- Vacuum that provides at least 25 cubic feet per minute (cfm) of airflow per inch of blade to capture dust at the point of grinding and removing mortar. For example, a 5″ grinding wheel would require a rating of 125 cfm of air flow or more for effective capture.
- Vacuum equipped with a cyclonic pre-separator or filter- cleaning mechanism with a filter that has 99 percent or greater collection efficiency for respirable-sized particles.
- Vacuum exhaust hose capable of providing the airflow recommended by the tool manufacturer. A 1.5″ to 2″ diameter vacuum exhaust hose is typically adequate.

The grinder and dust collector must be operated and maintained in accordance with the manufacturer's instructions to minimize dust emissions. VDCSs are most effective when workers are properly trained and use good work practices, including:

- **Make sure to keep** the vacuum hose clear and free of debris, kinks, and tight bends.
- **Follow** the equipment manufacturer's directions on how to reduce dust buildup on the filter.
- **Change** vacuum-collection bags as needed. Do not overfill the bag.
- **Set** a regular schedule for maintenance and filter cleaning of the grinder and VDCS.
- **Avoid** exposure to dust when changing vacuum bags and cleaning or replacing air filters.

Photo courtesy of OSHA

Worker grinding mortar from between bricks (tuckpointing) with a handheld grinder equipped with a shroud and dust collection system using respiratory protection.

Proper handling of the handheld grinder is very important. Ensure the following occurs:

- **Place** one side of the shroud against the working surface before inserting the blade into the mortar joint. This directs the dust into the shroud as the blade cuts into the mortar joint.
- **Keep** the shroud tight against the working surface. This cuts down on dust that would otherwise escape from the collection system.
- **Move** the grinder counter to the direction of blade rotation to minimize escaping dust.
- **Back off** the cutting pressure of the blade a short distance before removing it from the slot so the vacuum can have enough time to clear any dust buildup.
- **Do not** move the grinder back and forth along the slot, as this will create a gap that increases dust escape. For better results, move the grinder in one direction, making a second pass only if necessary.
- **Use** only enough cutting force to operate the tool effectively and keep the leading tool edge flush against the working surface. Do not leave a large gap between the shroud and uncut mortar.

Use of Compressed Air. Unless there is a ventilation system that effectively captures the dust cloud, do not use compressed air or blowers to clean surfaces, clothing, or filters because it can increase exposure to silica. Instead, clean with a HEPA filter-equipped vacuum or by wet methods.

Indoors or in Enclosed Areas

Using a VDCS indoors or in an enclosed area may not reliably keep exposure low, so extra ventilation may be needed to reduce visible airborne dust. Extra ventilation can be supplied by using:

- Exhaust trunks
- Portable exhaust fans
- Air ducts
- Other means of mechanical ventilation

Photo courtesy of OSHA

Worker is showing a handheld grinder equipped with shroud.

Ensure air flow is not impeded by the movements of employees during work, or by the opening or closing of doors and windows. Position the ventilation to move contaminated air away from the workers' breathing zones.

Respiratory Protection

In addition to using a VDCS, respiratory protection with a minimum Assigned Protection Factor **(APF) of 10** is also required whenever a handheld grinder for mortar removal is **used for 4 hours or less** per shift. Respiratory protection with a minimum **APF of 25** is required whenever a handheld grinder for mortar removal is used for **more than 4 hours** per shift.

When respirators are required, employers must put in place a written respiratory protection program in accordance with OSHA's Respiratory Protection standard 29 CFR 1910.134.

Additional Information

For more information, visit www.osha.gov/silica and see the OSHA Fact Sheet on the Crystalline Silica Rule for Construction, and the Small Entity Compliance Guide for the Respirable Crystalline Silica Standard for Construction.

OSHA can provide compliance assistance through a variety of programs, including technical assistance about effective safety and health programs, workplace consultations, and training and education. OSHA's On-Site Consultation Program offers free, confidential occupational safety and health services to small and medium-sized businesses in all states and several territories across the country, with priority given to high-hazard worksites. On-Site consultation services are separate from enforcement and do not result in penalties or citations. To locate the OSHA On-Site Consultation Program nearest you, visit www.osha.gov/consultation.

Workers' Rights

Workers have the right to:

- Working conditions that do not pose a risk of serious harm.
- Receive information and training (in a language and vocabulary the worker understands) about workplace hazards, methods to prevent them, and the OSHA standards that apply to their workplace.
- Review records of work-related injuries and illnesses.
- File a complaint asking OSHA to inspect their workplace if they believe there is a serious hazard or that their employer is not following OSHA's rules. OSHA will keep all identities confidential.
- Exercise their rights under the law without retaliation, including reporting an injury or raising health and safety concerns with their employer or OSHA. If a worker has been retaliated against for using their rights, they must file a complaint with OSHA as soon as possible, but no later than 30 days.

For additional information, see OSHA's Workers page.

How to Contact OSHA

Under the Occupational Safety and Health Act of 1970, employers are responsible for providing safe and healthful workplaces for their employees. OSHA's role is to ensure these conditions for America's working men and women by setting and enforcing standards, and providing training, education and assistance. For more information, visit www.osha.gov or call OSHA at 1-800-321-OSHA (6742), TTY 1-877-889-5627.

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

U.S. Department of Labor

OSHA® **Occupational Safety and Health Administration**

DSG FS-3632 12/2017

OSHA FactSheet

CONTROL SILICA DUST
Breathe Easier

CONTROL OF SILICA DUST IN CONSTRUCTION

Walk-Behind Saws

Using a walk-behind saw to cut masonry, concrete, stone, or other silica-containing materials can generate *respirable crystalline silica* dust. When inhaled, the small particles of silica can irreversibly damage the lungs. This fact sheet describes dust controls that can be used to minimize the amount of dust that gets into the air when using walk-behind saws as listed in Table 1 of the Respirable Crystalline Silica Standard for Construction, 29 CFR 1926.1153.

Engineering Control Method: Water continuously fed to saw blade

Wet Cutting

Wet cutting is an effective method to reduce exposure to silica dust when using walk-behind saws equipped with an integrated water delivery system that directs a continuous stream of water onto the blade where it wets the material being cut and reduces the amount of dust generated. These saws have built-in water tanks, or water is supplied to the saw from a source such as a hose connected to a faucet or portable tank. Water flow rates must be sufficient to minimize the release of visible dust.

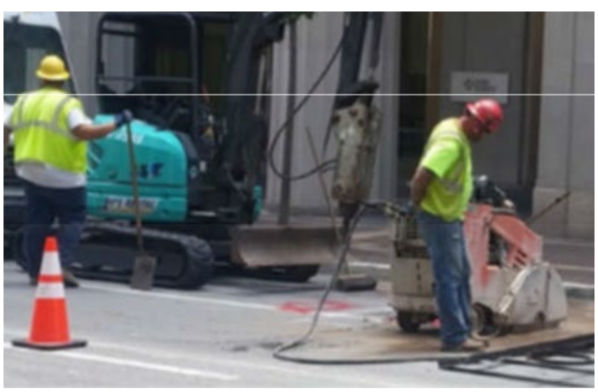


Photo courtesy of OSHA

Worker using a walk-behind saw with an integrated water delivery system to cut asphalt roadway.

The saw must be operated and maintained in accordance with manufacturer's instructions to minimize dust emissions. Focus on the following:

- **Check** that hoses are securely connected and are not cracked or broken.
- **Adjust** nozzles so that water goes to the blade and wets the cutting area.
- **Inspect** the saw blade before use to be sure it is in good condition and does not show excessive wear.

Clean up any slurry produced during wet cutting to prevent the slurry from drying and releasing silica dust into the air. Wet slurry can be cleaned up using, for example, shovels or a vacuum equipped with a HEPA filter.

Indoors or in Enclosed Spaces

Using wet methods indoors or in an enclosed area may not reliably keep exposure low, so extra ventilation may be needed to reduce visible airborne dust. Extra ventilation can be supplied by using:

- Exhaust trunks
- Portable exhaust fans
- Air ducts
- Other means of mechanical ventilation

Ensure air flow is not impeded by the movements of employees during work, or by the opening or closing of doors and windows. Position the ventilation to move contaminated air away from the workers' breathing zones.

Electrical Safety. Where water is used to control dust, electrical safety is a particular concern. Use ground-fault circuit interrupters (GFCIs) and watertight, sealable electrical connectors for electric tools and equipment on construction sites.

Respiratory Protection

When properly used outdoors, wet methods can effectively control silica dust. Therefore, Table 1 in the silica standard does not require use of respiratory protection when cutting with walk-behind saws using wet methods **outdoors.**

However, when wet cutting with walk-behind saws **indoors or in enclosed** areas, Table 1 requires the use of respiratory protection with a minimum Assigned Protection Factor **(APF) of 10.** When respirators are required, employers must put in place a written respiratory protection program in accordance with OSHA's Respiratory Protection standard 29 CFR 1910.134.

Additional Information

For more information, visit www.osha.gov/silica and see the OSHA Fact Sheet on the Crystalline Silica Rule for Construction, and the Small Entity Compliance Guide for the Respirable Crystalline Silica Standard for Construction.

OSHA can provide compliance assistance through a variety of programs, including technical assistance about effective safety and health programs, workplace consultations, and training and education. OSHA's On-Site Consultation Program offers free, confidential occupational safety and health services to small and medium-sized businesses in all states and several territories across the country, with priority given to high-hazard worksites. On-Site consultation services are separate from enforcement and do not result in penalties or citations. To locate the OSHA On-Site Consultation Program nearest you, visit www.osha.gov/consultation.

Workers' Rights

Workers have the right to:

- Working conditions that do not pose a risk of serious harm.
- Receive information and training (in a language and vocabulary the worker understands) about workplace hazards, methods to prevent them, and the OSHA standards that apply to their workplace.
- Review records of work-related injuries and illnesses.
- File a complaint asking OSHA to inspect their workplace if they believe there is a serious hazard or that their employer is not following OSHA's rules. OSHA will keep all identities confidential.
- Exercise their rights under the law without retaliation, including reporting an injury or raising health and safety concerns with their employer or OSHA. If a worker has been retaliated against for using their rights, they must file a complaint with OSHA as soon as possible, but no later than 30 days.

For additional information, see OSHA's Workers page.

How to Contact OSHA

Under the Occupational Safety and Health Act of 1970, employers are responsible for providing safe and healthful workplaces for their employees. OSHA's role is to ensure these conditions for America's working men and women by setting and enforcing standards, and providing training, education and assistance. For more information, visit www.osha.gov or call OSHA at 1-800-321-OSHA (6742), TTY 1-877-889-5627.

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

U.S. Department of Labor

OSHA® Occupational Safety and Health Administration

DSG FS-3633 12/2017

OSHA®

Occupational
Safety and Health
Administration

www.osha.gov

Construction Industry Digest

OSHA 2202-09R 2015

OSHA®
www.osha.gov

Occupational Safety and Health Act of 1970

"To assure safe and healthful working conditions for working men and women; by authorizing enforcement of the standards developed under the Act; by assisting and encouraging the States in their efforts to assure safe and healthful working conditions; by providing for research, information, education, and training in the field of occupational safety and health..."

This informational booklet is intended to provide an overview of frequently used OSHA standards in the Construction industry. This publication does not itself alter or determine compliance responsibilities, which are set forth in OSHA standards themselves and the *Occupational Safety and Health Act*.

Employers and employees in the 28 states and territories that operate their own OSHA-approved workplace safety and health plans should check with their state safety and health agency. Their state may be enforcing standards and other procedures that, while "at least as effective as" federal standards, are not always identical to the federal requirements. For more information on states with OSHA-approved state plans, please visit: www.osha.gov/dcsp/osp.

This information will be made available to sensory-impaired individuals upon request. Voice phone: (202) 693-1999; teletypewriter (TTY) number: 1-877-889-5627.

Construction Industry Digest

U.S. Department of Labor

Occupational Safety and Health Administration

OSHA 2202-09R
2015

U.S. Department of Labor

Contents

Foreword 7

General 8

OSHA Worksite Investigations 8

Frequently Used Standards in Construction 9

Access to Medical and Exposure Records 9

Aerial Lifts 9

Air Tools 10

Asbestos 10

Belt Sanding Machines 12

Chains (See Wire Ropes, Chains, and Ropes) 12

Chemicals (See Gases, Vapors, Fumes, Dusts, and Mists; Asbestos; Lead; Silica; and Hazard Communication) 12

Compressed Air, Use of 12

Compressed Gas Cylinders 12

Concrete and Masonry Construction 13

Confined Spaces 14

Cranes and Derricks 15

Demolition 16

Disposal Chutes 16

Diving 17

Drinking Water 18

Electrical Installations 18

Electrical Work Practices 19

Excavating and Trenching 20

Exits 22

Explosives and Blasting 22

Eye and Face Protection 23

Fall Protection 24

Fall Protection, Falling Objects 26

Fall Protection, Wall Openings 26

Fire Protection 26
Flaggers 27
Flammable and Combustible Liquids 28
Forklifts (See Powered Industrial Trucks) 29
Gases, Vapors, Fumes, Dusts, and Mists 29
General Duty Clause 30
Grinding 30
Hand Tools 31
Hazard Communication 31
Hazardous Waste Operations 33
Head Protection 33
Hearing Protection 34
Heating Devices, Temporary 35
Highway Work Zones (See Flaggers; Signs, Signals, and Barricades) 35
Hoists, Material and Personnel 35
Hooks (See Wire Ropes, Chains, and Ropes) 36
Housekeeping 36
Illumination 36
Jointers 37
Ladders 38
Lasers 39
Lead 40
Lift Slab 41
Liquefied Petroleum Gas 42
Medical Services and First Aid 42
Motor Vehicles and Mechanized Equipment 43
Noise (See Hearing Protection) 43
Personal Protective Equipment 43
Powder-Actuated Tools 44
Power Transmission and Distribution 44
Powered Industrial Trucks (Forklifts) 45

Power Transmission, Mechanical 45
Process Safety Management of Highly Hazardous Chemicals 46
Radiation, Ionizing 46
Railings 47
Recordkeeping: Recording and Reporting Requirements 47
Reinforced Steel 48
Respiratory Protection 48
Rollover Protective Structures (ROPS) 49
Safety Nets 49
Saws 50
Band 50
Portable Circular 50
Radial 50
Swing or Sliding Cut-Off 51
Table 51
Scaffolds, General Requirements 52
Bricklaying 53
Erectors and Dismantlers 53
Fall Arrest Systems 54
Guardrails 54
Mobile 55
Planking 55
Supported 56
Suspension (Swing) 56
Signs, Signals, and Barricades (See Flaggers) 58
Silica 58
Stairs 58
Steel Erection 60
Storage 62
Tire Cages 62
Toeboards 62
Toilets 62
Training and Inspections 63

Underground Construction 63
Washing Facilities 64
Water, Working Over or Near 64
Welding, Cutting, and Heating 65
Wire Ropes, Chains, and Ropes 66
Woodworking Machinery 67
Workplace Complaints: Workers' Rights 67
OSHA Assistance, Services and Programs 68
NIOSH Health Hazard Evaluation Program 73
How to Contact OSHA 73
OSHA Regional Offices 74
OSHA-Approved State Plans 76

Foreword

The Construction Industry Digest contains summaries of the most frequently used standards in the construction industry. The standards are presented alphabetically followed by the reference to the appropriate regulation. With few exceptions, standards in this digest are from *Title 29 of the Code of Federal Regulations (CFR)*, Part 1926.

Remember, this booklet is only a digest of basic applicable standards and should not be considered as a complete substitute for any provisions of the *Occupational Safety and Health Act of 1970* (OSH Act), or for any standards issued under the OSH Act. The requirements discussed in this publication are summarized and abbreviated. The actual source standards are referenced at the end of each topic discussed; consult the CFR for a more complete explanation of the specific standards listed.

General

Employers have the responsibility to provide a safe workplace. **Employers MUST provide their employees with a workplace that does not have serious hazards and follow all relevant OSHA safety and health standards**.

Employers must comply with specific standards. All employers in the construction industry must also have injury and illness prevention programs. Contractors and employers who do construction work must comply with standards in 29 CFR 1926. Subpart C, *General Safety and Health Provisions*, as well as other specific sections of these standards, include the responsibilities for each contractor/employer to initiate and maintain injury and illness prevention programs, provide for a competent person to conduct frequent and regular inspections, and instruct each employee to recognize and avoid unsafe conditions and know what regulations are applicable to the work environment. Employees must be provided training in a language and vocabulary they can understand.

OSHA Worksite Investigations

OSHA conducts on-site inspections of worksites to enforce the OSHA law that protects workers and their rights. Inspections are initiated without advance notice, conducted using on-site or telephone and facsimile investigations, and performed by highly trained compliance officers. Worksite inspections are conducted based on the following priorities:

- Imminent danger;
- A fatality or hospitalizations;
- Worker complaints and referrals;
- Targeted inspections – particular hazards, high injury rates; and
- Follow-up inspections.

Inspections are conducted without employers knowing when or where they will occur. The employer is not informed in advance that there will be an inspection, regardless of whether it is in response to a complaint or is a programmed inspection.

Frequently Used Standards in Construction

Access to Medical and Exposure Records

Each employer shall permit employees, their designated representatives, and OSHA direct access to employer-maintained exposure and medical records. The standard limits access only to those employees who are, have been (including former employees), or will be exposed to toxic substances or harmful physical agents. **1910.1020 made applicable to construction by 1926.33**

Each employer must preserve and maintain accurate medical and exposure records for each employee. Exposure records and data analyses based on them are to be kept for 30 years. Medical records are to be kept for at least the duration of employment plus 30 years. Background data for exposure records such as laboratory reports and work sheets need to be kept for only 1 year. **1910.1020(b)(3), .1020(d)(1)(i), and .1020(d)(1)(ii)**

Records of employees who have worked for less than 1 year need not be retained after employment if they are provided to the employee upon the termination of employment. First-aid records of one-time treatment need not be retained for any specified period. **1910.1020(d)(1)(i)(B) and (C)**

Aerial Lifts

Aerial lifts, powered or manual, include, but are not limited to, the following types of vehicle-mounted aerial devices used to elevate personnel to jobsites above ground: extensible boom platforms, aerial ladders, articulating boom platforms, and vertical towers. **1926.453(a)(1)**

When operating aerial lifts, employers must ensure that employees are

- Trained,
- Authorized,
- Setting brakes,
- Positioning outriggers on pads or a solid surface,
- Not exceeding boom and basket load limits,
- Attached to the boom or basket with a restraint device or personal fall arrest system,
- Standing firmly on the floor of the basket,
- Not climbing on the edge of the basket or using ladders, planks, or other devices for a work position. **1926.453(b) and 1926.454**

In addition, manufacturers (or the equivalent, such as a nationally recognized testing laboratory) must certify in writing that all modifications to aerial lifts conform to applicable OSHA and ANSI A92.2-1969 provisions, and are at least as safe as the equipment was before modification. **1926.453(a)(2)**

Air Tools

Pneumatic power tools shall be secured to the hose in a positive manner to prevent accidental disconnection. **1926.302(b)(1)**

Safety clips or retainers shall be securely installed and maintained on pneumatic impact tools to prevent attachments from being accidentally expelled. **1926.302(b)(2)**

The manufacturer's safe operating pressure for all fittings shall not be exceeded. **1926.302(b)(5)**

All hoses exceeding 1/2-inch (1.3-centimeters) inside diameter shall have a safety device at the source of supply or branch line to reduce pressure in case of hose failure. **1926.302(b)(7)**

Asbestos

Each employer who has a workplace or work operation where exposure monitoring is required must perform monitoring to determine accurately the airborne concentrations of asbestos to which employees may be exposed. **1926.1101(f)(1)(i)**

Employers also must ensure that no employee is exposed to an airborne concentration of asbestos in excess of 0.1 fiber per cubic centimeter of air (f/cc) as an 8-hour time-weighted average (TWA). **1926.1101(c)(1)**

In addition, employers must ensure that no employee is exposed to an airborne concentration of asbestos in excess of 1 f/cc as averaged over a sampling period of 30 minutes. **1926.1101(c)(2)**

Respirators must be used during (1) all Class I asbestos jobs; (2) all Class II work where an asbestos-containing material is not removed substantially intact; (3) all Class II and III work not using wet methods, except on sloped roofs; (4) all Class II and III work without a negative exposure assessment; (5) all Class III jobs where thermal system insulation or surfacing asbestos-containing or presumed asbestos-containing material is cut, abraded, or broken; (6) all Class IV work within a regulated area where respirators are required; (7) all work where employees are exposed above the PEL or STEL; and (8) in emergencies. **1926.1101(h)(1)(i) through (viii)**

The employer must provide and require the use of protective clothing – such as coveralls or similar whole-body clothing, head coverings, gloves, and foot coverings – for:

- Any employee exposed to airborne asbestos exceeding the PEL or STEL,
- Work without a negative exposure assessment, or
- Any employee performing Class I work involving the removal of over 25 linear or 10 square feet (10 square meters) of thermal system insulation or surfacing asbestos containing or presumed asbestos-containing materials. **1926.1101(i)(1)**

The employer must provide a medical surveillance program for all employees who – for a combined total of 30 or more days per year – engage in Class I, II, or III work or are exposed at or above the PEL or STEL; or who wear negative-pressure respirators. **1926.1101(m)(1)(i)**

Belt Sanding Machines

Belt sanding machines shall be provided with guards at each nip point where the sanding belt runs onto a pulley. **1926.304(f), incorporated from ANSI 01.1-1961, Section 4.9.4**

The unused run of the sanding belt shall be guarded against accidental contact. **1926.304(f), incorporated from ANSI 01.1-1961, Section 4.9.4**

Chains (See Wire Ropes, Chains, and Ropes)

Chemicals (See Gases, Vapors, Fumes, Dusts, and Mists; Asbestos; Lead; Silica; and Hazard Communication)

Compressed Air, Use of

Compressed air used for cleaning purposes shall be reduced to less than 30 pounds per square inch (psi) and then only with effective chip guarding and personal protective equipment. This requirement does not apply to concrete form, mill scale, and similar cleaning operations. **1926.302(b)(4)**

Compressed Gas Cylinders

Valve protection caps shall be in place and secured when compressed gas cylinders are transported, moved, or stored. **1926.350(a)(1)**

Cylinder valves shall be closed when work is finished and when cylinders are empty or are moved. **1926.350(a)(8)**

Compressed gas cylinders shall be secured in an upright position at all times, except if necessary for short periods of time when cylinders are actually being hoisted or carried. **1926.350(a)(9)**

Cylinders shall be kept far enough away from the actual welding or cutting operations so that sparks, hot slag, or flame will not reach them.

When this is impractical, fire-resistant shields shall be provided. Cylinders shall be placed where they cannot become part of an electrical circuit. **1926.350(b)(1) through (2)**

Oxygen and fuel gas pressure regulators, including their related gauges, shall be in proper working order while in use. **1926.350(h)**

Concrete and Masonry Construction

No construction loads shall be placed on a concrete structure or portion of a concrete structure unless the employer determines, based on information received from a person who is qualified in structural design, that the structure or portion of the structure is capable of supporting the loads. **1926.701(a)**

No employee shall be permitted to work under concrete buckets while buckets are being elevated or lowered into position. **1926.701(e)(1)**

To the extent practical, elevated concrete buckets shall be routed so that no employee or the fewest number of employees is exposed to the hazards associated with falling concrete buckets. **1926.701(e)(2)**

Formwork shall be designed, fabricated, erected, supported, braced, and maintained so that it is capable of supporting – without failure – all vertical and lateral loads that may reasonably be anticipated to be applied to the formwork. **1926.703(a)(1)**

Forms and shores (except those used for slabs on grade and slip forms) shall not be removed until the employer determines that the concrete has gained sufficient strength to support its weight and superimposed loads. Such determination shall be based on compliance with one of the following:

- The plans and specifications stipulate conditions for removal of forms and shores, and such conditions have been followed, or
- The concrete has been properly tested with an appropriate American Society for Testing Materials (ASTM) standard test method designed

to indicate the concrete compressive strength, and the test results indicate that the concrete has gained sufficient strength to support its weight and superimposed loads. (ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428; (610) 832-9585). **1926.703(e)(1)(i) through (ii)**

A limited access zone shall be established whenever a masonry wall is being constructed. The limited access zone shall conform to the following:

- Established prior to the start of construction of the wall,
- Equal to the height of the wall to be constructed plus 4 feet (1.2 meters), and shall run the entire length of the wall,
- Established on the side of the wall that will be unscaffolded,
- Restricted to entry by employees actively engaged in constructing the wall. No other employees shall be permitted to enter the zone,
- Remain in place until the wall is adequately supported to prevent overturning and to prevent collapse; where the height of a wall is more than 8 feet (2.4 meters), the limited access zone shall remain in place until the requirements of paragraph (b) of this section have been met. **1926.706(a)(1) through (5)**

All masonry walls more than 8 feet (2.4384 meters) in height shall be adequately braced to prevent overturning and to prevent collapse unless the wall is adequately supported so that it will not overturn or collapse. The bracing shall remain in place until permanent supporting elements of the structure are in place. **1926.706(b)**

Confined Spaces

All employees required to enter into confined or enclosed spaces must be instructed as to the nature of the hazards involved, the necessary precautions to be taken, and in the use of required protective and emergency equipment.

The employer shall comply with any specific regulations that apply to work in dangerous or potentially dangerous areas. Confined or enclosed spaces include, but are not limited to, storage tanks, process vessels, bins, boilers, ventilation or exhaust ducts, sewers, underground utility vaults, tunnels, pipelines, and open top spaces more than 4 feet deep (1.2 meters) such as pits, tubs, vaults, and vessels. **1926.21(b)(6)(i) through (ii)**

Cranes and Derricks

Before assembly or use of a crane, ground conditions must be firm, drained, and graded so that the equipment manufacturer's specifications for adequate support and degree of level are met. **1926.1402(b)**

A competent person must begin a visual inspection prior to each shift during which the equipment will be used, which must be completed before or during the shift. The inspection must consist of observation for apparent deficiencies. **1926.1412(d)(1)**

A qualified person must conduct a comprehensive inspection at least every 12 months. **1926.1412(f)(1)**

The employer must comply with all manufacturer procedures applicable to the operational functions of equipment, including its use with attachments. **1926.1417(a)**

Hand signal charts must be either posted on the equipment or conspicuously posted in the vicinity of the hoisting operations. **1926.1422**

A personal fall arrest system is permitted to be anchored to the crane/derrick's hook (or other part of the load line) where a qualified person has determined the set-up and rated capacity of the crane/derrick (including the hook, load line, and rigging) meets or exceeds the requirements in §1926.502(d)(15) and no load is suspended from the load line when the personal fall arrest system is anchored to the crane/derrick's hook (or other part of the load line). The equipment operator must be at the work site and know the equipment is being used for this purpose. **1926.1423(j)**

Where available, hoisting routes that minimize the exposure of employees to hoisted loads must be used, to the extent consistent with public safety. **1926.1425(a)**

The employer must ensure that, prior to operating any equipment covered under Subpart CC, the person operating the equipment is qualified or certified to operate the equipment. Exceptions: operation of derricks, sideboom cranes, and equipment with a rated hoisting/lifting capacity of 2,000 pounds or less. **1926.1427(a)(1) through (3)**

On equipment with a rated hoisting/lifting capacity of 2,000 pounds or less the employer must train each operator, prior to operating the equipment, on the safe operation of the type of equipment the operator will be using. **1926.1441(e)**

Demolition

Prior to permitting employees to start demolition operations, a competent person shall make an engineering survey of the structure to determine the condition of the framing, floors, and walls, and possibility of unplanned collapse of any portion of the structure. A similar survey of any adjacent structure where employees may be exposed shall be completed. The employer shall have in writing evidence that such a survey has been performed. **1926.850(a)**

During balling or claiming operations, employers shall not permit any workers in any area that can be adversely affected by demolition operations. Only those workers necessary for the performance of the operations shall be permitted in this area at any other time. **1926.859(a)**

Disposal Chutes

Whenever materials are dropped more than 20 feet (6 meters) to any exterior point of a building, an enclosed chute shall be used. **1926.252(a)**

When debris is dropped through holes in the floor without the use of chutes, the area where the material is dropped shall be enclosed with barricades not less than 42 inches high (106.7 centimeters) and not less than 6 feet (1.8 meters) back from the projected edges of the opening above. Warning signs of the hazard of falling material shall be posted at each level. **1926.252(b)**

Note: During demolition, **1926.852** applies to chutes and **1926.853** applies to the removal of materials through floor openings.

Diving

The employer shall develop and maintain a safe practice manual, and make it available at the dive location for each dive team member. **1910.420(a) made applicable to construction by 1926.1080**

The employer shall keep a record of each dive. The record shall contain the diver's name, his or her supervisor's name, date, time, location, type of dive (scuba, mixed gas, surface supply), underwater and surface conditions, and maximum depth and bottom time. **1910.423(d)(1)(i) through (vi) made applicable to construction by 1926.1083**

Each dive team member shall have the experience or training necessary to perform assigned tasks safely. **1910.410(a)(1) made applicable to construction by 1926.1076**

Each dive team member shall be briefed on the tasks, safety procedures, unusual hazards or environmental conditions, and modifications made to the operating procedures. **1910.421(f) made applicable to construction by 1926.1081**

The dive shall be terminated when a diver requests it, the diver fails to respond correctly, communication is lost, or when the diver begins to use the reserve breathing gas. **1910.422(i)(1) through (4) made applicable to construction by 1926.1082.**

Drinking Water

An adequate supply of potable water shall be provided in all places of employment. **1926.51(a)(1)**

Portable drinking water containers shall be capable of being tightly closed and equipped with a tap. **1926.51(a)(2)**

Using a common drinking cup is prohibited. **1926.51(a)(4)**

Where single service cups (to be used but once) are supplied, both a sanitary container for unused cups and a receptacle for used cups shall be provided. **1926.51(a)(5)**

Electrical Installations

Employers must provide either ground-fault circuit interrupters (GFCIs) or an assured equipment grounding conductor program to protect employees from ground-fault hazards at construction sites. The two options are detailed below.

- All 120-volt, single-phase, 15- and 20-ampere receptacles that are not part of the permanent wiring must be protected by GFCIs. Receptacles on smaller generators are exempt under certain conditions, or
- An assured equipment grounding conductor program covering extension cords, receptacles, and cord- and plug-connected equipment must be implemented. The program must include the following:
- A written description of the program,
- At least one competent person to implement the program,
- Daily visual inspections of extension cords and cord- and plug-connected equipment for defects. Equipment found damaged or defective shall not be used until repaired,
- Continuity tests of the equipment grounding conductors or receptacles, extension cords, and cord- and plug-connected equipment. These tests must generally be made every 3 months,

- Equipment that does not meet the above requirements may not be used,
- Required tests shall be recorded. **1926.404(b)(1)(i) through (iii)(e)**

Light bulbs for general illumination must be protected from breakage, and metal shell sockets must be grounded. **1926.405(a)(2)(ii)(E)**

Temporary lights must not be suspended by their cords, unless they are so designed. **1926.405(a)(2)(ii)(F)**

Portable lighting used in wet or conductive locations, such as drums, tanks, and vessels, must be operated at no more than 12 volts or must be protected by a ground-fault circuit interrupter (GFCI). **1926.405(a)(2)(ii)(G)**

Extension cords must be of the three-wire type. Extension cords and flexible cords used with temporary and portable lights must be designed for hard or extra hard usage (for example, types S, ST, and SO). **1926.405(a)(2)(ii)(J)**

Flexible cords must be connected to devices and fittings so that strain relief is provided which will prevent pull from being directly transmitted to joints or terminal screws. **1926.405(g)(2)(iv)**

Listed, labeled, or certified equipment shall be installed and used in accordance with instructions included in the listing, labeling, or certification. **1926.403(b)(2)**

Electrical Work Practices

Employers must not allow employees to work near live parts of electrical circuits, unless the employees are protected by one of the following means:

- Deenergizing and grounding the parts,
- Guarding the part by insulation,
- Any other effective means. **1926.416(a)(1)**

In work areas where the exact location of underground electrical power lines is unknown, employees using jack hammers, bars, or other hand tools that may contact the lines must be protected by insulating gloves. **1926.416(a)(2)**

Barriers or other means of guarding must be used to ensure that workspace for electrical equipment will not be used as a passageway during periods when energized parts of equipment are exposed. **1926.416(b)(1)**

Work spaces, walkways, and similar locations shall be kept clear of cords. **1926.416(b)(2)**

Worn or frayed electric cords or cables shall not be used. **1926.416(e)(1)**

Extension cords shall not be fastened with staples, hung from nails, or suspended by wire. **1926.416(e)(2)**

Equipment or circuits that are deenergized must be rendered inoperative and must have tags attached at all points where the equipment or circuits could be energized. **1926.417(b)**

Excavating and Trenching

The estimated location of utility installations – such as sewer, telephone, fuel, electric, water lines, or any other underground installations that reasonably may be expected to be encountered during excavation work – shall be determined prior to opening an excavation. **1926.651(b)(1)**

Utility companies or owners shall be contacted within established or customary local response times, advised of the proposed work, and asked to establish the location of the utility underground installations prior to the start of actual excavation. When utility companies or owners cannot respond to a request to locate underground utility installations within 24 hours (unless a longer period is required by state or local law), or cannot establish the exact location of these installations, the employer may proceed, provided the employer does so with caution, and provided detection equipment or other acceptable means to locate utility installations are used. **1926.651(b)(2)**

When excavation operations approach the estimated location of underground installations, the exact location of the installations shall be determined by safe and acceptable means. While the excavation is open, underground installations shall be protected, supported, or removed, as necessary, to safeguard employees. **1926.651(b)(3) through (4)**

Each employee in an excavation shall be protected from cave-ins by an adequate protective system except when excavations are made entirely in stable rock, or excavations are less than 5 feet (1.5 meters) in depth and examination of the ground by a competent person provides no indication of a potential cave-in. **1926.652(a)(1)(i) through (ii)**

Protective systems shall have the capacity to resist, without failure, all loads that are intended or could reasonably be expected to be applied or transmitted to the system. **1926.652(a)(2)**

Employees shall be protected from excavated or other materials or equipment that could pose a hazard by falling or rolling into excavations. Protection shall be provided by placing and keeping such materials or equipment at least 2 feet (0.6 meters) from the edge of excavations, or by the use of retaining devices that are sufficient to prevent materials or equipment from falling or rolling into excavations, or by a combination of both if necessary. **1926.651(j)(2)**

Daily inspections of excavations, the adjacent areas, and protective systems shall be made by a competent person for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection shall be conducted by the competent person prior to the start of work and as needed throughout the shift. Inspections shall also be made after every rainstorm or other hazard-increasing occurrence. These inspections are only required when employee exposure can be reasonably anticipated. **1926.651(k)(1)**

Where a competent person finds evidence of a situation that could result in a possible cave-in, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions, exposed employees shall be removed from the hazardous area until the necessary precautions have been taken to ensure their safety. **1926.651(k)(2)**

A stairway, ladder, ramp, or other safe means of egress shall be located in trench excavations that are 4 feet (1.2 meters) or more in depth so as to require no more than 25 feet (7.6 meters) of lateral travel for employees. **1926.651(c)(2)**

Each employee at the edge of an excavation 6 feet deep (1.8 meters) or more in depth shall be protected from falling by guardrail systems, fences, barricades when the excavations are not readily seen because of plant growth or other visual barrier. **1926.501(b)(7)(i)**

Exits

Exits must be free of all obstructions so they can be used immediately in case of fire or emergency. **1926.34(c)**

Explosives and Blasting

Only authorized and qualified persons shall be permitted to handle and use explosives. **1926.900(a)**

Explosives and related materials shall be stored in approved facilities required under the applicable provisions of the Bureau of Alcohol, Tobacco and Firearms regulations contained in 27 CFR Part 55, Commerce in Explosives. (See Subpart K.) **1926.904(a)**

Smoking and open flames shall not be permitted within 50 feet (15.2 meters) of explosives and detonator storage magazines. **1926.904(c)**
Procedures that permit safe and efficient loading shall be established before loading is started. **1926.905(a)**

Eye and Face Protection

Eye and face protection shall be provided when machines or operations present potential for eye or face injury. **1926.102(a)(1)**

Eye and face protective equipment shall meet the requirements of ANSI Z87.1-1968, *Practice for Occupational and Educational Eye and Face Protection*. **1926.102(a)(2)**

Employees involved in welding operations shall be furnished with filter lenses or plates of at least the proper shade number as indicated in Table E-2. **1926.102(b)(1)**

Table E-2 – Filter Lens Shade Numbers for Protection Against Radiant Energy – 1926.102(b)(1)

Welding operation	Shade Number
Shielded metal-arc welding 1/16-, 3/32-, 1/8-, 5/32-inch diameter electrodes	10
Gas-shielded arc welding (nonferrous) 1/16-, 3/32-, 1/8-, 5/32-inch diameter electrodes	11
Gas-shielded arc welding (nonferrous) 1/16-, 3/32-, 1/8-, 5/32-inch diameter electrodes	12
Shielded metal-arc welding 3/16-, 7/32-, 1/4-inch diameter electrodes	12
5/16-, 3/8-inch diameter electrodes	14
Atomic hydrogen welding	10-14
Carbon-arc welding	14
Soldering	2
Torch brazing	3 or 4
Medium cutting, 1 inch to 6 inches	4 or 5
Heavy cutting, over 6 inches	5 or 6
Gas welding (light), up to 1/8-inch	4 or 5
Gas welding (medium), 1/8- to 1/2-inch	5 or 6
Gas welding (heavy), over 1/2-inch	6 or 8

Employees exposed to laser beams shall be furnished suitable laser safety goggles that will protect for the specific wave length of the laser and the optical density adequate for the energy involved. **1926.102(b)(2)(i)**

Fall Protection

Employers are required to assess the workplace to determine if the walking/working surface on which employees are to work have the strength and structural integrity to safely support workers. Employees are not permitted to work on those surfaces until it has been determined that the surfaces have the requisite strength and structural integrity to support the workers. **1926.501(a)(2)**

Where employees are exposed to falling 6 feet (1.8 meters) or more from an unprotected side or edge, the employer must select either a guardrail system, safety net system, or personal fall arrest system to protect the worker. **1926.501(b)(1)**

A personal fall arrest system consists of an anchorage, connectors, body harness and may include a lanyard, deceleration device, lifeline, or a suitable combination of these. Body belts used for fall arrests are prohibited. 1**926.500(b) and 1926.502(d)**

Each employee in a hoist area shall be protected from falling 6 feet (1.8 meters) or more by guardrail systems or personal fall arrest systems. If guardrail systems (or chain gate or guardrail) or portions thereof must be removed to facilitate hoisting operations, as during the landing of materials, and a worker must lean through the access opening or out over the edge of the access opening to receive or guide equipment and materials, that employee must be protected by a personal fall arrest system. **1926.501(b)(3)**

Each employee on walking/working surfaces shall be protected from falling through holes (including skylights) more than 6 feet (1.8 m) above lower levels, by personal fall arrest systems, covers, or guardrail systems erected around such holes. **1926.501(b)(4)(i)**

Each employee on ramps, runways, and other walkways shall be protected from falling 6 feet or more to lower levels by guardrail systems. **1926.501(b)(6)**

Each employee at the edge of an excavation 6 feet deep (1.8 meters) or more in depth shall be protected from falling by guardrail systems, fences, barricades when the excavations are not readily seen because of a visual barrier. **1926.501(b)(7)(i)**

Each employee at the edge of a well, pit, shaft, and similar excavation 6 feet (1.8 meters) or more in depth shall be protected from falling by guardrail systems, fences, barricades, or covers. **1926.501(b)(7)(ii)**

Each employee performing overhand bricklaying and related work 6 feet (1.8 meters) or more above lower levels, on surfaces other than scaffolds, shall be protected by guardrail systems, safety net systems, or personal fall arrest systems, or shall work in a controlled access zone. All employees reaching more than 10 inches (25.4 centimeters) below the level of a walking/working surface on which they are working shall be protected by a guardrail system, safety net system, or personal fall arrest systems. **1926.501(b)(9)**

Each employee engaged in roofing activities on low-slope roofs with unprotected sides and edges 6 feet (1.8 meters) or more above lower levels shall be protected from falling by guardrail, safety net, or personal fall arrest systems or a combination of a:

- Warning line system and guardrail system,
- Warning line system and safety net system,
- Warning line system and personal fall arrest system, or
- Warning line system and safety monitoring system.

On low-slope roofs 50 feet (15.2 meters) or less in width, the use of a safety monitoring system without a warning line system is permitted. **1926.501(b)(10)**

Each employee on a steep roof with unprotected sides and edges 6 feet (1.8 meters) or more above lower levels shall be protected by guardrail systems with toeboards, safety net systems, or personal fall arrest systems. **1926.501(b)(11)**

Fall Protection, Falling Objects

When an employee is exposed to falling objects, the employer must ensure that each employee wear a hard hat and erect toeboards, screens, or guardrail systems; or erect a canopy structure and keep potential fall objects far enough from the edge of the higher level; or barricade the area to which objects could fall. **1926.501(c)(1) and (2)**

Fall Protection, Wall Openings

Each employee working on, at, above, or near wall openings (including those with chutes attached) where the outside bottom edge of the wall opening is 6 feet (1.8 meters) or more above lower levels and the inside bottom edge of the wall opening is less than 39 inches (1 meter) above the walking/working surface must be protected from falling by the use of a guardrail system, a safety net system, or a personal fall arrest system. **1926.501(b)(14)**

Fire Protection

A fire protection program is to be followed throughout all phases of the construction and demolition work involved. It shall provide for effective firefighting equipment to be available without delay, and designed to effectively meet all fire hazards as they occur. **1926.150(a)(1)**

Firefighting equipment shall be conspicuously located and readily accessible at all times, be periodically inspected, and be maintained in operating condition. **1926.150(a)(2) to (4)**

A fire extinguisher, rated not less than 2A (acceptable substitutes are a 1/2-inch diameter garden-type hose not to exceed 100 feet capable of discharging a minimum of 5 gallons per minute or a 55-gallon drum of water with two fire pails), shall be provided for each 3,000 square feet (270 square meters) of the protected building area, or major fraction thereof. Travel distance from any point of the protected area to the nearest fire extinguisher shall not exceed 100 feet (30.5 meters). **1926.150(c)(1)(i) to (iii)**

The employer shall establish an alarm system at the worksite so that employees and the local fire department can be alerted for an emergency. **1926.150(e)(1)**

Flaggers

High-visibility clothing

For daytime work, the flagger's vest, shirt, or jacket shall be orange, yellow, strong yellow-green or fluorescent versions of these colors. For nighttime work, similar outside garments shall be retroreflective. The retroreflective material shall be orange, yellow, white, silver, strong yellow-green, or a fluorescent version of one of these colors and shall be visible at a minimum distance of 1,000 feet. The retroreflective clothing shall be designed to identify clearly the wearer as a person and be visible through the full range of body motions. ***Part VI of the Manual on Uniform Traffic Control Devices* made applicable to construction by 1926.201(a) and 1926.200(g)(2)**

Hand-signaling procedures

The STOP/SLOW paddle, which gives drivers more positive guidance than red flags, should be the primary hand-signaling device. Flag use should be limited to emergencies and at low-speed and/or low-volume locations that can best be controlled by a single flagger.

The following methods of signaling with STOP/SLOW paddles should be used:

- To Stop Traffic – The flagger shall face traffic and extend the STOP sign paddle in a stationary position with the arm extended horizontally away from the body. The free arm should be raised with the palm toward approaching traffic.
- To Direct Stopped Traffic to Proceed – The flagger shall face traffic with the SLOW paddle held in a stationary position with the arm extended horizontally away from the body. The flagger should motion with the free hand for traffic to proceed.

- To Alert or Slow Traffic – The flagger shall face traffic with the SLOW sign paddle held in a stationary position with the arm extended horizontally away from the body. The flagger may motion up and down with the free hand, palm down, indicating that the vehicle should slow down.

The following methods of signaling with a flag should be used:

- To Stop Traffic – The flagger shall face traffic and extend the flag staff horizontally across the traffic lane in a stationary position, so that the full area of the flag is visible hanging below the staff. The free arm should be raised with the palm toward approaching traffic.
- To Direct Stopped Traffic to Proceed – The flagger shall face traffic with the flag and arm lowered from view of the driver. With the free hand, the flagger should motion traffic to proceed. Flags shall not be used to signal traffic to proceed.
- To Alert or Slow Traffic – The flagger shall face traffic and slowly wave the flag in a sweeping motion of the extended arm from shoulder level to straight down, without raising the arm above a horizontal position.

Flammable and Combustible Liquids

Only approved containers and portable tanks shall be used for storing and handling flammable and combustible liquids. **1926.152(a)(1)**

No more than 25 gallons (94.7 liters) of flammable or combustible liquids shall be stored in a room outside of an approved storage cabinet. No more than three storage cabinets may be located in a single storage area. **1926.152(b)(1) and (3)**

Inside storage rooms for flammable and combustible liquids shall be of fire-resistant construction, have self-closing fire doors at all openings, 4-inch (10 centimeter) sills or depressed floors, a ventilation system that provides at least six air changes within the room per hour, and electrical wiring and equipment approved for Class 1, Division 1 locations. **1926.152(b)(4)**

Storage in containers outside buildings shall not exceed 1,100 gallons (4,169 liters) in any one pile or area. The storage area shall be graded to divert possible spills away from buildings or other exposures, or shall be surrounded by a curb or dike. **1926.152(c)(1) and (3)**

Outdoor portable tanks shall be located at least 20 feet (6 meters) from any building. **1926.152(c)(4)(i)**

Storage areas shall be free from weeds, debris, and other combustible materials not necessary to the storage. **1926.152(c)(5)**

Flammable liquids shall be kept in closed containers when not actually in use. **1926.152(f)(1)**

Conspicuous and legible signs prohibiting smoking shall be posted in service and refueling areas. **1926.152(g)(9)**

Forklifts (See Powered Industrial Trucks)

Gases, Vapors, Fumes, Dusts, and Mists

Exposure to toxic gases, vapors, fumes, dusts, and mists at a concentration above those specified in Appendix A, shall be avoided. **1926.55(a) and 1926.55 Appendix A**

Administrative or engineering controls must be implemented whenever feasible to comply with Threshold Limit Values. When engineering and administrative controls are not feasible to achieve full compliance, protective equipment or other protective measures shall be used to keep the exposure of employees to air contaminants within the limits prescribed. Any equipment and technical measures used for this purpose must first be approved for each particular use by a competent industrial hygienist or other technically qualified person. Whenever respirators are used, their use shall comply with 1910.134, made applicable to construction by **1926.103. 1926.55(b)**

General Duty Clause

Hazardous conditions or practices not covered in an OSHA standard may be covered under Section 5(a)(1) of the *Occupational Safety and Health Act of 1970*, which states: "Each employer shall furnish to each of his employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees."

Grinding

All abrasive wheel bench and stand grinders shall be equipped with safety guards that cover the spindle ends, nut and flange projections, and are strong enough to withstand the effects of a bursting wheel. **1926.303(b)(1), (2), and (c)(1)**

An adjustable work rest of rigid construction shall be used on floor and bench-mounted grinders, with the work rest kept adjusted to a clearance not to exceed 1/8-inch (0.3 centimeters) between the work rest and the surface of the wheel. **1926.303(c)(2)**

All abrasive wheels shall be closely inspected and ring-tested before mounting to ensure that they are free from cracks or other defects. **1926.303(c)(7)**

Portable abrasive wheel tools used for external grinding shall be provided with safety guards, except when the wheels are 2 inches (5 centimeters) or less in diameter or the work location makes it impossible (then a wheel equipped with safety flanges shall be used). **1926.303(c)(3)**

Portable abrasive wheel tools used for internal grinding shall be provided with safety flanges, except when the wheels are 2 inches (5 centimeters) or less in diameter or the wheel is entirely inside the work. **1926.303(c)(4)**

Hand Tools

All hand and power tools and similar equipment, whether furnished by the employer or employee, shall be maintained in a safe condition. Employers shall not issue or permit the use of unsafe hand tools. **1926.300(a) and 1926.301(a)**

Wrenches shall not be used when jaws are sprung to the point that slippage occurs. Impact tools shall be kept free of mushroomed heads. The wooden handles of tools shall be kept free of splinters or cracks and shall be kept tight in the tool. **1926.301(b) through (d)**

Electric power operated tools shall either be approved double-insulated, or be properly grounded in accordance with Subpart K of the standard. **1926.302(a)(1)**

Hazard Communication

Employers shall develop, implement, and maintain at the workplace a written hazard communication program for their workplaces. Employers must inform their employees of the availability of the program, including the required list(s) of hazardous chemicals, and material safety data sheets required. **1910.1200(e)(1) and (e)(4) made applicable to construction by 1926.59**

The chemical manufacturer, importer, or distributor shall ensure that each container of hazardous chemicals leaving the workplace is labeled, tagged, or marked with the identity of the hazardous chemical(s), the appropriate hazard warnings, and the name and address of the chemical manufacturer, importer, or other responsible party. **1910.1200(f)(1) made applicable to construction by 1926.59**

The employer shall ensure that each container of hazardous chemicals in the workplace is labeled, tagged or marked with the following information:

- Identity of the hazardous chemical(s) contained therein, and

- Appropriate hazard warnings, or alternatively, words, pictures, symbols, or combination thereof, which provide at least general information regarding the hazards of the chemicals, and which, in conjunction with the other information immediately available to employees under the hazard communication program, will provide employees with specific information regarding the physical and health hazards of the hazardous chemical. **1910.1200(f)(5) made applicable to construction by 1926.59**

Chemical manufacturers and importers shall obtain or develop a material safety data sheet for each hazardous chemical they produce or import. Employers shall have a material safety data sheet for each hazardous chemical they use. **1910.1200(g)(1) made applicable to construction by 1926.59**

Employers shall provide employees with information and training on hazardous chemicals in their work area at the time of their initial assignment, and whenever a new hazard is introduced into their work area. Employers shall also provide employees with information on any operations in their work area where hazardous chemicals are present, and the location and availability of the written hazard communication program, including the required list(s) of hazardous chemicals, and material safety data sheets required by the standard. **1910.1200(h)(1) and (2)(i) through (iii) made applicable to construction by 1926.59**

Employers who produce, use, or store hazardous chemicals at multi-employer workplaces shall additionally ensure that their hazard communication program includes the methods the employer will use to provide other employer(s) with a copy of the material safety data sheet for hazardous chemicals which employees of other employer(s) may be exposed to while working; the methods the employer will use to inform other employer(s) of any precautionary measures for the protection of employees; and the methods the employer will use to inform the other employer(s) of the labeling system used in the workplace. **1910.1200(e)(2) made applicable to construction by 1926.59**

Hazardous Waste Operations

Employers must develop and implement a written safety and health program for employees involved in hazardous waste operations. At a minimum, the program shall have an organizational structure, a comprehensive workplan, standard operating procedures, a site specific safety and health plan (which need not repeat the standard operating procedures), the training program, and medical surveillance program. **1926.65(b)(1)**

A site control program also shall be developed and shall include, at a minimum, a map, work zones, buddy systems, site communications – including alerting means for emergencies – standard operating procedures or safe work practices, and identification of the nearest medical assistance. **1926.65(d)(3)**

Training must be provided for all site employees, their supervisors, and management who are exposed to health or safety hazards before they are permitted to engage in hazardous waste operations. **1926.65(e)(1)(i)**

Head Protection

Head protective equipment (helmets) shall be worn in areas where there is a possible danger of head injuries from impact, flying or falling objects, or electrical shock and burns. **1926.100(a)**

Helmets for protection against impact and penetration of falling and flying objects shall meet the requirements of ANSI Z89.1-1969. Helmets for protection against electrical shock and burns shall meet the requirements of ANSI Z89.2-1971. **1926.100(b) and (c)**

Hearing Protection

Feasible engineering or administrative controls shall be utilized to protect employees against sound levels in excess of those shown in Table D-2.

When engineering or administrative controls fail to reduce sound levels within the limits of Table D-2, ear protective devices shall be provided and used. **1926.52(b) and .101(a)**

Plain cotton is not an acceptable protective device. **1926.101(c)**

In all cases where the sound levels exceed the values shown in Table D-2, a continuing, effective hearing conservation program shall be administered. **1926.52(d)(1)**

OSHA considers the following topics to be valuable in a hearing conservation program:

- Monitoring employee noise exposures (to determine if sound levels exceed those shown in **1926.52** Table D-2 at the right),
- Using engineering, work practice and administrative controls, and personal protective equipment measures (see "Training and Hazard Control" 1**926.21(b)(2)**),
- Fitting each overexposed employee with appropriate hearing protectors **1926.101(b)**,
- Training employees in the effects of noise and protection measures (see "Training and Hazard Control" **1926.21(b)(2)**,
- Explaining procedures for preventing further hearing loss, and recordkeeping and reporting.

For more information: OSHA describes hearing conservation program requirements for general industry in the General Industry Occupational Noise Exposure standard **1910.95(c) – (o)**.

Table D-2 – Permissible Noise Exposures – 1926.52(d)(1)

Duration per day, hours:	Sound Level/dBA slow response
8	90
6	92
4	95
3	97
2	100
1 1/2	102
1	105
1/2	110
1/4 or less	115

Exposure to impulsive or impact noise should not exceed 140 dB peak sound pressure level. **1926.52(e)**

Heating Devices, Temporary

When heating devices are used, fresh air shall be supplied in sufficient quantities to maintain the health and safety of workers. **1926.154(a)(1)**

Solid fuel salamanders are prohibited in buildings and on scaffolds. **1926.154(d)**

Highway Work Zones (See Flaggers and Signs, Signals, and Barricades)

Hoists, Material and Personnel

The employer shall comply with the manufacturer's specifications and limitations. **1926.552(a)(1)**

Rated load capacities, recommended operating speeds, and special hazard warnings or instructions shall be posted on cars and platforms. **1926.552(a)(2)**

Hoistway entrances of material hoists shall be protected by substantial full width gates or bars that are painted with diagonal contrasting colors such as black and yellow stripes. **1926.552(b)(2)**

Hoistway doors or gates of personnel hoists shall be not less than 6 feet 6 inches (198.1 meters) high and shall be protected with mechanical locks that cannot be operated from the landing side and that are accessible only to persons on the car. **1926.552(c)(4)**

Overhead protective coverings shall be provided on the top of the hoist cage or platform. **1926.552(b)(3) and (c)(7)**

All material hoists shall conform to the requirements of ANSI A10.5-1969, *Safety Requirements for Material Hoists*. **1926.552(b)(8)**

The requirements of 1926.1431 apply when one or more employees are hoisted using equipment covered by Subpart CC, Cranes and Derricks in Construction.

Hooks (See Wire Ropes, Chains, and Ropes)

Housekeeping

Form and scrap lumber with protruding nails and all other debris shall be kept clear from all work areas. **1926.25(a)**

Combustible scrap and debris shall be removed at regular intervals. **1926.25(b)**

Containers shall be provided for collection and separation of all refuse. Covers shall be provided on containers used for flammable or harmful substances. Waste shall be disposed of at frequent intervals. **1926.25(c)**

Illumination

Construction areas, aisles, stairs, ramps, runways, corridors, offices, shops, and storage areas shall be lighted to not less than the minimum illumination intensities listed in Table D-3 while any work is in progress. **1926.26**

Table D-3 – Minimum Illumination Intensities in Footcandles

Footcandles: Area of Operation

5........General construction area lighting

3........General construction areas, concrete placement, excavation, waste areas, accessways, active storage areas, loading platforms, refueling, and field maintenance areas

5........Indoor warehouses, corridors, hallways, and exitways

5........Tunnels, shafts, and general underground work areas (Exception: minimum of 10 footcandles is required at tunnel and shaft heading during drilling, mucking, and scaling. Bureau of Mines- approved cap lights shall be acceptable for use in the tunnel heading)

10.......General construction plant and shops (e.g., batch plants, screening plants, mechanical and electrical equipment rooms, carpenters shops, rigging lofts and active store rooms, barracks or living quarters, locker or dressing rooms, mess halls, indoor toilets, and workrooms)

30.......First-aid stations, infirmaries, and offices

1926.56(a)

Jointers

A jointer guard shall automatically adjust itself to cover the unused portion of the head and the section of the head on the working side and the back side of the fence or cage. The jointer guard shall remain in contact with the material at all times. **ANSI 01.1-1961, section 4.3.2, incorporated by reference to construction by 1926.304(f)**

Ladders

A ladder (or stairway) must be provided at all work points of access where there is a break in elevation of 19 inches (48.2 centimeters) or more except if a suitable ramp, runway, embankment, or personnel hoist is provided to give safe access to all elevations. **1926.1051(a)**

Portable and fixed ladders with structural defects – such as broken or missing rungs, cleats or steps, broken or split rails, or corroded components – shall be withdrawn from service by immediately tagging "DO NOT USE" or marking in a manner that identifies them as defective, or shall be blocked, such as with a plywood attachment that spans several rungs. Repairs must restore ladder to its original design criteria. **1926.1053(b)(16), (17)(i) through (iii) and (18)**

Portable non-self-supporting ladders shall have clear access at top and bottom and be placed at an angle so the horizontal distance from the top support to the foot of the ladder is approximately one-quarter the working length of the ladder. **1926.1053(b)(5)(i) and (b)(9)**

Portable ladders used for access to an upper landing surface must extend a minimum of 3 feet (0.9 meters) above the landing surface, or where not practical, be provided with grab rails and be secured against movement while in use. **1926.1053(b)(1)**

Ladders must have nonconductive siderails if they are used where the worker or the ladder could contact energized electrical conductors or equipment. **1926.1053(b)(12)**

Job-made ladders shall be constructed for their intended use. Cleats shall be uniformly spaced not less than 10 inches (25.4 centimeters) apart, nor more than 14 inches (35.5 centimeters) apart. **1926.1053(a)(3)(i)**

Wood job-made ladders with spliced side rails must be used at an angle where the horizontal distance is one-eighth the working length of the ladder. **1926.1053(b)(5)(ii)**

Fixed ladders must be used at a pitch no greater than 90 degrees from the horizontal, measured from the back side of the ladder. **1926.1053(b)(5)(iii)**

Ladders must be used only on stable and level surfaces unless secured to prevent accidental movement. **1926.1053(b)(6)**

Ladders must not be used on slippery surfaces unless secured or provided with slip-resistant feet to prevent accidental movement. Slip-resistant feet must not be used as a substitute for the care in placing, lashing, or holding a ladder upon a slippery surface. **1926.1053 (b)(7)**

Employers must provide a training program for each employee using ladders and stairways. The program must enable each employee to recognize hazards related to ladders and stairways and to use proper procedures to minimize these hazards. For example, employers must ensure that each employee is trained by a competent person in the following areas, as applicable:

- The nature of fall hazards in the work area,
- The correct procedures for erecting, maintaining, and disassembling the fall protection systems to be used,
- The proper construction, use, placement, and care in handling of all stairways and ladders, and
- The maximum intended load-carrying capacities of ladders used.

In addition, retraining must be provided for each employee, as necessary, so that the employee maintains the understanding and knowledge acquired through compliance with the standard. **1926.1060(a) and (b)**

Lasers

Only qualified and trained employees shall be assigned to install, adjust, and operate laser equipment. **1926.54(a)**

Employees shall wear proper (antilaser) eye protection when working in areas where there is a potential exposure to direct or reflected laser light greater than 0.005 watts (5 milliwatts). **1926.54(c)**

Beam shutters or caps shall be utilized, or the laser turned off, when laser transmission is not actually required. When the laser is left unattended for a substantial period of time – such as during lunch hour, overnight, or at change of shifts – the laser shall be turned off. **1926.54(e)**

Employees shall not be exposed to light intensities in excess of the following: direct staring – 1 microwatt per square centimeter, incidental observing – 1 milliwatt per square centimeter, and diffused reflected light – 2 1/2 watts per square centimeter. **1926.54(j)(1) through (3)**

Employees shall not be exposed to microwave power densities in excess of 10 milliwatts per square centimeter. **1926.54(1)**

Lead

Each employer who has a workplace or operation covered by this standard shall initially determine if any employee may be exposed to lead at or above the action level of 30 micrograms per cubic meter (30 $\mu g/m^3$) of air calculated as an 8-hour time-weighted average. **1926.62(d)(1)(i)**

The employer shall assure that no employee is exposed to lead at concentrations greater than 50 micrograms per cubic meter (50 $\mu g/m^3$) of air averaged over an 8-hour period (the permissible exposure limit PEL). **1926.62(c)(1)**

Whenever there has been a change of equipment, process, control, personnel, or a new task has been initiated that may result in additional employees being exposed to lead at or above the action level or may result in employees already exposed at or above the action level being exposed above the PEL, the employer shall conduct additional monitoring. **1926.62(d)(7)**

Training shall be provided in accordance with the Hazard Communication standard and additional training shall be provided for employees exposed at or above the action level. **1926.62(1)**

Prior to the start of the job, each employer shall establish and implement a written compliance program. **1926.62(e)(2)(i)**

Where employees are required to use respirators, the employer must implement a respiratory protection program. **1910.134(b) through (d) (except (d)(iii)), and (f) through (m) made applicable to construction by 1926.62(f)(2)(i)**

Where airborne concentrations of lead equal or exceed the action level at any time, an initial medical examination consisting of blood sampling and analysis shall be made available for each employee prior to initial assignment to the area. **1926.62 Appendix B, viii, paragraph (j)**

Lift Slab

Lift-slab operations shall be designed and planned by a registered professional engineer who has experience in lift-slab construction. Such plans and designs shall be implemented by the employer and shall include detailed instructions and sketches indicating the prescribed method of erection. **1926.705(a)**

Jacking equipment shall be capable of supporting at least two and one-half times the load being lifted during jacking operations. Also, do not overload the jacking equipment. **1926.705(d)**

During erection, no employee, except those essential to the jacking operation, shall be permitted in the building or structure while jacking operations are taking place unless the building or structure has been reinforced sufficiently to ensure its integrity. **1926.705(k)(1)**

Equipment shall be designed and installed to prevent slippage; otherwise, the employer shall institute other measures, such as locking or blocking devices, which will provide positive connection between the lifting rods and attachments and will prevent components from disengaging during lifting operations. **1926.705(p)**

Liquefied Petroleum Gas

Each system shall have containers, valves, connectors, manifold valve assemblies, and regulators of an approved type. **1926.153(a)(1)**

Every container and vaporizer shall be provided with one or more approved safety relief valves or devices. **1926.153(d)(1)**

Containers shall be placed upright on firm foundations or otherwise firmly secured. **1926.153(g) and (h)(11)**

Portable heaters shall be equipped with an approved automatic device to shut off the flow of gas in the event of flame failure. **1926.153(h)(8)**

All cylinder connectors shall be equipped with an excess flow valve to minimize the flow of gas in the event the fuel line becomes ruptured. **1926.153(i)(2)**

Storage of liquefied petroleum gas within buildings is prohibited. **1926.153(j)**

Storage locations shall have at least one approved portable fire extinguisher rated not less than 20-B:C. **1926.153(l)**

Medical Services and First Aid

The employer shall ensure the availability of medical personnel for advice and consultation on matters of occupational health. **1926.50(a)**

When a medical facility is not reasonably accessible for the treatment of injured employees, a person qualified to render first aid shall be available at the worksite. **1926.50(c)**

First-aid supplies when required should be readily available. **1926.50(d)(1)**

In areas where 911 is not available, the telephone numbers of the physicians, hospitals, or ambulances shall be conspicuously posted. **1926.50(f)**

Motor Vehicles and Mechanized Equipment

All vehicles in use shall be checked at the beginning of each shift to ensure that all parts, equipment, and accessories that affect safe operation are in proper operating condition and free from defects. All defects shall be corrected before the vehicle is placed in service. **1926.601 (b)(14)**

No employer shall use any motor vehicle, earthmoving, or compacting equipment having an obstructed view to the rear unless:

- The vehicle has a reverse signal alarm distinguishable from the surrounding noise level, or the vehicle is backed up only when an observer signals that it is safe to do so. **1926.601(b)(4)(i) through (ii) and 602(a)(9)(i) through (ii)**

Heavy machinery, equipment, or parts thereof that are suspended or held aloft shall be substantially blocked to prevent falling or shifting before employees are permitted to work under or between them. **1926.600(a)(3)(i)**

Noise (See Hearing Protection)

Personal Protective Equipment

The employer is responsible for requiring the wearing of appropriate personal protective equipment in all operations where there is an exposure to hazardous conditions or where the need is indicated for using such equipment to reduce the hazard to the employees. **1926.28(a) and 1926.95(a) through (c)**

Employers must provide most personal protective equipment at no cost to employees. **1926.95(d)(1), see 1926.95(d)(2) through (6) for exceptions**

OSHA requires employers to provide and for employees to use specific types of personal protective equipment in specific standards throughout 29 CFR 1926. These standards include, but are not limited to:

- Foot protection. **1926.96**
- Head protection. **1926.100**
- Hearing protection. **1926.101**
- Eye and face protection. **1926.102**
- Respiratory protection. **1910.134 made applicable to construction by 1926.103**
- Safety belts, lifelines, and lanyards. **1926.104**
- Safety nets. **1926.105**
- Working over or near water (life jackets). **1926.106**
- Personal fall arrest system. **1926.502(d)**
- Protective equipment for use during electrical work. **1926.416 and 1926.951**

Head, hearing, eye and face, safety nets, fall protection, and working over or near water are covered in detail in this digest.

Powder-Actuated Tools

Only trained employees shall be allowed to operate powder-actuated tools. **1926.302(e)(1)**

All powder-actuated tools shall be tested daily before use and all defects discovered before or during use shall be corrected. **1926.302(e)(2) through (3)**

Tools shall not be loaded until immediately before use. Loaded tools shall not be left unattended. **1926.302(e)(5) through (6)**

Power Transmission and Distribution

Existing conditions shall be determined before starting work, by an inspection or a test. Such conditions shall include, but not be limited to, energized lines and equipment, condition of poles, and the location of circuits and equipment including power and communications, cable television, and fire-alarm circuits. **1926.950(b)(1)**

Electric equipment and lines shall be considered energized until determined otherwise by testing or until grounding. 1**926.950(b)(2) and .954(a)**

Operating voltage of equipment and lines shall be determined before working on or near energized parts. **1926.950(b)(3)**

Rubber protective equipment shall comply with the provisions of the ANSI J6 series, and shall be visually inspected before use. **1926.951(a)(1)(i) through (ii)**

Protective equipment of material other than rubber shall provide equal or better electrical and mechanical protection. **1926.951(a)(iv)**

Powered Industrial Trucks (Forklifts)

Each powered industrial truck operator must be competent to operate a powered industrial truck safely, as demonstrated by the successful completion of the training and evaluation. **1910.178(l)(1)(i) made applicable to construction by 1926.602(d)**

Training shall consist of a combination of formal instruction (e.g., lecture, discussion, interactive computer learning, video tape, written material), practical training (demonstrations performed by the trainer and practical exercises performed by the trainee), and evaluation of the operator's performance in the workplace. **1910.178(l)(2)(ii) made applicable to construction by 1926.602(d)**

Power Transmission, Mechanical

Belts, gears, shafts, pulleys, sprockets, spindles, drums, flywheels, chains, or other reciprocating, rotating, or moving parts of equipment shall be guarded if such parts are exposed to contact by employees or otherwise constitute a hazard. Guarding shall meet the requirement of ANSI B15.1-1953 (R 1958), Safety Code for Mechanical Power Transmission Apparatus. **1926.300(b)(2)**

Process Safety Management of Highly Hazardous Chemicals

Employers shall develop a written plan of action regarding employee participation and consult with employees and their representatives on the conduct and development of process hazards analyses and on the development of the other elements of process safety management. **1926.64(c)(1) through (2)**

The employer, when selecting a contractor, shall obtain and evaluate information regarding the contract employer's safety performance and programs. **1926.64(h)(2)(i)**

The contract employer shall assure that each contract employee is trained in the work practices necessary to safely perform his/her job. **1926.64(h)(3)(i)**

The employer shall perform a pre-startup safety review for new facilities and for modified facilities when the modification is significant enough to require a change in the process safety information. **1926.64(i)(1)**

The employer shall establish and implement written procedures to maintain the ongoing integrity of process equipment. **1926.64(j)(2)**

Radiation, Ionizing

Pertinent provisions of the Nuclear Regulatory Commission (NRC) Standards for Protection Against Radiation (10 CFR Part 20) relating to protection against occupational radiation exposure shall apply. **1926.53(a)**

Any activity that involves the use of radioactive materials or X-rays, whether or not under license from the Nuclear Regulatory Commission, shall be performed by competent persons specially trained in the proper and safe operation of such equipment. **1926.53(b)**

Railings

Top edge height of top rails or equivalent guardrail system members shall have a vertical height of approximately 42 inches (106.6 centimeters), plus or minus 3 inches (7.6 centimeters) above the walking/working level. **1926.502(b)(1)**

Guardrail systems shall be surfaced so as to prevent injury to an employee, with a strength to withstand at least 200 pounds (90 kilograms), the minimum requirement applied in any outward or downward direction, at any point along the top edge. **1926.502(b)(3) and (6)**

A stair railing shall be of construction similar to a standard railing with a vertical height of not less than 36 inches (91.5 centimeters) from the upper surface of top rail to the surface of tread in line with face of riser at forward edge of tread. **1926.1052(c)(3)(i)**

Recordkeeping: Recording and Reporting Requirements

All employers must report the death of any employee from a work-related incident within 8 hours of learning about it or report within 24 hours any work-related inpatient hospitalization, amputation or loss of an eye to the closest OSHA office, or call 1-800-321-OSHA (6742). **1904.39(a) and (b)(7)**

If your company had more than 10 employees at any time during the last calendar year, you must keep the OSHA injury and illness records using the OSHA Forms 300, 300-A, and 301 or the equivalent form. **1904.1(a)(2) and 1904.29(a) and (b)(4)**

If your company had 10 or fewer employees at all times during the last calendar year, you do not need to keep OSHA injury and illness records unless OSHA or the Bureau of Labor Statistics informs you in writing that you must keep these records. **1904.1(a)(1)**

Each recordable injury or illness must be entered on the OSHA Forms 300 and 301 within 7 days of receiving the information. **1904.29(b)(3)**

OSHA injury and illness records must be kept for all projects. If the project is 1 year or longer a separate OSHA 300 log must be kept. If the projects are less than 1 year, these projects may be placed on one OSHA 300 log that covers all short-term projects. These records may be kept at a central location as long as the information is transferred within 7 days. **1904.30(a), (b)(1) and (2)**

The OSHA 300 log must be verified, certified by a company executive, and posted at the end of each calendar year. The log must be posted no later than February 1 of the following year and remain posted until April 30. **1904.32 (a) and (b)**

The OSHA 300 and 301 logs must be kept for 5 years following the year to which they relate. **1904.33(a) and 1904.44**

Reinforced Steel

All protruding reinforced steel, onto and into which employees could fall, shall be guarded to eliminate the hazard of impalement. **1926.701(b)**

No employee (except those essential to the post-tensioning operations) shall be permitted to be behind the jack during tensioning operations. **1926.701(c)(1)**

Reinforcing steel for walls, piers, columns, and similar vertical structures shall be adequately supported to prevent overturning and to prevent collapse. **1926.703(d)(1)**

Employers shall take measures to prevent unrolled wire mesh from recoiling. Such measures may include, but are not limited to, securing each end of the roll or turning over the roll. **1926.703(d)(2)**

Respiratory Protection

In emergencies, or when feasible engineering or administrative controls are not effective in controlling toxic substances, appropriate respiratory protective equipment shall be provided by the employer and shall be used. **1910.134(a)(1) made applicable to construction by 1926.103**

Employers must select a NIOSH-certified respirator. The respirator must be used in compliance with the conditions of its certification. **1910.134(d)(1)(ii) made applicable to construction by 1926.103**

Respiratory protective devices shall be appropriate for the hazardous material involved and the extent and nature of the work requirements and conditions. **1910.134(d)(1)(i) made applicable to construction by 1926.103**

Employees required to use respiratory protective devices shall be thoroughly trained in their use. **1910.134(k) made applicable to construction by 1926.103**

Respiratory protective equipment shall be inspected regularly and maintained in good condition. **1910.134(h) made applicable to construction by 1926.103**

Rollover Protective Structures (ROPS)

Rollover protective structures (ROPS) apply to the following types of materials handling equipment: all rubber-tired, self-propelled scrapers, rubber-tired frontend loaders, rubber-tired dozers, wheel-type agricultural and industrial tractors, crawler tractors, crawler-type loaders, and motor graders, with or without attachments, that are used in construction work. This requirement does not apply to sideboom pipelaying tractors. **1926.1000(a)(1)**

Safety Nets

Safety nets must be installed as close as practicable under the walking/working surface on which employees are working, but in no case more than 30 feet (9.14 meters) below such level. When nets are used on bridges, the potential fall area from the walking/working surface to the net shall be unobstructed. **1926.502(c)(1)**

Safety nets and their installations must be capable of absorbing an impact force equal to that produced by the drop test. **1926.502(c)(4)**

Saws

Band Saws

All portions of band saw blades shall be enclosed or guarded, except for the working portion of the blade between the bottom of the guide rolls and the table. **ANSI 01.1-1961, incorporated by reference to construction by 1926.304(f)**

Band saw wheels shall be fully encased. **ANSI 01.1-1961, incorporated by reference to construction by 1926.304(f)**

Portable Circular Saws

Portable, power-driven circular saws shall be equipped with guards above and below the base plate or shoe. The lower guard shall cover the saw to the depth of the teeth, except for the minimum arc required to allow proper retraction and contact with the work, and shall automatically return to the covering position when the blade is removed from the work. **1926.304(d)**

Circular saws shall have a constant pressure switch that will shut off the power when the pressure is released. **1926.300(d)(3)**

Radial Saws

Radial saws shall have an upper guard that completely encloses the upper half of the saw blade. The sides of the lower exposed portion of the blade shall be guarded by a device that will automatically adjust to the thickness of and remain in contact with the material being cut. **1926.304(g)(1)**

Radial saws used for ripping shall have nonkickback fingers or dogs. **ANSI 01.1-1961, incorporated by reference to construction by 1926.304(f)**

Radial saws shall be installed so that the cutting head will return to the starting position when released by the operator. **ANSI 01.1-1961, incorporated by reference to construction by 1926.304(f)**

Swing or Sliding Cut-Off Saws

All swing or sliding cut-off saws shall be provided with a hood that will completely enclose the upper half of the saw. **ANSI 01.1-1961, incorporated by reference to construction by 1926.304(f)**

Limit stops shall be provided to prevent swing or sliding type cut-off saws from extending beyond the front or back edges of the table. **ANSI 01.1-1961, incorporated by reference to construction by 1926.304(f)**

Each swing or sliding cut-off saw shall be provided with an effective device to return the saw automatically to the back of the table when released at any point of its travel. **ANSI 01.1-1961, incorporated by reference to construction by 1926.304(f)**

Inverted sawing of sliding cut-off saws shall be provided with a hood that will cover the part of the saw that protrudes above the top of the table or material being cut. **ANSI 01.1-1961, incorporated by reference to construction by 1926.304(f)**

Table Saws

Circular table saws shall have a hood over the portion of the saw above the table, so mounted that the hood will automatically adjust itself to the thickness of and remain in contact with the material being cut. **1926.304(h)(1)**

Circular table saws shall have a spreader aligned with the blade, spaced no more than 1/2-inch (1.27-centimeters) behind the largest blade mounted in the saw. This provision does not apply when grooving, dadoing, or rabbiting. **ANSI 01.1-1961, incorporated by reference to construction by 1926.304(f)**

Circular table saws used for ripping shall have nonkickback fingers or dogs. **ANSI 01.1-1961, incorporated by reference to construction by 1926.304(f)**

Feeder attachments shall have the feed rolls or other moving parts covered or guarded so as to protect the operator from hazardous points. **1926.304(c)**

Scaffolds, General Requirements

Scaffolds shall be erected, moved, dismantled, or altered only under the supervision and direction of a competent person. **1926.451(f)(7)**

Scaffolds are any temporary elevated platform (supported or suspended) and its supporting structure (including points of anchorage), used for supporting employees or materials or both. **1926.450(b)**

Each employee who performs work on a scaffold shall be trained by a person qualified to recognize the hazards associated with the type of scaffold used and to understand the procedures to control or minimize those hazards. The training shall include such topics as the nature of any electrical hazards, fall hazards, falling object hazards, the maintenance and disassembly of the fall protection systems, the use of the scaffold, handling of materials, the capacity and the maximum intended load. **1926.454(a)**

Fall protection (guardrail systems and personal fall arrest systems) must be provided for each employee on a scaffold more than 10 feet (3.1 meters) above a lower level. **1926.451(g)(1)**

Each scaffold and scaffold component shall support without failure its own weight and at least 4 times the maximum intended load applied or transmitted to it. Suspension ropes and connecting hardware must support 6 times the intended load. Scaffolds and scaffold components shall not be loaded in excess of their maximum intended loads or rated capacities, whichever is less. **1926.451(a)(1), (a)(4), (f)(1)**

The scaffold platform shall be planked or decked as fully as possible. **1926.451(b)(1)**

The platform shall not deflect more than 1/60 of the span when loaded. **1926.451(f)(16)**

The work area for each scaffold platform and walkway shall be at least 18 inches (46 centimeters) wide. When the work area must be less than 18 inches (46 centimeters) wide, guardrails and/or personal fall arrest systems shall still be used. **1926.451(b)(2)(ii)**

Access must be provided when the scaffold platforms are more than 2 feet (0.6 m) above or below a point of access. Direct access is acceptable when the scaffold is not more than 14 inches (36 centimeters) horizontally and not more than 24 inches (61 centimeters) vertically from the other surfaces. Crossbraces shall not be used as a means of access. **1926.451(e)(1) and (e)(8)**

A competent person shall inspect the scaffold, scaffold components, and ropes on suspended scaffolds before each work shift and after any occurrence which could affect the structural integrity and authorize prompt corrective action. **1926.450 (b), 451(f)(3)**

Scaffold, Bricklaying

Employees doing overhand bricklaying from a supported scaffold shall be protected by a guardrail or personal fall arrest system on all sides except the side where the work is being done. **1926.451(g)(1)(vi)**

Scaffold, Erectors and Dismantlers

A competent person shall determine the feasibility for safe access and fall protection for employees erecting and dismantling supported scaffolds. **1926.451(e)(9) and (g)(2)**

Scaffold, Fall Arrest Systems

A personal fall arrest system consists of an anchorage, connectors, a body harness, a lanyard, and may include a deceleration device. Anchorages used for attachment shall be capable of supporting at least 5,000 pounds (22.2 kN) per employee attached or shall be designed, installed, and used under the supervision of a qualified person as part of a complete personal fall arrest system which maintains a safety factor of at least two. Personal fall arrest systems used on scaffolds must be attached by lanyard to a vertical lifeline, horizontal lifeline, or scaffold structural member. **1926.502(d)(15) and 1926.451(g)(3)**

Vertical or horizontal lifelines may be used. **1926.451(g)(3)(ii) through (iv)**

Lifelines shall be independent of support lines and suspension ropes and not attached to the same anchorage point as the support or suspension ropes. **1926.451(g)(3)(iii) and (iv)**

Employees must be tied off when working from an aerial lift. Fall restraint systems or personal fall arrest systems may be used. The use of personal fall arrest systems must comply with Subpart M. **1926.453(b)(2)(v) and 1926.502(d)**

Scaffold, Guardrails

Guardrails shall be installed along all open sides and ends of platforms before the scaffold is released for use by employees other than the erection and dismantling crews. Guardrails are not required on the front edge of a platform if the front edge of the platform is less than 14 inches (36 centimeters) from the face of the work. For plastering and lathing, the distance is 18 inches (46 centimeters) or less from the front edge. When outrigger scaffolds are attached to supported scaffolds the distance is 3 inches (8 centimeters) or less from the front edge of the outrigger. **1926.451(b)(3) and (g)(4)**

The toprail for scaffolds must be 38 inches (0.97 meters) to 45 inches (1.2 meters) from the platform. Midrails are to be installed approximately halfway between the toprail and the platform surface. **1926.451(g)(4)(ii) and (iii)**

Toeboards or other barriers are to be used to protect employees working below. **1926.451(h)**

When screens and mesh are used for guardrails, they shall extend from the top edge of the guardrail system to the scaffold platform, and along the entire opening between the supports. **1926.451(g)(4)(v)**

Crossbracing is not acceptable as an entire guardrail system but is acceptable for a toprail when the crossing point of the two braces is between 38 inches (0.9 meters) and 48 inches (1.3 meters) above the work platform and for midrails when between 20 inches (0.5 meters) and 30 inches (0.8 meters) above the work platform. The end points of the crossbracing shall be no more than 48 inches (1.3 meters) apart vertically. **1926.451(g)(4)(xv)**

Scaffolds, Mobile

Scaffolds shall be braced by cross, horizontal, or diagonal braces, or a combination thereof. Scaffolds must be plumb, level, and squared. All brace connections must be secured. **1926.452(w)(1)**

Each employee on a scaffold more than 10 feet above a lower level shall be protected from falling to that lower level by use of guardrail systems or personal fall arrest systems. **1926.451(g)(1), (g)(1)(vii), and (g)(4)**

Scaffold, Planking

Scaffold planking shall be capable of supporting without failure its own weight and at least 4 times the intended load. Solid sawn wood, fabricated planks, and fabricated platforms may be used as scaffold planks, following the recommendations by the manufacturer or a lumber grading association or inspection agency. Tables showing maximum permissible spans, rated load capacity, nominal thickness, etc., are in Appendix A of Subpart L (1)(b) and (c). **1926.451(a)(1)**

Scaffolds, Supported

Supported scaffolds are platforms supported by legs, outrigger beams, brackets, poles, uprights, posts, frames, or similar rigid support. The structural members, poles, legs, posts, frames, and uprights, shall be plumb and braced to prevent swaying and displacement. **1926.451(b) and (c)(3)**

Supported scaffolds poles, legs, posts, frames, and uprights shall bear on base plates and mud sills, or on another adequate firm foundation. **1926.451(c)(2)**

Either the manufacturer's recommendation or the following placements shall be used for guys, ties, and braces: install guys, ties, and braces at the closest horizontal member to the 4:1 height and repeat vertically with the top restraint no further than the 4:1 height from the top:

Vertically

Every 20 feet (6.1 meters) or less for scaffolds less than 3 feet (0.9 meters) wide;

Every 26 feet (7.9 meters) or less for scaffolds more than 3 feet (0.9 meters) wide;

Horizontally

At each end;

At intervals not to exceed 30 feet (9.1 meters) from one end. **1926.451(c)(1)(ii)**

Scaffolds, Suspension (Swing)

Each employee more than 10 feet (3.1 meters) above a lower level shall be protected from falling by guardrails and a personal fall arrest system when working from single or two-point suspended scaffolds and self-contained adjustable scaffolds that are supported by ropes. **1926.451(g)(1)(ii) and (iv)**

Each employee 10 feet (3.1 meters) above a lower level shall be protected from falling by a personal fall arrest system when working from a boatswain's chair, ladder jack, needle beam, float, or catenary scaffolds. **1926.451(g)(1)(i)**

Lifelines shall be independent of support lines and suspension ropes and not attached to the same anchorage point as the support or suspension ropes. **1926.451(g)(3)(iii) and (iv)**

A competent person shall inspect the ropes for defects prior to each workshift and after every occurrence which could affect a rope's integrity, evaluate the direct connections that support the load, and determine if two-point and multi-point scaffolds are secured from swaying. **1926.451(d)(3)(i), (d)(10), (d)(18), (f)(3)**

The use of repaired wire rope is prohibited. **1926.451(d)(7)**

Tiebacks shall be secured to a structurally sound anchorage on the building or structure. **1926.451(d)(3)(ix)**

Tiebacks shall not be secured to standpipes, vents, other piping systems, or electrical conduit. **1926.451(d)(3)(ix) and (d)(5)**

A single tieback shall be installed perpendicular to the face of the building or structure. Two tiebacks installed at opposing angles are required when a perpendicular tieback cannot be installed. **1926.451(d)(3)(x)**

Only those items specifically designed as counterweights shall be used. Sand, gravel, masonry units, rolls of roofing felt, and other such materials shall not be used as counterweights. **1926.451(d)(3)(ii) and (iii)**

Counterweights used for suspended scaffolds shall be made of materials that can not be easily dislocated. **1926.451(d)(3)(ii)**

Counterweights shall be secured by mechanical means to the outrigger beams. **1926.451(d)(3)(iv)**

Signs, Signals, and Barricades (See Flaggers)

Construction areas shall be posted with legible traffic signs at points of hazard. **1926.200 (g)(1)**

Barricades for protection of employees shall conform to Part 6 of the *Manual on Uniform Traffic Control Devices*. **1926.202**

Silica

Appropriate engineering controls, personal protective equipment, respirators, and work practices shall be used to protect employees from crystalline silica. **1926.55(a) and (b) and OSHA National Emphasis Program on Crystalline Silica 1/24/2008**

Stairs

A stairway or ladder must be provided at all worker points of access where there is a break in elevation of 19 inches (48.3 centimeters) or more and no ramp, runway, sloped embankment, or personnel hoist is provided. **1926.1051(a)**

Except during construction of the actual stairway, skeleton metal frame structures and steps must not be used (where treads and/or landings are to be installed at a later date), unless the stairs are fitted with secured temporary treads and landings. **1926.1052(b)(2)**

When there is only one point of access between levels, it must be kept clear to permit free passage by workers. If free passage becomes restricted, a second point of access must be provided and used. **1926.1051(a)(3)**

When there are more than two points of access between levels, at least one point of access must be kept clear. **1926.1051(a)(4)**

All stairway and ladder fall protection systems must be provided and installed as required by the stairway and ladder rules before employees begin work that requires them to use stairways or ladders and their respective fall protection systems. **1926.1051(b)**

Stairways that will not be a permanent part of the structure on which construction work is performed must have landings at least 30 inches deep and 22 inches wide (76.2 x 55.9 centimeters) at every 12 feet (3.6 meters) or less of vertical rise. **1926.1052(a)(1)**

Stairways must be installed at least 30 degrees, and no more than 50 degrees, from the horizontal. **1926.1052(a)(2)**

Where doors or gates open directly onto a stairway, a platform must be provided, and the swing of the door shall not reduce the effective width of the platform to less than 20 inches (50.8 centimeters). **1926.1052(a)(4)**

Except during construction of the actual stairway, stairways with metal pan landings and treads must not be used where the treads and/or landings have not been filled in with concrete or other material, unless the pans of the stairs and/or landings are temporarily filled in with wood or other material. All treads and landings must be replaced when worn below the top edge of the pan. **1926.1052(b)(1)**

Stairways having four or more risers, or rising more than 30 inches in height (76.2 centimeters), whichever is less, must have at least one handrail. A stairrail also must be installed along each unprotected side or edge. **1926.1052(c)(1)(i) through (ii)**

Midrails, screens, mesh, intermediate vertical members, or equivalent intermediate structural members must be provided between the top rail and stairway steps of the stairrail system. **1926.1052(c)(4)**

Midrails, when used, must be located midway between the top of the stairrail system and the stairway steps. **1926.1052(c)(4)(i)**

The height of handrails must not be more than 37 inches (93.9 centimeters) nor less than 30 inches (76.2 centimeters) from the upper surface of the handrail to the surface of the tread in line with face of riser at forward edge of tread. **1926.1052(c)(6)**

When the top edge of a stairrail system also serves as a handrail, the height of the top edge must not be more than 37 inches (94 cm) nor less than 36 inches (91.5 cm) from the upper surface of the stairrail system to the surface of the tread, in line with face of riser at forward edge of the tread. **1926.1052(c)(7)**

Temporary handrails must have a minimum clearance of 3 inches (7.6 centimeters) between the handrail and walls, stairrail systems, and other objects. **1926.1052(c)(11)**

Unprotected sides and edges of stairway landings must be provided with guardrail systems. **1926.1052(c)(12)**

Steel Erection

Each employee engaged in a steel erection activity who is on a walking/working surface with an unprotected side or edge more than 15 feet (4.6 meters) above a lower level shall be protected from fall hazards by guardrail systems, safety net systems, personal fall arrest systems, positioning device systems or fall restraint systems. **1926.760(a)(1)**

Connectors more than two stories or 30 feet (9.1 meters) above a lower level, whichever is less, shall be protected by guardrail systems, safety net systems, personal fall arrest systems, positioning devices systems, or fall restraint systems. **1926.760(b)(1)**

Connectors at heights over 15 feet and up to 30 feet above a lower level shall be provided with a personal fall arrest system, positioning device system, or fall restraint system and wear the equipment necessary to be tied off; or be provided with other means of protection from fall hazards in accordance with **1926.760(a)(1) and 1926.760(b)(3)**

Training shall be provided for all employees exposed to fall hazards. Special training shall be provided to connectors, workers in controlled decking zones, and those rigging for multiple lifts. **1926.761(c)**

Steel erection begins when written notification that the concrete in the footings, piers, and walls or the mortar in the masonry piers and walls has attained the strength to support the loads imposed during steel erection. **1926.752(b)**

Shear connectors (such as headed steel studs, steel bars or steel lugs), reinforcing bars, deformed anchors or threaded studs shall not be attached to the top flanges of beams, joists or beam attachments so that they project vertically from or horizontally across the top flange of the member until after the metal decking, or other walking/working surface, has been installed. **1926.754(c)(1)**

Columns shall be anchored by a minimum of four anchor rods (anchor bolts). **1926.755(a)(1)**

Solid web structural members shall be secured with at least two bolts per connection before being released from the hoisting line. **1926.756(a)(1)**

Open web joists must be field bolted at each end of the bottom chord before being released from the hoisting line. **1926.757(a)(1)(iii)**

Decking shall be laid tightly and secured. **1926.754(e)(5)**

Controlled decking zones shall be clearly marked and access limited to only those employees engaged in leading edge work. **1926.760(c)(2) and (3)**

Cranes used in steel erection shall be inspected prior to each shift by a competent person. Routes for suspended loads shall be planned to ensure no employee is required to work directly under the load except for connecting or hooking or unhooking. Hooks with self-closing latches shall be used. All loads shall be rigged by a qualified rigger. Multiple lifts shall hoist a maximum of five members. **1926.753(c)(1)(i), (d)(1) and (e)(1)(ii)**

Storage

All materials stored in tiers shall be secured to prevent sliding, falling, or collapsing. **1926.250(a)(1)**

Aisles and passageways shall be kept clear and in good repair. **1926.250(a)(3)**

Storage of materials shall not obstruct exits. **1926.151(d)(1)**

Materials shall be stored with due regard to their fire characteristics. **1926.151(d)(2)**

Tire Cages

A safety tire rack, cage, or equivalent protection shall be provided and used when inflating, mounting, or dismounting tires installed on split rims, or rims equipped with locking rings or similar devices. **1926.600(a)(2)**

Toeboards

Toeboards, when used to protect workers from falling objects, shall be erected along the edge of the overhead walking/working surface. **1926.502(j)(1)**

Toeboards shall be capable of withstanding, without failure, a force of at least 50 pounds (222 N) applied in any downward or outward direction at any point along the toeboard. **1926.502(j)(2)**

A standard toeboard shall be at least 3 1/2 inches (9 centimeters) in height and may be of any substantial material either solid or open, with openings not to exceed 1 inch (2.54 centimeters) in greatest dimension. **1926.502(j)(3)**

Toilets

Toilets shall be provided according to the following: 20 or fewer persons – one facility; 20 or more persons – one toilet seat and one urinal per 40 persons; 200 or more persons – one toilet seat and one urinal per 50 workers. **1926.51(c)(1)**

This requirement does not apply to mobile crews having transportation readily available to nearby toilet facilities. **1926.51(c)(4)**

Training and Inspections

The employer shall initiate and maintain such programs as may be necessary to provide for frequent and regular inspections of the job site, materials, and equipment by designated competent persons. **1926.20(b)(1) through (2)**

The employer should avail himself of the safety and health training programs the Secretary provides. **1926.21(b)(1)**

The employer shall instruct each employee in the recognition and avoidance of unsafe conditions and in the regulations applicable to his work environment to control or eliminate any hazards or other exposure to illness or injury. **1926.21(b)(2)**

The use of any machinery, tool, material, or equipment that is not in compliance with any applicable requirement of Part 1926 is prohibited. **1926.20(b)(3)**

The employer shall permit only those employees qualified by training or experience to operate equipment and machinery. **1926.20(b)(4)**

Underground Construction

The employer shall provide and maintain safe means of access and egress to all work stations. **1926.800(b)(1)**

The employer shall control access to all openings to prevent unauthorized entry underground. Unused chutes, manways, or other openings shall be tightly covered, bulkheaded, or fenced off, and shall be posted with signs indicating “Keep Out” or similar language. Complete or unused sections of the underground facility shall be barricaded. **1926.800(b)(3)**

Unless underground facilities are sufficiently completed so that the permanent environmental controls are effective and the remaining construction activity will not cause any environmental hazard or structural failure within the facilities, the employer shall maintain a check-in/check-out procedure that will ensure that aboveground designated personnel can determine an accurate count of the number of persons underground in the event of an emergency. **1926.800(c)**

All employees shall be instructed to recognize and avoid hazards associated with underground construction activities. **1926.800(d)**

Hazardous classifications are for “potentially gassy” and “gassy” operations. **1926.800(h)** The employer shall assign a competent person to perform all air monitoring to determine proper ventilation and quantitative measurements of potentially hazardous gases. **1926.800(j)(1)(i)(A)**

Fresh air shall be supplied to all underground work areas in sufficient quantities to prevent dangerous or harmful accumulation of dust, fumes, mists, vapors, or gases. **1926.800(k)(1)(i)**

Washing Facilities

The employer shall provide adequate washing facilities for employees engaged in operations involving harmful substances. Washing facilities shall be near the worksite and shall be so equipped as to enable employees to remove all harmful substances. **1926.51(f)**

Water, Working Over or Near

Employees working over or near water, where the danger of drowning exists, shall be provided with U.S. Coast Guard-approved life jackets or buoyant work vests. **1926.106(a)**

Welding, Cutting, and Heating

Employers shall instruct employees in the safe use of welding equipment. **1926.350(d) and 1926.351(d)**

Proper precautions (isolating welding and cutting, removing fire hazards from the vicinity, providing a fire watch) for fire prevention shall be taken in areas where welding or other "hot work" is being done. No welding, cutting, or heating shall be done where the application of flammable paints, or the presence of other flammable compounds or heavy dust concentrations creates a fire hazard. **1926.352(a) through (c) and (f)**

Arc welding and cutting operations shall be shielded by noncombustible or flameproof screens to protect employees and other persons in the vicinity from direct arc rays. **1926.351(e)**

When electrode holders are to be left unattended, the electrodes shall be removed and the holder shall be placed or protected so that they cannot make electrical contact with employees or conducting objects. **1926.351(d)(1)**

All arc welding and cutting cables shall be completely insulated and be capable of handling the maximum current requirements for the job. There shall be no repairs or splices within 10 feet (3 meters) of the electrode holder, except where splices are insulated equal to the insulation of the cable. Defective cable shall be repaired or replaced. **1926.351(b)(1) through (2) and (4)**

Employees performing such operations in the open air shall be protected by filter-type respirators in accordance with the requirements of 1910.134, except that employees performing such operations on beryllium-containing base or filler metals shall be protected with air line respirators in accordance with 1910.134. **1926.353(c)(3)**

Fuel gas and oxygen hose shall be easily distinguishable and shall not be interchangeable. Hoses shall be inspected at the beginning of each shift and shall be repaired or replaced if defective. **1926.350(f)(1) and (3)**

General mechanical ventilation, local exhaust ventilation, air line respirators, and other protection shall be provided, as required, when welding, cutting or heating:

- Zinc, lead, cadmium, chromium, mercury, or materials bearing, based, or coated with beryllium in enclosed spaces,
- Stainless steel with inert-gas equipment,
- In confined spaces, and
- Where an unusual condition can cause an unsafe accumulation of contaminants. **1926.353(b)(1), (c)(1)(i) through (iv), (c)(2)(i) through (iv), (d)(1)(iv), and (e)(1)**

Proper eye protective equipment to prevent exposure of personnel shall be provided. **1926.353(e)(2)**

Wire Ropes, Chains, and Ropes

Wire ropes, chains, ropes, and other rigging equipment shall be inspected prior to use and as necessary during use to ensure their safety. Defective gear shall be removed from service. **1926.251(a)(1)**

Job or shop hooks and links or makeshift fasteners formed from bolts, rods, or other such attachments shall not be used. **1926.251(b)(3)**

When U-bolts are used for eye splices, the U-bolt shall be applied so that the "U" section is in contact with the dead end of the rope. **1926.251(c)(5)(i)**

When U-bolt wire rope clips are used to form eyes, the following table shall be used to determine the number and spacing of clips. **1926.251(c)(5)**

Table H-2 – Number and Spacing of U-Bolt Wire Rope Clips – 1926.251(c)(5)

Improved plow steel, rope diameter (inches)	Number of clips Drop forged	Other material	Minimum spacing (inches)
1/2 (1.27 cm)	3	4	3 (7.62 cm)
5/8 (.625 cm)	3	4	3-3/4 (8.37 cm)
3/4 (.75 cm)	4	5	4-1/2 (11.43 cm)
7/8 (.875 cm)	4	5	5-1/4 (12.95 cm)
1 (2.54 cm)	5	6	6 (15.24 cm)
1-1/8 (2.665 cm)	6	6	6-3/4 (15.99 cm)
1-1/4 (2.79 cm)	6	7	7-1/2 (19.05 cm)
1-3/8 (2.915 cm)	7	7	8-1/4 (20.57 cm)
1-1/2 (3.81 cm)	7	8	9 (22.86 cm)

Woodworking Machinery

All fixed power-driven woodworking tools shall be provided with a disconnect switch that can be either locked or tagged in the off position. **1926.304(a)**

All woodworking tools and machinery shall meet applicable requirements of ANSI 01.1-1961, *Safety Code for Woodworking Machinery*. **1926.304(f)**

Workplace Complaints: Workers' Rights

Workers have the right to a safe workplace. The *Occupational Safety and Health Act of 1970* (OSH Act) was passed to prevent workers from being killed or seriously harmed at work. The law requires employers to provide their employees with working conditions that are free of known dangers. Workers may file a complaint to have OSHA inspect their workplace if they believe that their employer is not following OSHA standards or that there are serious hazards. Further, the OSH Act gives complainants the right to request that their names not be revealed to their employers. It is also against the law for an employer to fire, demote, transfer, or retaliate in any way against a worker for filing a complaint or using other OSHA rights.

If a workplace has unsafe or unhealthful working conditions, workers may want to file a complaint. Often the best and fastest way to get a hazard corrected is to notify a supervisor or employer. Workers or their representatives may file a complaint online or by phone, mail, email or fax with the nearest OSHA office and request an inspection. A worker may also ask OSHA not to reveal his or her name. To file a complaint, call 1-800-321-OSHA (6742) or contact the nearest OSHA regional, area, state plan, or consultation office listed at www.osha.gov. The teletypewriter (TTY) number is (877) 889-5627. **Written, signed complaints submitted to OSHA area offices are more likely to result in an on-site OSHA inspection.** Most online or unsigned complaints are resolved informally over the phone with the employer. Complaints from workers in states with an OSHA approved state plan will be forwarded to the appropriate state plan for response. Workers can call 1-800-321-OSHA (6742) to request a complaint form from their local OSHA office or visit www.osha.gov/pls/osha7/eComplaintForm.html to submit the form online. Completed forms can be faxed or mailed to the local OSHA office (provided at the end of this guide). Include your name, address and telephone number so that OSHA can contact you.

OSHA Assistance, Services and Programs

OSHA has a great deal of information to assist employers in complying with their responsibilities under OSHA law. Several OSHA programs and services can help employers identify and correct job hazards, as well as improve their injury and illness prevention program.

Establishing an Injury and Illness Prevention Program

The key to a safe and healthful work environment is a comprehensive injury and illness prevention program.

Injury and illness prevention programs are systems that can substantially reduce the number and severity of workplace injuries and illnesses, while reducing costs to employers. Thousands of employers across the United States already manage safety using injury and illness prevention programs, and OSHA believes that all employers can and should do the same. Thirty-four states have requirements or voluntary guidelines for workplace injury and illness prevention programs. Most successful injury and illness prevention programs are based on a common set of key elements. These include management leadership, worker participation, hazard identification, hazard prevention and control, education and training, and program evaluation and improvement. Visit OSHA's Injury and Illness Prevention Programs web page at www.osha.gov/dsg/topics/safetyhealth for more information.

Compliance Assistance Specialists

OSHA has compliance assistance specialists throughout the nation located in most OSHA offices. Compliance assistance specialists can provide information to employers and workers about OSHA standards, short educational programs on specific hazards or OSHA rights and responsibilities, and information on additional compliance assistance resources. For more details, visit www.osha.gov/dcsp/compliance_assistance/cas.html or call 1-800-321-OSHA (6742) to contact your local OSHA office.

Free On-site Safety and Health Consultation Services for Small Business

OSHA's On-site Consultation Program offers free and confidential advice to small and medium-sized businesses in all states across the country, with priority given to high-hazard worksites. Each year, responding to requests from small employers looking to create or improve their safety and health management programs, OSHA's On-site Consultation Program conducts over 29,000 visits to small business worksites covering over 1.5 million workers across the nation.

On-site consultation services are separate from enforcement and do not result in penalties or citations. Consultants from state agencies or universities work with employers to identify workplace hazards, provide advice on compliance with OSHA standards, and assist in establishing safety and health management programs.

For more information, to find the local On-site Consultation office in your state, or to request a brochure on consultation services, visit www.osha.gov/consultation, or call 1-800-321-OSHA (6742).

Under the consultation program, certain exemplary employers may request participation in **OSHA's Safety and Health Achievement Recognition Program (SHARP)**. Eligibility for participation includes, but is not limited to, receiving a full-service, comprehensive consultation visit, correcting all identified hazards and developing an effective safety and health management program. Worksites that receive SHARP recognition are exempt from programmed inspections during the period that the SHARP certification is valid.

Cooperative Programs

OSHA offers cooperative programs under which businesses, labor groups and other organizations can work cooperatively with OSHA. To find out more about any of the following programs, visit www.osha.gov/cooperativeprograms.

Strategic Partnerships and Alliances

The OSHA Strategic Partnerships (OSP) provide the opportunity for OSHA to partner with employers, workers, professional or trade associations, labor organizations, and/or other interested stakeholders. OSHA Partnerships are formalized through unique agreements designed to encourage, assist, and recognize partner efforts to eliminate serious hazards and achieve model workplace safety and health practices. Through the Alliance Program, OSHA works with groups committed to worker safety and health to prevent workplace fatalities, injuries and illnesses by developing compliance assistance tools and resources to share with workers and employers, and educate workers and employers about their rights and responsibilities.

Voluntary Protection Programs (VPP)

The VPP recognize employers and workers in private industry and federal agencies who have implemented effective safety and health management programs and maintain injury and illness rates below the national average for their respective industries. In VPP, management, labor, and OSHA work cooperatively and proactively to prevent fatalities, injuries, and illnesses through a system focused on: hazard prevention and control, worksite analysis, training, and management commitment and worker involvement.

Occupational Safety and Health Training

The OSHA Training Institute partners with 27 OSHA Training Institute Education Centers at 42 locations throughout the United States to deliver courses on OSHA standards and occupational safety and health topics to thousands of students a year. For more information on training courses, visit www.osha.gov/otiec.

OSHA Educational Materials

OSHA has many types of educational materials in English, Spanish, Vietnamese and other languages available in print or online. These include:

- Brochures;
- Fact Sheets;
- Guidance documents that provide detailed examinations of specific safety and health issues;
- Online Safety and Health Topics pages;
- Posters;
- Small, laminated QuickCards™ that provide brief safety and health information; and
- *QuickTakes*, OSHA's free, twice-monthly online newsletter with the latest news about OSHA initiatives and products to assist employers and workers in finding and preventing workplace hazards. To sign up for *QuickTakes* visit www.osha.gov/quicktakes.

To view materials available online or for a listing of free publications, visit www.osha.gov/publications. You can also call 1-800-321-OSHA (6742) to order publications.

Select OSHA publications are available in e-Book format. OSHA e-Books are designed to increase readability on smartphones, tablets and other mobile devices. For access, go to www.osha.gov/ebooks.

OSHA's web site also has information on job hazards and injury and illness prevention for employers and workers. To learn more about OSHA's safety and health resources online, visit www.osha.gov or www.osha.gov/html/a-z-index.html.

NIOSH Health Hazard Evaluation Program

Getting Help with Health Hazards

The National Institute for Occupational Safety and Health (NIOSH) is a federal agency that conducts scientific and medical research on workers' safety and health. At no cost to employers or workers, NIOSH can help identify health hazards and recommend ways to reduce or eliminate those hazards in the workplace through its Health Hazard Evaluation (HHE) Program.

Workers, union representatives and employers can request a NIOSH HHE. An HHE is often requested when there is a higher than expected rate of a disease or injury in a group of workers. These situations may be the result of an unknown cause, a new hazard, or a mixture of sources. To request a NIOSH Health Hazard Evaluation go to www.cdc.gov/niosh/hhe/request.html. To find out more, in English or Spanish, about the Health Hazard Evaluation Program:

E-mail HHERequestHelp@cdc.gov or
call 800-CDC-INFO (800-232-4636).

How to Contact OSHA

For questions or to get information or advice, to report an emergency, fatality, inpatient hospitalization, amputation, or loss of an eye, or to file a confidential complaint, contact your nearest OSHA office, visit www.osha.gov or call OSHA at 1-800-321-OSHA (6742), TTY 1-877-889-5627.

For assistance, contact us.
We are OSHA. We can help.
It's confidential.

OSHA Regional Offices

Region I
Boston Regional Office
(CT*, ME*, MA, NH, RI, VT*)
JFK Federal Building, Room E340
Boston, MA 02203
(617) 565-9860 (617) 565-9827 Fax

Region II
New York Regional Office
(NJ*, NY*, PR*, VI*)
201 Varick Street, Room 670
New York, NY 10014
(212) 337-2378 (212) 337-2371 Fax

Region III
Philadelphia Regional Office
(DE, DC, MD*, PA, VA*, WV)
The Curtis Center
170 S. Independence Mall West
Suite 740 West
Philadelphia, PA 19106-3309
(215) 861-4900 (215) 861-4904 Fax

Region IV
Atlanta Regional Office
(AL, FL, GA, KY*, MS, NC*, SC*, TN*)
61 Forsyth Street, SW, Room 6T50
Atlanta, GA 30303
(678) 237-0400 (678) 237-0447 Fax

Region V
Chicago Regional Office
(IL*, IN*, MI*, MN*, OH, WI)
230 South Dearborn Street
Room 3244
Chicago, IL 60604
(312) 353-2220 (312) 353-7774 Fax

Region VI
Dallas Regional Office
(AR, LA, NM*, OK, TX)
525 Griffin Street, Room 602

Dallas, TX 75202
(972) 850-4145 (972) 850-4149 Fax
(972) 850-4150 FSO Fax

Region VII
Kansas City Regional Office
(IA*, KS, MO, NE)
Two Pershing Square Building
2300 Main Street, Suite 1010
Kansas City, MO 64108-2416
(816) 283-8745 (816) 283-0547 Fax

Region VIII
Denver Regional Office
(CO, MT, ND, SD, UT*, WY*)
Cesar Chavez Memorial Building
1244 Speer Boulevard, Suite 551
Denver, CO 80204
(720) 264-6550 (720) 264-6585 Fax

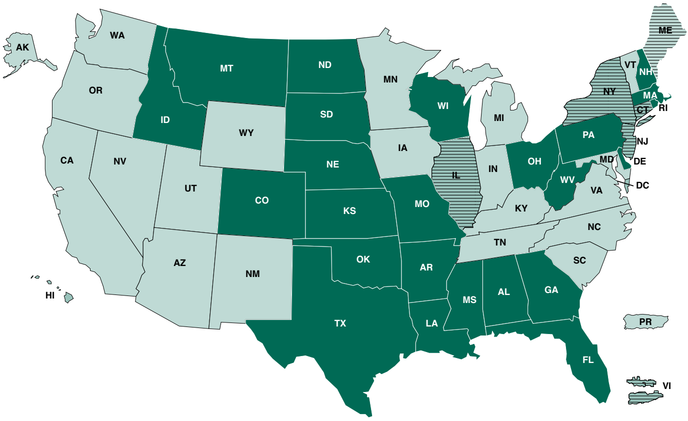
Region IX
San Francisco Regional Office
(AZ*, CA*, HI*, NV*, and American Samoa, Guam and the Northern Mariana Islands)
90 7th Street, Suite 18100
San Francisco, CA 94103
(415) 625-2547 (415) 625-2534 Fax

Region X
Seattle Regional Office
(AK*, ID, OR*, WA*)
300 Fifth Avenue, Suite 1280
Seattle, WA 98104
(206) 757-6700 (206) 757-6705 Fax

* These states and territories operate their own OSHA-approved job safety and health plans and cover state and local government employees as well as private sector employees. The Connecticut, Illinois, Maine, New Jersey, New York and Virgin Islands programs cover public employees only. (Private sector workers in these states are covered by Federal OSHA). States with approved programs must have standards that are identical to, or at least as effective as, the Federal OSHA standards.

Note: To get contact information for OSHA area offices, OSHA-approved state plans and OSHA consultation projects, please visit us online at www.osha.gov or call us at 1-800-321-OSHA (6742).

OSHA-Approved State Plans



- OSHA-approved state plans (private sector and public employees)
- Federal OSHA (private sector and most federal employees)
- OSHA-approved state plans (for public employees only; private sector employees are covered by Federal OSHA)

www.osha.gov

(800) 321-OSHA (6742)

U.S. Department of Labor

For more information:

Occupational Safety and Health Administration

www.osha.gov (800) 321-OSHA (6742)

Asbestos Standard for the Construction Industry

OSHA 3096
2002 (Revised)

Occupational Safety and Health Administration
U.S. Department of Labor

This informational booklet provides a generic, non-exhaustive overview of a particular topic related to OSHA standards. It does not alter or determine compliance responsibilities in OSHA standards or the *Occupational Safety and Health Act of 1970*. Because interpretations and enforcement policy may change over time, you should consult current administrative interpretations and decisions by the Occupational Safety and Health Review Commission and the Courts for additional guidance on OSHA compliance requirements.

This information is available to sensory impaired individuals upon request.

Voice phone: (202) 693–1999;
Teletypewriter (TTY) number: (877) 889–5627.

Asbestos Standard for the Construction Industry

U.S. Department of Labor
Elaine L. Chao, Secretary

Occupational Safety and Health Administration
John L. Henshaw, Assistant Secretary

OSHA 3096
2002 (Revised)

Contents

Introduction

What is asbestos? 1
What are the dangers of asbestos exposure? 1
What construction activities does this booklet cover? 1

Provisions of the OSHA Standard

What is work classification? 3
What is the permissible exposure limit for asbestos? 4
Which asbestos operations must employers monitor and assess? 4
What is the function of a *competent person*? 4
What is an initial exposure assessment? 5
What is a negative exposure assessment? 6
Are employers required to perform exposure monitoring? 6
When must employers conduct periodic monitoring? 7
Is additional monitoring ever needed? 8
Are employers required to establish medical surveillance programs for employees? 8
Do employers have to keep any employee records? 10
What is a regulated area? 12
Who is responsible for communicating asbestos hazards at worksites? 14
Does the OSHA standard require the posting of warning signs? 15
Must employers provide asbestos warning labels? 16
Do employers have to train employees regarding asbestos exposure? 16

Methods of Compliance

What methods must employers use to control asbestos exposure levels? 19
What are the compliance requirements for Class I work? 20
What are the compliance requirements for Class II work? 23
What are the compliance requirements for Class III work? 27
What are the compliance requirements for Class IV work? 28
Does the competent person have duties that apply to more than one work class? 28
What does the OSHA standard require concerning respirators? 29
Do employers have to provide protective clothing for employees? 31
What are the hygiene-related requirements for employees performing Class I asbestos work involving more than 25 linear feet or 10 square feet of thermal system insulation or surfacing ACM or PACM? 32
What are the hygiene-related requirements for employees performing other Class I asbestos work and Class II and III asbestos work where exposures exceed a PEL or where a negative exposure assessment has not been produced? 34
What are the hygiene-related requirements for employees performing Class IV work? 35
What are an employer's housekeeping responsibilities? 35
Quick Reference of Provisions by Work Class 37

OSHA Assistance

What are safety and health system management guidelines? 43
What are state programs? 44
How do I obtain consultation services? 44

What are Voluntary Protection Programs (VPPs)? 45
What is the Strategic Partnership Program? 46
Does OSHA offer training and education? 46
Does OSHA provide any information electronically? 47
How do I learn more about related OSHA publications? 48
How do I contact OSHA about emergencies, complaints, or further assistance? 48

OSHA Office Directory

OSHA Regional Offices 49
OSHA Area Offices 50
OSHA-Approved State Plans 53
OSHA Consultation Projects 56

Introduction

What is asbestos?

Asbestos is the generic term for a group of naturally occurring, fibrous minerals with high tensile strength, flexibility, and resistance to heat, chemicals, and electricity.

In the construction industry, asbestos is found in installed products such as sprayed-on fireproofing, pipe insulation, floor tiles, cement pipe and sheet, roofing felts and shingles, ceiling tiles, fire-resistant drywall, drywall joint compounds, and acoustical products. Because very few asbestos-containing products are being installed today, most worker exposures occur during the removal of asbestos and the renovation and maintenance of buildings and structures containing asbestos.

What are the dangers of asbestos exposure?

Asbestos fibers enter the body when a person inhales or ingests airborne particles that become embedded in the tissues of the respiratory or digestive systems. Exposure to asbestos can cause disabling or fatal diseases such as asbestosis, an emphysema-like condition; lung cancer; mesothelioma, a cancerous tumor that spreads rapidly in the cells of membranes covering the lungs and body organs; and gastrointestinal cancer. The symptoms of these diseases generally do not appear for 20 or more years after initial exposure.

What construction activities does this booklet cover?

The asbestos standard for the construction industry (29 *CFR* Part 1926.1101, see www.osha.gov) regulates asbestos exposure for the following activities:

- Demolishing or salvaging structures where asbestos is present.

- Removing or encapsulating asbestos-containing material (ACM).
- Constructing, altering, repairing, maintaining, or renovating asbestos-containing structures or substrates.
- Installing asbestos-containing products.
- Cleaning up asbestos spills/emergencies.
- Transporting, disposing, storing, containing, and housekeeping involving asbestos or asbestos-containing products on a construction site.

Note: The standard does not apply to asbestos-containing asphalt roof coatings, cements, and mastics.

Provisions of the OSHA Standard

OSHA has established strict exposure limits and requirements for exposure assessment, medical surveillance, recordkeeping, *competent persons*, regulated areas, and hazard communication.

What is work classification?

The OSHA standard establishes a classification system for asbestos construction work that spells out mandatory, simple, technological work practices that employers must follow to reduce worker exposures. Under this system, the following four classes of construction work are matched with increasingly stringent control requirements:

- *Class I* asbestos work is the most potentially hazardous class of asbestos jobs. This work involves the removal of asbestos-containing thermal system insulation and sprayed-on or troweled-on surfacing materials. Employers must presume that thermal system insulation and surfacing material found in pre-1981 construction is ACM. That presumption, however, is rebuttable. If you believe that the surfacing material or thermal system insulation is not ACM, the OSHA standard specifies the means that you must use to rebut that presumption. Thermal system insulation includes ACM applied to pipes, boilers, tanks, ducts, or other structural components to prevent heat loss or gain. Surfacing materials include decorative plaster on ceilings and walls; acoustical materials on decking, walls, and ceilings; and fireproofing on structural members.
- *Class II* work includes the removal of other types of ACM that are not thermal system insulation such as resilient flooring and roofing materials. Examples of *Class II* work include removal of asbestos-containing floor or ceiling tiles, siding, roofing, or transite panels.
- *Class III* asbestos work includes repair and maintenance operations where ACM or presumed ACM (PACM) are disturbed.

- *Class IV* work includes custodial activities where employees clean up asbestos-containing waste and debris produced by construction, maintenance, or repair activities. This work involves cleaning dust-contaminated surfaces, vacuuming contaminated carpets, mopping floors, and cleaning up ACM or PACM from thermal system insulation or surfacing material.

What is the permissible exposure limit for asbestos?

Employers must ensure that no employee is exposed to an airborne concentration of asbestos in excess of 0.1 f/cc as an 8-hour time-weighted average (TWA). In addition, employees must not be exposed to an airborne concentration of asbestos in excess of 1 f/cc as averaged over a sampling period of 30 minutes.

Which asbestos operations must employers monitor and assess?

Employers must assess all asbestos operations for the potential to generate airborne fibers, and use exposure monitoring data to assess employee exposures. You must also designate a *competent person* to help ensure the safety and health of your workers.

What is the function of a *competent person*?

On all construction sites with asbestos operations, employers must designate a *competent person*—one who can identify asbestos hazards in the workplace and has the authority to correct them. This person must be qualified and authorized to ensure worker safety and health as required by *Subpart C, General Safety and Health Provisions for Construction* (29 *CFR* Part 1926.20). Under these requirements for safety and health prevention programs, the *competent person* must frequently inspect job sites, materials, and equipment.

The *competent person* must attend a comprehensive training course for contractors and supervisors certified by the U.S. Environmental Protection Agency (EPA) or a state-approved training provider, or a complete a course that is equivalent in length and content.

For *Class III and IV* asbestos work, training must include a course equivalent in length, stringency, and content to the 16-hour *Operations and Maintenance* course developed by EPA for maintenance and custodial workers. For more specific information, see 40 *CFR* Part 763.92(a)(2).

What is an initial exposure assessment?

To determine expected exposures, a *competent person* must perform an initial exposure assessment to assess exposures immediately before or as the operation begins. This person must perform the assessment in time to comply with all standard requirements triggered by exposure data or the lack of a negative exposure assessment and to provide the necessary information to ensure all control systems are appropriate and work properly. A negative exposure assessment demonstrates that employee exposure during an operation is consistently below the permissible exposure limit (PEL).

The initial exposure assessment must be based on the following criteria:

- Results of employee exposure monitoring, unless a negative exposure assessment has been made; and
- Observations, information, or calculations indicating employee exposure to asbestos, including any previous monitoring.

For *Class I* asbestos work, until employers document that employees will not be exposed in excess of the 8-hour TWA PEL and short-term exposure limit STEL, employers must assume that employee exposures are above those limits.

What is a negative exposure assessment?

For any specific asbestos job that trained employees perform, employers may show that exposures will be below the PELs (i.e., negative exposure assessment) through the following:

- Objective data demonstrating that ACM, or activities involving it, cannot release airborne fibers in excess of the 8-hour TWA PEL or STEL;
- Exposure data obtained within the past 12 months from prior monitoring of work operations closely resembling the employer's current work operations (the work operations that were previously monitored must have been conducted by employees whose training and experience were no more extensive than that of current employees, and the data must show a high degree of certainty that employee exposures will not exceed the 8-hour TWA PEL or STEL under current conditions); or
- Current initial exposure monitoring that used breathing zone air samples representing the 8-hour TWA and 30-minute short-term exposures for each employee in those operations most likely to result in exposures over the 8-hour TWA PEL for the entire asbestos job.

Are employers required to perform exposure monitoring?

Yes. Employers must determine employee exposure measurements from breathing zone air samples representing the 8-hour TWA and 30-minute short-term exposures for each employee.

Employers must take one or more samples representing full-shift exposure to determine the 8-hour TWA exposure in each work area. To determine short-term employee exposures, you must take one or more samples representing 30-minute exposures for the operations most likely to expose employees above the excursion limit in each work area.

You must also allow affected employees and their designated representatives to observe any employee exposure monitoring. When observation requires entry into a regulated area, you must provide and require the use of protective clothing and equipment.

When must employers conduct periodic monitoring?

For *Class I and II* jobs, employers must conduct monitoring daily that is representative of each employee working in a regulated area, unless you have produced a negative exposure assessment for the entire operation and nothing has changed. When all employees use supplied-air respirators operated in positive-pressure mode, however, you may discontinue daily monitoring. When employees perform *Class I* work using control methods not recommended in the standard, you must continue daily monitoring even when employees use supplied-air respirators.

For operations other than *Class I and II*, employers must monitor all work where exposures can possibly exceed the PEL often enough to validate the exposure prediction.

If periodic monitoring shows that certain employee exposures are below the 8-hour TWA PEL and the STEL, you may discontinue monitoring these employees' exposures.

Is additional monitoring ever needed?

Changes in processes, control equipment, personnel, or work practices that could result in new or additional exposures above the 8-hour TWA PEL or STEL require additional monitoring regardless of a previous negative exposure assessment for a specific job.

Are employers required to establish medical surveillance programs for employees?

It depends. Employers must provide a medical surveillance program for all employees who do the following:

- Engage in *Class I, II, or III* work or are exposed at or above the PEL or STEL for a combined total of 30 or more days per year; or
- Wear negative-pressure respirators.

In addition, a licensed physician must perform or supervise all medical exams and procedures that you provide at no cost to your employees and at a reasonable time.

Employers must make medical exams and consultations available to employees as follows:

- Prior to employee assignment to an area where negative-pressure respirators are worn;
- Within 10 working days after the 30th day of combined engagement in Class I, II, and III work and exposure at or above a PEL, and at least annually thereafter; and
- When an examining physician suggests them more frequently.

If an employee was examined within the past 12 months and that exam meets the criteria of the standard, however, another medical exam is not required.

Medical exams must include the following:

- Medical and work histories;
- Completion of a standardized questionnaire with the initial exam (see 29 *CFR* Part 1926.1101, Appendix D, Part 1) and an abbreviated standardized questionnaire with annual exams (see 29 *CFR* Part 1926.1101, Appendix D, Part 2);
- Physical exam focusing on the pulmonary and gastrointestinal systems; and
- Any other exams or tests deemed necessary by the examining physician.

Employers must provide the examining physician with the following:

- Copy of OSHA's asbestos standard and its appendices D, E, and I;
- Description of the affected employee's duties relating to exposure;
- Employee's representative exposure level or anticipated exposure level;
- Description of any personal protective equipment and respiratory equipment used; and
- Information from previous medical exams not otherwise available.

It is the employer's responsibility to obtain the physician's written opinion containing results of the medical exam as well as the following information:

- Any medical conditions of the employee that increase health risks from asbestos exposure.
- Any recommended limitations on the employee or protective equipment used.

- A statement that the employee has been informed of the results of the medical exam and any medical conditions resulting from asbestos exposure.
- A statement that the employee has been informed of the increased risk of lung cancer from the combined effect of smoking and asbestos exposure.

Note: A physician's written opinion must not reveal specific findings or diagnoses unrelated to occupational exposure to asbestos. You must provide a copy of the physician's written opinion to the employee involved within 30 days after receipt.

Do employers have to keep any employee records?

Yes. Employers must maintain employee records concerning objective data, exposure monitoring, and medical surveillance.

If using *objective data* to demonstrate that products made from or containing asbestos cannot release fibers in concentrations at or above the PEL or STEL, employers must keep an accurate record for as long as it is relied on and include the following information:

- Exempt products.
- Objective data source.
- Testing protocol, test results, and analysis of the material for release of asbestos.
- Exempt operation and support data descriptions.
- Relevant data for operations, materials, processes, or employee exposures.

Employers must keep records of all employee *exposure monitoring* for at least 30 years, including following information:

- Date of measurement.
- Operation involving asbestos exposure that you monitored.
- Methods of sampling and analysis that you used and evidence of their accuracy.
- Number, duration, and results of samples taken.
- Type of protective devices worn.
- Name, social security number, and exposures of the employees involved.

Employers must also make exposure records available when requested to affected employees, former employees, their designated representatives, and/or OSHA's Assistant Secretary.

In addition to retaining a copy of the information provided to the examining physician, employers must keep all *medical surveillance* records for the duration of an employee's employment plus 30 years, including the following information:

- Employee's name and social security number.
- Employee's medical exam results, including the medical history, questionnaires, responses, test results, and physician's recommendations.
- Physician's written opinions.
- Employee's medical complaints related to asbestos exposure.

Employers must also make employees' medical surveillance records available to them, as well as to anyone having specific written consent of an employee, and to OSHA's Assistant Secretary.

Also, employers must maintain other records. Employers must maintain all employee training records for 1 year beyond the last date of employment.

If data demonstrate ACM does not contain asbestos, building owners or employers must keep associated records for as long as they rely on them. Building owners must maintain written notifications on the identification, location, and quantity of any ACM or PACM for the duration of ownership, and transfer the records to successive owners.

When employers cease to do business without a successor to keep their records, employers must notify the Director of the National Institute for Occupational Safety and Health (NIOSH) at least 90 days prior to their disposal and transmit them as requested.

What is a regulated area?

A regulated area is a marked-off site where employees work with asbestos, including any adjoining areas where debris and waste from asbestos work accumulates or where airborne concentrations of asbestos exceed, or can possibly exceed, the PEL.

All *Class I, II, and III* asbestos work, or any other operations where airborne asbestos exceeds the PEL, must be performed within regulated areas. Only persons permitted by an employer and required by work duties to be present in regulated areas may enter a regulated area. The designated *competent person* supervises all asbestos work performed in this area.

Employers must mark off the regulated area in a manner that minimizes the number of persons within the area and protects persons outside the area from exposure to airborne asbestos. You may use critical barriers (i.e., plastic sheeting placed over all openings to the work area to prevent airborne asbestos from migrating to an adjacent area) or negative-pressure enclosures to mark off a regulated area.

Posted warning signs demarcating the area must be easily readable and understandable. The signs must bear the following information:

DANGER

ASBESTOS

CANCER AND LUNG DISEASE HAZARD

AUTHORIZED PERSONNEL ONLY

RESPIRATORY AND PROTECTIVE CLOTHING ARE REQUIRED IN THIS AREA

Employers must supply a respirator to all persons entering regulated areas. (See respiratory protection requirements elsewhere in this booklet.) Employees must not eat, drink, smoke, chew (tobacco or gum), or apply cosmetics in regulated areas.

An employer performing work in a regulated area must inform other employers onsite of the following:

- Nature of the work,
- Regulated area requirements, and
- Measures taken to protect onsite employees.

The contractor creating or controlling the source of asbestos contamination must abate the hazards. All employers with employees working near regulated areas, must daily assess the enclosure's integrity or the effectiveness of control methods to prevent airborne asbestos from migrating.

General contractors on a construction project must oversee *all* asbestos work, even though they may not be the designated *competent person*. As supervisor of the entire project, the general contractor determines whether asbestos contractors comply with the standard and ensures that they correct any problems.

Who is responsible for communicating asbestos hazards at worksites?

The communication of asbestos hazards is vital to prevent further overexposure. Most asbestos-related construction involves previously installed building materials. Building/facility owners often are the only or best source of information concerning these materials.

Building/facility owners, as well as employers of workers who may be exposed to asbestos hazards, have specific duties under the standard.

Before work begins, building/facility owners must identify all thermal system insulation at the worksite, sprayed or troweled-on surfacing materials in buildings, and resilient flooring material installed before 1981. They also must notify the following persons of the presence, location, and quantity of ACM or PACM:

- Prospective employers applying or bidding for work in or adjacent to areas containing asbestos.
- Building owners' employees who work in or adjacent to these areas.
- Other employers on multi-employer worksites with employees working in or adjacent to these areas.
- All tenants who will occupy the areas containing ACM.

Employers discovering ACM on a worksite must notify the building/facility owner and other employers onsite within 24 hours regarding its presence, location, and quantity. You also must inform owners and employees working in nearby areas of the precautions taken to confine airborne asbestos. Within 10 days of project completion, you must inform building/facility owners and other employers onsite of the current locations and quantities of remaining ACM and any final monitoring results.

At any time, employers or building and facility owners may demonstrate that a PACM does not contain asbestos by inspecting the material in accordance with the requirements of the *Asbestos Hazard Emergency Response Act* (AHERA) (40 *CFR* Part 763, Subpart E) or by performing tests of bulk samples collected in the manner described in 40 *CFR* Part 763.86. (See 29 *CFR* Part 1926.1101 for specific testing requirements.)

Employers do not have to inform employees of asbestos-free building materials present; however, you must retain the information, data, and analysis supporting the determination. (See recordkeeping requirements elsewhere in this publication for more specific information.)

Does the OSHA standard require the posting of warning signs?

Yes. At the entrance to mechanical rooms or areas with ACM or PACM, the building/facility owner must post signs identifying the material present, its specific location, and appropriate work practices that ensure it is not disturbed.

Also, employers must post warning signs in regulated areas to inform employees of the dangers and necessary protective steps to take before entering. (See the regulated area requirements elsewhere in this publication.)

Must employers provide asbestos warning labels?

Employers must attach warning labels to all products and containers of asbestos, including waste containers, and all installed asbestos products, when possible. Labels must be printed in large, bold letters on a contrasting background and used in accordance with OSHA's *Hazard Communication Standard* (29 *CFR* Part1910.1200). All labels must contain a warning statement against breathing asbestos fibers and contain the following legend:

DANGER

CONTAINS ASBESTOS FIBERS

AVOID CREATING DUST

CANCER AND LUNG DISEASE HAZARD

Labels are not required if asbestos is present in concentrations less than 1 percent by weight. They also are not required if bonding agents, coatings, or binders have altered asbestos fibers, prohibiting the release of airborne asbestos over the PEL or STEL during reasonable use, handling, storage, disposal, processing, or transportation.

When building owners or employers identify previously installed asbestos or PACM, employers must attach or post clearly noticeable and readable labels or signs to inform employees which materials contain asbestos.

Do employers have to train employees regarding asbestos exposure?

Yes. Employers must provide a free training program for all employees who are likely to be exposed in excess of a PEL and for all employees performing *Class I* through *IV* asbestos operations. Employees must be trained prior to or at initial assignment and at least annually thereafter. Training courses must be easily understandable and include the following information:

- Ways to recognize asbestos.
- Adverse health effects of asbestos exposure.
- Relationship between smoking and asbestos in causing lung cancer.
- Operations that could result in asbestos exposure and the importance of protective controls to minimize exposure.
- Purpose, proper use, fitting instruction, and limitations of respirators.
- Appropriate work practices for performing asbestos jobs.
- Medical surveillance program requirements.
- Contents of the standard.
- Names, addresses, and phone numbers of public health organizations that provide information and materials or conduct smoking cessation programs.
- Sign and label requirements and the meaning of their legends.
- Written materials relating to employee training and self-help smoking cessation programs at no cost to employees.

Also, the following additional training requirements apply depending on the work class involved:

- For *Class I* operations and for *Class II* operations that require the use of critical barriers (or equivalent isolation methods) and/or negative pressure enclosures, training must be equivalent in curriculum, method, and length to the EPA Model Accreditation Plan (MAP) asbestos abatement worker training (see 40 *CFR* Part 763, Subpart E, Appendix C).

- For employees performing *Class II* operations involving one generic category of building materials containing asbestos (e.g., roofing, flooring, or siding materials or transite panels), training may be covered in an 8-hour course that includes hands-on experience.
- For *Class III* operations, training must be equivalent in curriculum and method to the 16-hour *Operations and Maintenance* course developed by EPA for maintenance and custodial workers whose work disturbs ACM (see 40 *CFR* Part 763.92). The course must include hands-on training on proper respirator use and work practices.
- For *Class IV* operations, training must be equivalent in curriculum and method to EPA awareness training (see 29 *CFR* Part1926.1101 for more information). Training must focus on the locations of ACM or PACM and the ways to recognize damage and deterioration and avoid exposure. The course must be at least 2 hours in length.

Note: Employers must provide OSHA's Assistant Secretary and the Director of NIOSH all information and training materials as requested.

Methods of Compliance

What methods must employers use to control asbestos exposure levels?

For all covered work, employers must use the following control methods to comply with the PEL and STEL:

- Local exhaust ventilation equipped with HEPA-filter dust collection systems (a high-efficiency particulate air [HEPA] filter is capable of trapping and retaining at least 99.97 percent of all mono-dispersed particles of 0.3 micrometers in diameter).
- Enclosure or isolation of processes producing asbestos dust.
- Ventilation of the regulated area to move contaminated air away from the employees' breathing zone and toward a filtration or collection device equipped with a HEPA filter.
- Feasible engineering and work practice controls to reduce exposure to the lowest possible levels, supplemented by respirators to reach the PEL or STEL or lower.

Employers must use the following engineering controls and work practices for all operations regardless of exposure levels:

- Vacuum cleaners equipped with HEPA filters to collect all asbestos-containing or presumed asbestos-containing debris and dust.
- Wet methods or wetting agents to control employee exposures except when infeasible (e.g., due to the creation of electrical hazards, equipment malfunction, and slipping hazards).
- Prompt cleanup and disposal in leak-tight containers of asbestos-contaminated wastes and debris.

The following work practices and engineering controls are *prohibited* for all asbestos-related work or work that disturbs asbestos or PACM regardless of measured exposure levels or the results of initial exposure assessments:

- High-speed abrasive disc saws not equipped with a point-of-cut ventilator or enclosure with HEPA-filtered exhaust air.
- Compressed air to remove asbestos or ACM unless the compressed air is used with an enclosed ventilation system.
- Dry sweeping, shoveling, or other dry cleanup of dust and debris.
- Employee rotation to reduce exposure.

In addition, OSHA's asbestos standard has specific requirements for each class of asbestos work in construction.

What are the compliance requirements for Class I work?

A designated *competent person* must supervise all *Class I* work, including installing and operating the control system. The *competent person* must inspect onsite at least once during each work shift and upon employee request.

Employers must place critical barriers over all openings to regulated areas or use another barrier or isolation method to prevent airborne asbestos from migrating for the following jobs:

- All *Class I* jobs removing more than 25 linear or 10 square feet of thermal system insulation or surfacing material.
- All other *Class I* jobs without a negative exposure assessment.
- All jobs where employees are working in areas adjacent to a *Class I* regulated area.

If using other barriers or isolation methods instead of critical barriers, employers must perform perimeter area surveillance during each work shift. No asbestos dust should be visible. Perimeter monitoring must show that clearance levels are met (as contained in 40 *CFR* Part 763, Subpart E of the *EPA Asbestos in Schools* rule) or that perimeter area levels are no greater than background levels.

Employers must ensure the following for all *Class I* jobs:

- Isolating heating, ventilating, and air-conditioning (HVAC) systems in regulated areas by sealing with a double layer of 6 mil plastic or the equivalent.
- Placing impermeable drop cloths on surfaces beneath all removal activity.
- Covering and securing all objects within the regulated area with impermeable drop cloths or plastic sheeting.
- Ventilating the regulated area to move the contaminated air away from the employee breathing zone and toward a HEPA filtration or collection device for jobs without a negative exposure assessment or where exposure monitoring shows the PEL is exceeded.

In addition, employees performing *Class I* work must use one or more of the following control methods:

- Negative-pressure enclosure systems when the configuration of the work area does not make it infeasible to erect the enclosure.
- Glove bag systems to remove ACM or PACM from piping.
- Negative-pressure glove bag systems to remove asbestos or PACM from piping.
- Negative-pressure glove box systems to remove asbestos or ACM from pipe runs.

- Water spray process systems to remove asbestos or PACM from cold-line piping if employees carrying out the process have completed a 40-hour training course on its use in addition to training required for all employees performing *Class I* work.
- Small walk-in enclosure that accommodates no more than 2 people (mini-enclosure) if the disturbance or removal can be completely contained by the enclosure.

For the specifications, limitations, and recommended work practices of these required control methods, refer to *Occupational Exposure to Asbestos*, 29 *CFR* Part 1926.1101.

Employers may use different or modified engineering and work practice controls if they adhere to the following provisions:

- Control method encloses, contains, or isolates the process or source of airborne asbestos dust, or captures and redirects the dust before it enters into the employees' breathing zone.
- Certified industrial hygienist or licensed professional engineer qualified as a project designer evaluates the work area, the projected work practices, and the engineering controls and certifies, in writing, that based on evaluations and data the planned control method adequately reduces direct and indirect employee exposure to or below the PEL under worst-case conditions. The planned control method also must prevent asbestos contamination outside the regulated area, as measured by sampling meeting the requirements of the *EPA Asbestos in Schools* rule or perimeter monitoring.
- Employer sends a copy of the evaluation and certification to the OSHA National Office, Office of Technical Support, Room N3653, 200 Constitution Avenue, N.W., Washington, DC 20210, before using alternative methods to remove

more than 25 linear or 10 square feet of thermal system insulation or surfacing material.

What are the compliance requirements for Class II work?

In addition to all indoor *Class II* jobs without a negative exposure assessment, employers must use critical barriers over all openings to the regulated area or another barrier or isolation method to prevent airborne asbestos from migrating for the following:

- When changing conditions indicate exposure above the PEL, or
- When ACM is not removed substantially intact.

If using other barriers or isolation methods instead of critical barriers, employers must perform perimeter area monitoring to verify that the barrier works properly. In addition, impermeable drop cloths must cover all surfaces beneath removal activities.

All *Class II* asbestos work can use the same work practices and requirements as *Class I* asbestos jobs. Alternatively, *Class II* work can be performed using work practices set out in the standard for specific jobs.

For removing vinyl and asphalt flooring materials containing asbestos or installed in buildings constructed before 1981 and not verified as asbestos-free, employers must ensure that workers observe the following:

- Do not sand flooring or its backing,
- Do not rip up resilient sheeting,
- Do not dry sweep,
- Perform mechanical chipping only in a negative-pressure enclosure,

- Use vacuums equipped with HEPA filters to clean floors,
- Remove resilient sheeting by cutting with wetting of the snip point and wetting during delamination,
- Use wet methods to scrape residual adhesives and/or backing,
- Remove tiles intact, unless impossible (you may omit wetting when tiles are heated and removed intact), and
- Assume resilient flooring material—including associated mastic and backing—is asbestos-containing unless an industrial hygienist determines that it is asbestos-free.

To remove asbestos-containing roofing materials, employers must ensure that workers do the following:

- Remove them intact if feasible,
- Use wet methods when intact removal is infeasible, and
- Mist cutting machines continuously during use, unless the *competent person* determines misting to be unsafe.

When removing built-up roofs using a power roof cutter employers must ensure that workers observe the following procedures:

- Use power cutters equipped with HEPA dust collectors or perform HEPA vacuuming along the cut line for roofs that have asbestos-containing roofing felts and an aggregate surface.
- Use power cutters equipped with HEPA dust collectors, or perform HEPA vacuuming along the cut line, or gently sweep along the cut line and then carefully and completely wipe up the still-wet dust and debris that was acquired for roofs that have asbestos-containing roofing felts and a smooth surface.

- Do not drop or throw to the ground ACM that has been removed from a roof.
- Carry or pass the ACM to the ground by hand, or lower the material to the ground via covered, dust-tight chute, crane or hoist.
- Lower both intact ACM and non-intact ACM to the ground as soon as it is practicable, but no later than the end of the work shift.
- Keep material wet if it is not intact, or place it in impermeable waste bags, or wrap it in plastic sheeting while it remains on the roof.
- Lower to the ground, as soon as possible or by the end of the work shift, any unwrapped or unbagged roofing material using a covered, dust-tight chute, crane, or hoist.
- Place unwrapped materials in closed containers to prevent scattering dust after the materials reach the ground.
- Isolate roof level heating and ventilation air intake sources or shut down the ventilation system.

When removing cement-like asbestos-containing siding or shingles, or asbestos-containing transite panels on building exteriors other than roofs, employers must ensure that employees adhere to the following:

- Do not cut, abrade, or break siding, shingles, or transite panels unless methods less likely to result in asbestos fiber release cannot be used;
- Spray each panel or shingle with amended water before removing (amended water is water to which a surfactant [wetting agent] has been added to increase the ability of the liquid to penetrate ACM);

- Lower immediately to the ground any unwrapped or unbagged panels or shingles using a covered dust-tight chute, crane, or hoist, or place them in an impervious waste bag or wrap them in plastic sheeting and lower them to the ground no later than the end of the work shift; and
- Cut nails with flat, sharp instruments.

When removing asbestos-containing gaskets, employers must ensure that employees do the following:

- Remove gaskets within glove bags if they are visibly deteriorated and unlikely to be removed intact;
- Wet the gaskets thoroughly with amended water prior to removing;
- Place the wet gaskets in a disposal container immediately; and
- Keep the residue wet if removed by scraping.

For removal of any other *Class II* ACM, employers must ensure that employees observe the following:

- Do not cut, abrade, or break the material unless infeasible;
- Wet the material thoroughly with amended water before and during removal;
- Remove the material intact, if possible; and
- Bag or wrap removed ACM immediately or keep it wet until transferred to a closed receptacle no later than the end of the work shift.

Employers may use different or modified engineering and work practice controls under the following conditions:

- If they can demonstrate that employee exposure will not exceed the PEL under any anticipated circumstances; and

- If a *competent person* evaluates the work area, the projected work practices, and the engineering controls and certifies, in writing, that these different or modified controls will reduce all employee exposure to or below the PELs under all expected conditions of use and that they meet the requirements of the standard. This evaluation must include, and be based on, data representing employee exposure during use of the controls under conditions closely resembling those of the current job. Also, the employees participating in the evaluation must not have better training and more experience than that of the employees who are to perform the current job.

What are the compliance requirements for Class III work?

Employers must use wet methods and local exhaust ventilation, to the extent feasible, during *Class III* work. When drilling, cutting, abrading, sanding, chipping, breaking, or sawing of asbestos-containing thermal system insulation or surfacing materials occurs, employers must use impermeable drop cloths as well as mini-enclosures, glove bag systems, or other effective isolation methods and ensure that workers wear respirators. If the material is not thermal system insulation or surfacing material and a negative exposure assessment has not been produced or monitoring shows the PEL is exceeded, employers must contain the area with impermeable drop cloths and plastic barriers or other isolation methods and ensure that employees wear respirators. (See also respirator requirements elsewhere in this publication.) In addition, the *competent person* must inspect often enough to assess changing conditions and upon employee request.

What are the compliance requirements for Class IV work?

Employees conducting *Class IV* asbestos work must have attended an asbestos awareness training program. They must use wet methods and HEPA vacuums to promptly clean asbestos-containing or presumed asbestos-containing debris. When cleaning debris and waste in regulated areas, employees must wear respirators. In areas where thermal system insulation or surfacing material is present, workers must assume that all waste and debris contain asbestos.

Does the competent person have duties that apply to more than one work class?

Yes. For *Class II, III, and IV* jobs, the *competent person* must inspect often enough to assess changing conditions and upon employee request.

For *Class I or II* asbestos work, the *competent person* must ensure the integrity of the enclosures or other containments by onsite inspection and supervise the following activities:

- Setup of regulated areas, enclosures, or other containments.
- Setup procedures to control entry to and exit from the enclosure or area.
- Employee exposure monitoring by ensuring it is properly conducted.
- Use of required protective clothing and equipment by employees working within the enclosure or using glove bags (a plastic bag-like enclosure affixed around ACM, with glove-like appendages through which materials and tools may be handled).
- Setup, removal, and performance of engineering controls, work practices, and personal protective equipment through onsite inspection.

- Use of hygiene facilities by employees.
- Required decontamination procedures.
- Notification requirements.

What does the OSHA standard require concerning respirators?

Employees must use respirators during the following activities:

- *Class I* asbestos jobs.
- *Class II* work where ACM is not removed substantially intact.
- *Class II and III* work not using wet methods.
- *Class II and III* work without a negative exposure assessment.
- *Class III* jobs where thermal system insulation or surfacing ACM or PACM is cut, abraded, or broken.
- *Class IV* work within a regulated area where respirators are required.
- Work where employees are exposed above the TWA or excursion limit.
- Emergencies.

Employers must provide respirators at no cost to workers, selecting the appropriate type from among those certified by NIOSH.

Employers must provide employees performing *Class I* work with full-facepiece supplied air respirators operated in pressure-demand mode and equipped with an auxiliary positive-pressure, self-contained breathing apparatus when exposure levels exceed 1 f/cc as an 8-hour TWA.

Employers must provide half-mask purifying respirators—other than disposable respirators—equipped with high-efficiency filters for *Class II and III* asbestos jobs where work disturbs thermal system insulation or surfacing ACM or PACM.

If a particular job is not *Class* I, II, or III and exposures are above the PEL or STEL, the asbestos standard, 29 *CFR* Part 1926.1101, contains a table specifying types of respirators to use.

According to 29 *CFR* Part 1910.134, employers must institute a respiratory program that includes the following:

- Procedures for selecting respirators for use in the workplace;
- Fit testing procedures for tight-fitting respirators;
- Procedures for proper use of respirators in routine and reasonably foreseeable emergency situations;
- Procedures and schedules for cleaning, disinfecting, storing, inspecting, repairing, discarding, and maintaining respirators;
- Procedures to ensure adequate air quality, quantity, and flow of breathing air for atmosphere-supplying respirators;
- Training of employees in the respiratory hazards to which they are potentially exposed during routine and emergency situations;
- Training of employees in the proper use and maintenance of respirators, including putting on and removing them, and any limitations on their use; and
- Procedures for regularly evaluating the effectiveness of the program.

(See *Respiratory Protection,* 29 *CFR* Part 1910.134, for complete program requirements.)

With regard to fit testing, employers must do the following:

- Ensure that employees are fit tested with the same make, model, style, and size of respirator that they will be using;
- Ensure that employees using a tight-fitting facepiece respirator pass an appropriate qualitative fit test (QLFT) or quantitative fit test (QNFT);
- Ensure that an employee using a tight-fitting facepiece respirator is fit tested prior to initial use of the respirator, whenever a different size, style, model or make of respirator facepiece is used, and at least annually thereafter.
- Conduct an additional fit test whenever an employee reports (or the employer, physician or other licensed health-care professional, supervisor, or program administrator makes) visual observations of changes in an employee's physical condition that could affect respirator fit. Such conditions include, but are not limited to, facial scarring, dental changes, cosmetic surgery, or an obvious change in body weight.

Employers must not assign any employee to tasks requiring respirator use who, based on the most recent physical exam and the examining physician's recommendations, would be unable to function normally. Employers must assign such employees to other jobs or give them the opportunity to transfer to different positions in the same geographical area and with the same seniority, status, pay rate, and job benefits as they had before transferring, if such positions are available.

Do employers have to provide protective clothing for employees?

Employers must provide and require the use of protective clothing—such as coveralls or similar whole-body clothing, head coverings, gloves, and foot coverings—for the following:

- Employees exposed to airborne asbestos exceeding the PEL or STEL;
- Work without a negative exposure assessment; or
- Employees performing *Class I* work involving the removal of over 25 linear or 10 square feet of thermal system insulation or surfacing ACM or PACM.

Employers must ensure that the laundering of contaminated clothing does not release airborne asbestos in excess of the PEL or STEL. Employers who give contaminated clothing to other persons for laundering must inform them of the requirement to follow procedures that do not release airborne asbestos in excess of the PEL or STEL.

Employers must transport contaminated clothing in sealed, impermeable bags or other closed impermeable containers bearing appropriate labels. (See the hazard communication section elsewhere in this publication for label requirements.)

The *competent person* must examine employee worksuits at least once per work shift for rips or tears. Rips or tears found while an employee is working must be mended or the worksuit replaced immediately.

What are the hygiene-related requirements for employees performing Class I asbestos work involving more than 25 linear feet or 10 square feet of thermal system insulation or surfacing ACM or PACM?

For this class of asbestos work, the requirements are as follows:

- Employers must create a decontamination area adjacent to and connected with the regulated area.
- Workers must enter and exit the regulated area through the decontamination area.

The decontamination area must include an equipment room, shower area, and clean room in series and comply with the following:

- Equipment room must have impermeable, labeled bags and containers to store and dispose of contaminated protective equipment.
- Shower area must be adjacent to both the equipment and clean rooms, unless work is performed outdoors or this arrangement is not feasible (in either case, employers must ensure that employees remove asbestos contamination from their worksuits in the equipment room using a HEPA vacuum before proceeding to a shower not adjacent to the work area or remove their contaminated worksuits in the equipment room, don clean worksuits, and proceed to a shower not adjacent to the work area).
- Clean room must have a locker or appropriate storage container for each employee.

Note: When it is not feasible to provide a change area adjacent to the work area, or when the work is performed outdoors, employees may clean protective clothing with a portable HEPA vacuum before leaving the regulated area. Employees then must shower and change into "street clothing" in a clean change area meeting the requirements described above.

To enter the regulated area, employees must pass through the equipment room. But before entering the regulated area, employees must do the following:

- Enter the decontamination area through the clean room.
- Remove and deposit street clothing within a provided locker.
- Put on protective clothing and respiratory protection before leaving the clean area.

Before exiting the regulated area, employees must do the following:

- Remove all gross contamination and debris.
- Remove protective clothing in the equipment room (depositing the clothing in labeled, impermeable bags or containers).
- Remove respirators in the shower and then shower before entering the clean room to change into "street clothing."

Note: When workers consume food or beverages at the *Class I* worksite, employers must provide lunch areas with airborne asbestos levels below the PEL and/or excursion limit.

What are the hygiene-related requirements for employees performing other Class I asbestos work and Class II and III asbestos work where exposures exceed a PEL or where a negative exposure assessment has not been produced?

For this class of asbestos work, the requirements are as follows:

- Employers must establish an equipment room or area adjacent to the regulated area for the decontamination of employees and their equipment.
- Workers must cover area with an impermeable drop cloth on the floor or horizontal work surface and must be large enough to accommodate equipment cleaning and personal protective equipment removal without spreading contamination beyond the area.
- Workers must clean area with a HEPA vacuum before removing work clothing.

- Workers must clean all equipment and surfaces of containers filled with ACM before removal.
- Employers must ensure employees enter and exit the regulated area through the equipment room or area.

What are the hygiene-related requirements for employees performing Class IV work?

For this class of asbestos work, the requirements are as follows:

- Employers must ensure that workers cleaning up dust, waste, and debris while a Class I, II, or III activity is still in progress observe the hygiene practices required of the workers performing that activity.
- Workers cleaning up asbestos-containing surfacing material or thermal system insulation debris from a Class I or III activity after the activity is finished must be provided decontamination facilities required for *Class* I work involving less than 25 linear or 10 square feet of material, or for *Class III* work where exposure exceeds a PEL or no negative exposure assessment exists.

Note: For *any* class of asbestos work, employers must ensure that workers do not smoke in any work area with asbestos exposure.

What are an employer's housekeeping responsibilities?

Asbestos waste, scrap, debris, bags, containers, equipment, and contaminated clothing consigned for disposal must be collected and disposed of in sealed, labeled, impermeable bags or other closed, labeled impermeable containers. When vacuuming methods are selected, employees must use and empty HEPA-filtered vacuuming equipment carefully and in a way that will minimize asbestos reentry into the workplace.

Unless the building/facility owner demonstrates that the flooring does not contain asbestos, all vinyl and asphalt flooring material must be maintained in accordance with the following conditions:

- Sanding flooring material is prohibited.
- Employees stripping finishes must use wet methods and low abrasion pads at speeds lower than 300 revolutions per minute.
- Burnishing or dry buffing may be done only on flooring with enough finish that the pad cannot contact the flooring material.
- Employees must not dust, dry sweep, or vacuum without a HEPA filter in an area containing thermal system insulation or surfacing material or visibly deteriorated ACM.
- Employees must promptly clean up the waste and debris and accompanying dust, and dispose of it in leak-tight, labeled containers.

For a quick reference to the OSHA standard's provisions by work class, please see the following table.

Quick Reference of Provisions by Work Class*

	Class I	Class II	Class III	Class IV
Definition	Removal of thermal system insulation (TSI) and surfacing material (SM) containing > 1% asbestos	Removal of material other than TSI or SM containing > 1% asbestos	Maintenance and repair operations disturbing material containing > 1% asbestos	Housekeeping and custodial cleanup of dust, waste, and debris from Class I, II, or III activities
Regulated Areas	Required (warning signs mandatory)	Required (warning signs mandatory)	Required (warning signs mandatory)	Required (warning signs mandatory)
Competent Person	■ Must be onsite ■ Must inspect each workshift ■ Must attend supervisory training	■ Must be onsite ■ Must inspect often ■ Must attend supervisory training	■ Must be onsite ■ Must inspect often ■ Must attend operational and maintenance training	■ Must be onsite ■ Must inspect often ■ Must attend operational and maintenance training
Air Monitoring	■ Initial if no negative exposure assessment (NEA) ■ Daily unless positive pressure mode respirator is used ■ Additional if conditions change *Note*: Terminate if < permissible exposure limits (PELs)	■ Initial if no NEA ■ Daily unless positive pressure mode respirator is used ■ Additional if conditions change *Note*: Terminate if < PELs	■ Initial if no NEA ■ Periodic to accurately predict if > PELs ■ Additional if conditions change *Note*: Terminate if < PELs	■ Initial if no NEA ■ Periodic to accurately predict if > PELs ■ Additional if conditions change *Note*: Terminate if < PELs

*This is an overview of the standards' requirements. You must consult the standard for the specifics of the requirements for each class.

Quick Reference of Provisions by Work Class* *(continued)*

	Class I	Class II	Class III	Class IV
Medical Surveillance	Required if ■ Wearing negative-pressure respirator, or ■ > 30 days of work/year	Required if ■ Wearing negative-pressure respirator, or ■ > 30 days of work/year	Required if ■ Wearing negative-pressure respirator, or ■ > 30 days of work/year	Required if ■ Wearing negative-pressure respirator, or ■ > PEL for more than 30 days/year
Respirators	Mandatory for all Class I jobs	Mandatory if ■ Non-intact removal, or ■ No NEA, or ■ > PEL, or ■ Dry removal (except for roofing), or ■ In emergencies	Mandatory if ■ No NEA, or ■ TSI or SM disturbed, or ■ > PEL, or ■ Dry removal (except for roofing), or ■ In emergencies	Mandatory ■ In regulated area where required, or ■ If > PEL, or ■ In emergencies
Protective Clothing and Equipment	Required for all jobs if ■ > 25 linear or 10 square feet of TSI or ■ SM removal, or ■ No NEA, or ■ > PEL	Required for all jobs if ■ No NEA, or ■ > PEL	Required for all jobs if ■ No NEA, or ■ > PEL	Required for all jobs if ■ No NEA, or ■ > PEL
Training	Equivalent to EPA Model Accreditation Plan (MAP) asbestos abatement workers course	Equivalent to MAP course if critical barriers required; otherwise, train on specific work practices and engineering controls that must be used	Equivalent to AHERA course for maintenance and custodial staff	Equivalent to AHERA course for maintenance and custodial staff

*This is an overview of the standards' requirements. You must consult the standard for the specifics of the requirements for each class.

Quick Reference of Provisions by Work Class* *(continued)*

	Class I	Class II	Class III	Class IV
Employee and Equipment Decontamination	Required if > 25 linear or 10 square feet TSI or SM removal ■ Full decon unit ■ Equipment room, shower, and clean room in series connected to the regulated area; other decon facility arrangements are acceptable if the specified series arrangement is not feasible (see 29 *CFR* Part 1926.1101, Subpart Z) ■ Lunch areas *Note:* Must follow detailed decontamination procedures (see 29 *CFR* Part 1926.1101(j)(1)(iii) If < 25 linear or 10 square feet TSI or SM removal ■ Equipment room/area required ■ Impermeable dropcloths required ■ Area must accommodate cleanup ■ Must decontaminate all personal protective equipment (PPE) ■ Must enter regulated area through equipment room/decon area No smoking in work area	If > PEL or no NEA ■ Equipment room/area required ■ Impermeable dropcloths required ■ Area must accommodate cleanup ■ Must clean work clothes with HEPA vacuum before removal ■ Must Decontaminate all PPE ■ Must enter regulated area through equipment room/ decon area ■ Must enter regulated area through equipment room/ decon area No smoking in work area	If > PEL or no NEA ■ Equipment room/area required ■ Impermeable dropcloths required ■ Area must accommodate cleanup ■ Must clean work clothes with HEPA vacuum before removal ■ Must Decontaminate all PPE ■ Must enter regulated area through equipment room/ decon area ■ Must enter regulated area through equipment room/ decon area If NEA must vacuum No smoking in work area	If cleaning up asbestos containing surfacing material or thermal system insulation debris from a Class I or III activity after the activity is finished ■ Equipment room/area required ■ Dropcloths required ■ Area must accommodate cleanup ■ Must clean work clothes with HEPA vacuum before removal ■ Must decontaminate all PPE ■ Must enter regulated area through equipment room/ decon area No smoking in work area *Note*: If cleaning up dust, waste, and debris while a Class I, II, or III activity is still in progress, the requirements of that activity apply.

*This is an overview of the standards' requirements. You must consult the standard for the specifics of the requirements for each class.

Quick Reference of Provisions by Work Class* *(continued)*

	Class I	Class II	Class III	Class IV
Generally Required Work Practices and Engineering Controls	■ Wet methods ■ HEPA vacuum ■ Prompt cleanup/disposal	■ Wet methods ■ HEPA vacuum ■ Prompt cleanup/disposal	■ Wet methods ■ HEPA vacuum ■ Prompt cleanup/disposal	■ Wet methods ■ HEPA vacuum ■ Prompt cleanup/disposal
Required Work Practices and Engineering Controls to Comply with PELs	■ HEPA local exhaust ■ Enclosure or isolation ■ Directed ventilation ■ Other work practices ■ Respirators	■ HEPA local exhaust ■ Enclosure ■ Directed ventilation ■ Other work practices ■ Respirators	■ HEPA local exhaust ■ Enclosure ■ Directed ventilation ■ Other work practices ■ Respirators	■ HEPA local exhaust ■ Enclosure ■ Directed ventilation ■ Other work practices ■ Respirators
Prohibited Work Practices and Administrative Controls	■ High-speed abrasive disc saws without HEPA ■ Compressed air without capture device ■ Dry sweeping/shoveling	■ High-speed abrasive disc saws without HEPA ■ Compressed air without capture device ■ Dry sweeping/shoveling	■ High-speed abrasive disc saws without HEPA ■ Compressed air without capture device ■ Dry sweeping/shoveling	■ High-speed abrasive disc saws without HEPA ■ Compressed air without capture device ■ Employee rotation
Controls and Work Practices	■ Critical barriers/isolation methods required if • > 25 linear or 10 square feet of TSI or SM removal • < 25 linear or 10 square feet of TSI or SM removal only if no NEA or there are adjacent workers ■ HVAC isolation required	For indoor work only ■ Critical barriers/isolation methods required if • no NEA • likely > a PEL • non-intact removal ■ Impermeable dropcloths required	■ Critical barriers required • If no NEA • > Pel via monitoring ■ Impermeable dropcloths required ■ Local HEPA exhaust required	See *Generally Required Work Practices and Engineering Controls* in this table

*This is an overview of the standards' requirements. You must consult the standard for the specifics of the requirements for each class.

Quick Reference of Provisions by Work Class* *(continued)*

	Class I	Class II	Class III	Class IV
Controls and Work Practices *(continued)*	■ Impermeable dropcloths required ■ Directed ventilation required if no NEA or > a PEL ■ Objects must be covered One or more of the following controls must be used: ■ Negative-pressure enclosure ■ Glove bag ■ Negative-pressure glove bag ■ Negative pressure glove box ■ Water spray process ■ Mini enclosure	For removal of vinyl and asphalt flooring materials ■ No sanding ■ HEPA vacuum ■ Wet methods ■ No dry sweeping ■ Any mechanical chipping must be done in negative-pressure enclosure ■ Intact removal if possible ■ Dry heat removal allowed ■ Assume contains asbestos without an analysis For removal of roofing materials ■ Intact removal if possible ■ Wet methods if feasible ■ Cutting machine misting ■ HEPA-vacuum debris ■ Lower to ground as soon as possible but no later than day's end ■ Control dust of unbagged material ■ Prevent intake of airborne asbestos through roof vent system	*Note*: Enclosure or isolation of operation required if TSI or SM is drilled, cut, abraded, sanded, sawed, or chipped	

*This is an overview of the standards' requirements. You must consult the standard for the specifics of the requirements for each class.

Quick Reference of Provisions by Work Class* *(continued)*

	Class I	Class II	Class III	Class IV
Controls and Work Practices *(continued)*		For removal of cement-like siding, shingles, or transite panels ■ Intact removal if possible ■ Wet Methods ■ Lower to ground via dust-tight chute, crane, or hoist immediately or place in an impervious waste bag or wrap in plastic sheeting and lower to ground by day's end ■ Cut nail heads For removal of gaskets ■ Use glove bags if not intact ■ Wet removal ■ Prompt disposal ■ Wet scraping Additional requirements ■ Wet methods ■ Intact removal if possible ■ Cutting, abrading, or breaking prohibited		

*This is an overview of the standards' requirements. You must consult the standard for the specifics of the requirements for each class.

OSHA Assistance

OSHA can provide extensive help through a variety of programs, including technical assistance about effective safety and health programs, state plans, workplace consultations, voluntary protection programs, strategic partnerships, and training and education, and more. An overall commitment to workplace safety and health can add value to your business, to your workplace, and to your life.

What are safety and health system management guidelines?

Effective management of worker safety and health protection is a decisive factor in reducing the extent and severity of work-related injuries and illnesses and their related costs. In fact, an effective safety and health program forms the basis of good worker protection and can save time and money—about $4 for every dollar spent—and increase productivity and reduce worker injuries, illnesses, and related worker compensation costs.

To assist employers and employees in developing effective safety and health programs, OSHA published recommended *Safety and Health Program Management Guidelines (Federal Register* 54(16): 3904-3916, January 26, 1989). These voluntary guidelines can be applied to all places of employment covered by OSHA.

The guidelines identify four general elements critical to the development of a successful safety and health management system:

- Management leadership and employee involvement,
- Worksite analysis,
- Hazard prevention and control, and
- Safety and health training.

The guidelines recommend specific actions, under each of these general elements, to achieve an effective safety and health program. The *Federal Register* notice is available online at **www.osha.gov**.

What are state programs?

The *Occupational Safety and Health Act of 1970 (OSH Act)* encourages states to develop and operate their own job safety and health plans. OSHA approves and monitors these plans. There are currently 26 state plans: 23 cover both private and public (state and local government) employment; 3 states, Connecticut, New Jersey, and New York, cover the public sector only. States and territories with their own OSHA-approved occupational safety and health plans must adopt standards identical to, or at least as effective as, the federal standards.

How do I obtain consultation services?

Consultation assistance is available on request to employers who want help in establishing and maintaining a safe and healthful workplace. Largely funded by OSHA, the service is provided at no cost to the employer. Primarily developed for smaller employers with more hazardous operations, the consultation service is delivered by state governments employing professional safety and health consultants. Comprehensive assistance includes an appraisal of all mechanical systems, work practices, and occupational safety and health hazards of the workplace and all aspects of the employer's present job safety and health program. In addition, the service offers assistance to employers in developing and implementing an effective safety and health program. No penalties are proposed or citations issued for hazards identified by the consultant. OSHA provides consultation assistance to the employer with the assurance that his or her name and firm and any information about the workplace will not be routinely reported to OSHA enforcement staff.

Under the consultation program, certain exemplary employers may request participation in OSHA's Safety and Health Achievement Recognition Program (SHARP). Eligibility for participation in SHARP includes receiving a comprehensive consultation visit, demonstrating exemplary achievements in workplace safety and health by abating all identified hazards, and developing an excellent safety and health program.

Employers accepted into SHARP may receive an exemption from programmed inspections (not complaint or accident investigation inspections) for a period of 1 year. For more information concerning consultation assistance, see the list of consultation projects listed at the end of this publication.

What are Voluntary Protection Programs (VPPs)?

Voluntary Protection Programs and onsite consultation services, when coupled with an effective enforcement program, expand worker protection to help meet the goals of the OSH Act. The three VPPs—Star, Merit, and Demonstration—are designed to recognize outstanding achievements by companies that have successfully incorporated comprehensive safety and health programs into their total management system. The VPPs motivate others to achieve excellent safety and health results in the same outstanding way as they establish a cooperative relationship between employers, employees, and OSHA.

For additional information on VPPs and how to apply, contact the OSHA regional offices listed at the end of this publication.

What is the Strategic Partnership Program?

OSHA's Strategic Partnership Program, the newest member of OSHA's cooperative programs, helps encourage, assist, and recognize the efforts of partners to eliminate serious workplace hazards and achieve a high level of worker safety and health. Whereas OSHA's Consultation Program and VPP entail one-on-one relationships between OSHA and individual worksites, most strategic partnerships seek to have a broader impact by building cooperative relationships with groups of employers and employees. These partnerships are voluntary, cooperative relationships between OSHA, employers, employee representatives, and others (e.g., trade unions, trade and professional associations, universities, and other government agencies).

For more information on this program, contact your nearest OSHA office, or visit OSHA's website at **www.osha.gov**.

Does OSHA offer training and education?

OSHA's area offices offer a variety of information services, such as compliance assistance, technical advice, publications, audiovisual aids and speakers for special engagements. OSHA's Training Institute in Des Plaines, IL, provides basic and advanced courses in safety and health for federal and state compliance officers, state consultants, federal agency personnel, and private sector employers, employees, and their representatives.

The OSHA Training Institute also has established OSHA Training Institute Education Centers to address the increased demand for its courses from the private sector and from other federal agencies. These centers are nonprofit colleges, universities, and other organizations that have been selected after a competition for participation in the program.

OSHA also provides funds to nonprofit organizations, through grants, to conduct workplace training and education in subjects where OSHA believes there is a lack of workplace training. Grants are awarded annually. Grant recipients are expected to contribute 20 percent of the total grant cost.

For more information on grants, training, and education, contact the OSHA Training Institute, Office of Training and Education, 1555 Times Drive, Des Plaines, IL 60018, (847) 297–4810. For further information on any OSHA program, contact your nearest OSHA area or regional office listed at the end of this publication.

Does OSHA provide any information electronically?

OSHA has a variety of materials and tools available on its website—www.osha.gov. These include e-Tools such as Expert Advisors, Electronic Compliance Assistance Tools (e-CATs), Technical Links; regulations, directives, publications; videos, and other information for employers and employees. OSHA's software programs and compliance assistance tools walk you through challenging safety and health issues and common problems to find the best solutions for your workplace.

OSHA's CD-ROM includes standards, interpretations, directives, and more and can be purchased on CD-ROM from the U.S. Government Printing Office. To order, write to the Superintendent of Documents, P.O. Box 371954, Pittsburgh, PA 15250-7954 or phone (202) 512–1800.

How do I learn more about related OSHA publications?

OSHA has an extensive publications program. For a listing of free or sales items, visit OSHA's website at **www.osha.gov** or contact the OSHA Publications Office, U.S. Department of Labor, 200 Constitution Avenue, N.W., N-3101, Washington, DC 20210. Telephone (202) 693–1888 or fax to (202) 693–2498.

How do I contact OSHA about emergencies, complaints, or further assistance?

To report an emergency, file a complaint, or seek OSHA advice, assistance, or products, call 1–800–321–OSHA or contact your nearest OSHA regional or area office listed at the end of this publication. The teletypewriter (TTY) number is 1–877–889–5627.

You can also file a complaint online and obtain more information on OSHA federal and state programs by visiting OSHA's website at **www.osha.gov**.

For more information on grants, training, and education, contact the OSHA Training Institute, Office of Training and Education, 1555 Times Drive, Des Plaines, Il 60018, (847) 297–4810, or see **Outreach** on OSHA's website at **www.osha.gov**.

OSHA Office Directory

OSHA Regional Offices

Region I
(CT,* ME, MA, NH, RI, VT*)
JFK Federal Building, Room E340
Boston, MA 02203
(617) 565–9860

Region II
(NJ,* NY,* PR,* VI*)
201 Varick Street, Room 670
New York, NY 10014
(212) 337–2378

Region III
(DE, DC, MD,* PA,* VA,* WV)
The Curtis Center
170 S. Independence Mall West
Suite 740 West
Philadelphia, PA 19106-3309
(215) 861–4900

Region IV
(AL, FL, GA, KY,* MS, NC,* SC,* TN*)
SNAF
61 Forsyth Street SW, Room 6T50
Atlanta, GA 30303
(404) 562–2300

Region V
(IL, IN,* MI,* MN,* OH, WI)
230 South Dearborn Street, Room 3244
Chicago, IL 60604
(312) 353–2220

Region VI
(AR, LA, NM,* OK, TX)
525 Griffin Street, Room 602
Dallas, TX 75202
(214) 767–4731 or 4736 x224

Region VII
(IA,* KS, MO, NE)
City Center Square
1100 Main Street, Suite 800
Kansas City, MO 64105
(816) 426–5861

Region VIII
(CO, MT, ND, SD, UT,* WY*)
1999 Broadway, Suite 1690
PO Box 46550
Denver, CO 80202-5716
(303) 844–1600

Region IX
(American Samoa, AZ,* CA,* HI, NV,* Northern Mariana Islands)
71 Stevenson Street, Room 420
San Francisco, CA 94105
(415) 975–4310

Region X
(AK,* ID, OR,* WA*)
1111 Third Avenue, Suite 715
Seattle, WA 98101-3212
(206) 553–5930

---

* These states and territories operate their own OSHA-approved job safety and health programs (Connecticut, New Jersey, and New York plans cover public employees only). States with approved programs must have a standard that is identical to, or at least as effective as, the federal standard.

OSHA Area Offices

Anchorage, AK
(907) 271–5152

Birmingham, AL
(205) 731–1534

Mobile, AL
(251) 441–6131

Little Rock, AR
(501) 324–6291(5818)

Phoenix, AZ
(602) 640–2348

Sacramento, CA
(916) 566–7471

San Diego, CA
(619) 557–5909

Denver, CO
(303) 844–5285

Greenwood Village, CO
(303) 843–4500

Bridgeport, CT
(203) 579–5581

Hartford, CT
(860) 240–3152

Wilmington, DE
(302) 573–6518

Fort Lauderdale, FL
(954) 424–0242

Jacksonville, FL
(904) 232–2895

Tampa, FL
(813) 626–1177

Savannah, GA
(912) 652–4393

Smyrna, GA
(770) 984–8700

Tucker, GA
(770) 493–6644/6742/8419

Des Moines, IA
(515) 284–4794

Boise, ID
(208) 321–2960

Calumet City, IL
(708) 891–3800

Des Plaines, IL
(847) 803–4800

Fairview Heights, IL
(618) 632–8612

North Aurora, IL
(630) 896–8700

Peoria, IL
(309) 671–7033

Indianapolis, IN
(317) 226–7290

Wichita, KS
(316) 269–6644

Frankfort, KY
(502) 227–7024

Baton Rouge, LA
(225) 389–0474 (0431)

Braintree, MA
(617) 565–6924

Methuen, MA
(617) 565–8110

Springfield, MA
(413) 785–0123

Linthicum, MD
(410) 865–2055/2056

Augusta, ME
(207) 622–8417

Bangor, ME
(207) 941–8177

Portland, ME
(207) 780–3178

Lansing, MI
(517) 327–0904

Minneapolis, MN
(612) 664– 5460

Kansas City, MO
(816) 483–9531

St. Louis, MO
(314) 425–4249

Jackson, MS
(601) 965–4606

Billings, MT
(406) 247–7494

Raleigh, NC
(919) 856–4770

Bismark, ND
(701) 250–4521

Omaha, NE
(402) 221–3182

Concord, NH
(603) 225–1629

Avenel, NJ
(732) 750–3270

Hasbrouck Heights, NJ
(201) 288–1700

Marlton, NJ
(856) 757–5181

Parsippany, NJ
(973) 263–1003

Carson City, NV
(775) 885–6963

Albany, NY
(518) 464–4338

Bayside, NY
(718) 279–9060

Bowmansville, NY
(716) 684–3891

New York, NY
(212) 337–2636

North Syracuse, NY
(315) 451–0808

Tarrytown, NY
(914) 524–7510

Westbury, NY
(516) 334–3344

Cincinnati, OH
(513) 841–4132

Cleveland, OH
(216) 522–3818

Columbus, OH
(614) 469–5582

Toledo, OH
(419) 259–7542

Oklahoma City, OK
(405) 278–9560

Portland, OR
(503) 326–2251

Allentown, PA
(610) 776–0592

Erie, PA
(814) 833–5758

Harrisburg, PA
(717) 782–3902

Philadelphia, PA
(215) 597–4955

Pittsburgh, PA
(412) 395–4903

Wilkes–Barre, PA
(570) 826–6538

Guaynabo, PR
(787) 277–1560

Providence, RI
(401) 528–4669

Columbia, SC
(803) 765–5904

Nashville, TN
(615) 781–5423

Austin, TX
(512) 916–5783 (5788)

Corpus Christi, TX
(361) 888–3420

Dallas, TX
(214) 320–2400 (2558)

El Paso, TX
(915) 534–6251

Fort Worth, TX
(817) 428–2470 (485–7647)

Houston, TX
(281) 591–2438 (2787)

Houston, TX
(281) 286–0583/0584 (5922)

Lubbock, TX
(806) 472–7681 (7685)

Salt Lake City, UT
(801) 530–6901

Norfolk, VA
(757) 441–3820

Bellevue, WA
(206) 553–7520

Appleton, WI
(920) 734–4521

Eau Claire, WI
(715) 832–9019

Madison, WI
(608) 264–5388

Milwaukee, WI
(414) 297–3315

Charleston, WV
(304) 347-5937

OSHA-Approved State Plans

Commissioner
Alaska Department of Labor
1111 W. 8th Street, Room 308
P.O. Box 21149
Juneau, AK 99802-1149
(907) 465–2700

Director
Industrial Commission of Arizona
800 W. Washington
Phoenix, AZ 85007
(602) 542–5795

Director
California Department of
Industrial Relations
455 Golden Gate Avenue
10th Floor
San Francisco, CA 94102
(415) 703–5050

Commissioner
Connecticut Department of Labor
200 Folly Brook Boulevard
Wethersfield, CT 06109
(860) 263–6505

Director
Hawaii Department of Labor
and Industrial Relations
830 Punchbowl Street
Honolulu, HI 96831
(808) 586–8844

Commissioner
Iowa Division of Labor
1000 E. Grand Avenue
Des Moines, IA 50319
(515) 281–3447

Commissioner
Indiana Department of Labor
State Office Building
402 West Washington Street
Room W195
Indianapolis, IN 46204
(317) 232–2378

Secretary
Kentucky Labor Cabinet
1047 U.S. Highway 127 South
Suite 4
Frankfort, KY 40601
(502) 564–3070

Commissioner
Maryland Division of Labor
and Industry
Department of Labor Licensing
and Regulation
MOSH
1100 N. Eutaw Street, Room 613
Baltimore, MD 21201-2206
(410) 767–2215

Director
Michigan Department of
Consumer and Industry Services
P.O. Box 30643
7150 Harris Drive
Lansing, MI 48909
(517) 373–7230

Commissioner
Minnesota Department of Labor
and Industry
443 Lafayette Road
St. Paul, MN 55155
(651) 284–5010

Commissioner
North Carolina Department
of Labor
4 West Edenton Street
Raleigh, NC 27601-1092
(919) 807–2900

Commissioner
New Jersey Department of Labor
John Fitch Plaza—Labor Building
Market and Warren Streets
P.O. Box 110
Trenton, NJ 08625-0110
(609) 292–2975

Secretary
New Mexico Environment
Department
1190 St. Francis Drive
P.O. Box 26110
Santa Fe, NM 87502
(505) 827–2850

Commissioner
New York Department of Labor
W. Averell Harriman State Office
Building-12, Room 500
Albany, NY 12240
(518) 457–2741

Administrator
Nevada Division of
Industrial Relations
400 West King Street, Suite 400
Carson City, NV 89703
(775) 684–7260

Administrator
Oregon Department of
Consumer and Business Services
Occupational Safety and
Health Division (OR–OSHA)
350 Winter Street, N.E. Room 430
Salem, OR 97310-3882
(503) 378–3272

Secretary
Puerto Rico Department of
Labor and Human Resources
Prudencio Rivera Martinez
Building
505 Munoz Rivera Avenue
Hato Rey, PR 00918
(787) 754–2119

Director
South Carolina Department
of Labor
Licensing and Regulation
Koger Office Park
Kingstree Building
110 Centerview Drive
P.O. Box 11329
Columbia, SC 29211
(803) 896–4300

Commissioner
Tennessee Department of Labor
and Workforce Development
710 James Robertson Parkway
Andrew Johnson Tower
Nashville, TN 37243-0659
(615) 741–2582

Commissioner
Labor Commission of Utah
160 East 300 South Street
3rd Floor
P.O. Box 146650
Salt Lake City, UT 84111
(801) 530–6901

Commissioner
Virginia Department of Labor
and Industry
Powers–Taylor Building
13 South 13th Street
Richmond, VA 23219
(804) 786–2377

Commissioner
Virgin Islands Department
of Labor
2203 Church Street
Christiansted
St. Croix, VI 00820-4660
(340) 773–1990

Commissioner
Vermont Department of Labor
and Industry
National Life Building—
Drawer 20
120 State Street
Montpelier VT 05620-3401
(802) 828–2288

Director
Washington Department of
Labor and Industries
P.O. Box 44001
Olympia, WA 98504-4001
(360) 902–4200
(360) 902–5430

Administrator
Worker's Safety and
Compensation Division (WSC)
Wyoming Department of
Employment
Herschler Building, 2nd Floor East
122 West 25th Street
Cheyenne, WY 82002
(307) 777–7786

OSHA Consultation Projects

Anchorage, AK
(907) 269–4957

Tuscaloosa, AL
(205) 348–3033

Little Rock, AR
(501) 682–4522

Phoenix, AZ
(602) 542–1695

Sacramento, CA
(916) 263–2856

Fort Collins, CO
(970) 491–6151

Wethersfield, CT
(860) 566–4550

Washington, DC
(202) 541–3727

Wilmington, DE
(302) 761–8219

Tampa, FL
(813) 974–9962

Atlanta, GA
(404) 894–2643

Tiyam, GU
9–1–(671) 475–1101

Honolulu, HI
(808) 586–9100

Des Moines, IA
(515) 281–7629

Boise, ID
(208) 426–3283

Chicago, IL
(312) 814–2337

Indianapolis, IN
(317) 232–2688

Topeka, KS
(785) 296–2251

Frankfort, KY
(502) 564–6895

Baton Rouge, LA
(225) 342–9601

West Newton, MA
(617) 727–3982

Laurel, MD
(410) 880–4970

Augusta, ME
(207) 624–6400

Lansing, MI
(517) 322–1809

Saint Paul, MN
(651) 284–5060

Jefferson City, MO
(573) 751–3403

Pearl, MS
(601) 939–2047

Helena, MT
(406) 444–6418

Raleigh, NC
(919) 807–2905

Bismarck, ND
(701) 328–5188

Lincoln, NE
(402) 471–4717

Concord, NH
(603) 271–2024

Trenton, NJ
(609) 292–3923

Santa Fe, NM
(505) 827–4230

Henderson, NV
(702) 486–9140

Albany, NY
(518) 457–2238

Columbus, OH
(614) 644–2631

Oklahoma City, OK
(405) 528–1500

Salem, OR
(503) 378–3272

Indiana, PA
(724) 357–2396

Hato Rey, PR
(787) 754–2171

Providence, RI
(401) 222–2438

Columbia, SC
(803) 734–9614

Brookings, SD
(605) 688–4101

Nashville, TN
(615) 741–7036

Austin, TX
(512) 804–4640

Salt Lake City, UT
(801) 530–6901

Richmond, VA
(804) 786–6359

Christiansted St. Croix, VI
(809) 772–1315

Montpelier, VT
(802) 828–2765

Olympia, WA
(360) 902–5638

Madison, WI
(608) 266–9383

Waukesha, WI
(262) 523–3044

Charleston, WV
(304) 558–7890

Cheyenne, WY
(307) 777–7786

OSHA

Occupational Safety
and Health Administration

U.S. Department of Labor

OSHA Occupational Safety and Health Administration
www.osha.gov

Underground Construction (Tunneling)

OSHA 3115-06R 2003

This informational booklet provides a general overview of a particular topic related to OSHA standards. It does not alter or determine compliance responsibilities in OSHA standards or the *Occupational Safety and Health Act of 1970*. Because interpretations and enforcement policy may change over time, you should consult current OSHA administrative interpretations and decisions by the Occupational Safety and Health Review Commission and the Courts for additional guidance on OSHA compliance requirements.

This information is available to sensory impaired individuals upon request. Voice phone: (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

OSHA
www.osha.gov

Underground Construction (Tunneling)

U.S. Department of Labor
Elaine L. Chao, Secretary

Occupational Safety and Health Administration
John L. Henshaw, Assistant Secretary

OSHA 3115-06R
2003

Contents

Introduction...4

Construction operations covered by the OSHA standard...4

Employers and employees covered by the OSHA standard...5

Requirements of the OSHA standard...6

The need for a "competent person"...6

Training requirements...6

Notification and communication requirements...7

Site control procedures...8

- Check-in/check-out procedures...8
- Control of access and egress...9
- Ground support of portal and subsidence areas...9
- Ground support of underground areas...9
- Ground support of shafts...10
- Fire prevention and control...10

Ventilation requirements...12

Illumination requirements...13

Special air monitoring requirements...13

- Test for oxygen first...14
- Testing for methane and other flammable gases...14
- Hydrogen sulfide levels...15

Special conditions for drilling and blasting underground...15

Special requirements for using cranes and hoists underground...16

Potential hazards that require special precautions...18

Gassy or potentially gassy operations...18

Emergency procedures...21

Recordkeeping requirements...22

OSHA assistance...22

Safety and health management system guidelines...22

State programs...23

OSHA consultation services...23

The OSHA Voluntary Protection Program (VPP)...24

Strategic Partnership Programs...25

The OSHA Alliance Program...25

OSHA training and education...26

Information available electronically...26

OSHA publications...27

Contacting OSHA...27

OSHA Regional Offices...28

Introduction

The construction of underground tunnels, shafts, chambers, and passageways are essential yet dangerous activities. Working under reduced light conditions, difficult or limited access and egress, with the potential for exposure to air contaminants and the hazards of fire and explosion, underground construction workers face many dangers. To help employers protect the safety and health of underground construction workers, the Occupational Safety and Health Administration (OSHA) has prepared a number of guidance documents, including the underground construction regulations, found in Part 1926, section 800 of Title 29 of the Code of Federal Regulations (29 CFR 1926.800).

OSHA regulations relating to underground construction were originally adopted in 1971 and revised over the years to add new protective measures and enhance worker safety. This publication summarizes OSHA's regulations related to underground construction. As such, it should be used as a guide but not as a substitute for the complete text of 29 CFR 1926.800.

Construction operations covered by the OSHA standard

The OSHA underground construction regulation (29 CFR 1926.800) applies to the construction of underground tunnels, shafts, chambers, and passageways. It also applies to cut-and-cover excavations connected to ongoing underground construction as well as those that create conditions characteristic of underground construction. These hazards include reduced natural ventilation and light, difficult and limited access and egress, exposure to air contaminants, fire, flooding, and explosion. The regulation does not apply to excavation and trenching operations for above ground structures that are not physically connected to an underground construction operation or to underground electrical transmission and distribution lines.

OSHA has developed the following definitions for construction activities that fall within the underground construction field:

A tunnel is "an excavation beneath the surface of the ground, the longer axis of which makes an angle not greater than 20 degrees to the horizontal."

A shaft is "(1) a passage made from the surface of the ground to a point underground, the longer axis of which makes an angle greater than 20 degrees to the horizontal; or (2) a pit in which there are employees, and it is foreseeable that they may enter (or do enter) the horizontal excavation; or (3) a pit that has typical underground construction hazards and is connected to a horizontal excavation."

Employers and employees covered by the OSHA standard

In general, OSHA authority extends to all private sector employers with one or more employees, as well as to civilian employees in federal agencies. As such, OSHA coverage applies to employers and employees in the construction industry. Workers not covered by OSHA include the self-employed; public employees of state and local governments; employees whose working conditions are regulated by other federal agencies, such as mine workers and atomic energy workers; and immediate family members of farming operations that do not employ outside workers.

States can administer their own occupational safety and health programs through plans approved by the Department of Labor under section 18(b) of the Occupational Safety and Health (OSH) Act of 1970, but they must enforce standards that are at least as effective as federal requirements. In 2003, 26 states operated their own safety and health programs under approved programs. (See OSHA's website at www.osha.gov for a list of those states.) Of these, 23 states cover both private and public employees while three states cover only public sector employees.

State safety and health standards under approved plans must either be identical to or at least as effective as federal OSHA standards.

Requirements of the OSHA standard

The underground construction standard covers many topics of concern to those who work in the challenging environment of underground construction. A sampling of items covered by the standard includes requirements for safe access and egress routes, employee training in hazard recognition, a "check-in/check-out" procedure, and emergency procedures. This booklet summarizes all requirements of the standard.

The standard provides some flexibility in methods to control workplace hazards in underground construction as long as appropriate precautions are taken to protect workers in a variety of situations. OSHA requires that a "competent person" be responsible for carrying out several requirements of the underground construction regulations. Situations that require intervention by a "competent person" are identified in the following sections.

The need for a "competent person"

The definition of a "competent person" in 29 CFR 1926.32 (f) is as follows:

One who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt correctivemeasures to eliminate them.

Under Subpart S, Underground Construction, caissons, cofferdams, and compressed air, a competent person is responsible for inspecting and evaluating workplace conditions, including air monitoring and the presence of air contaminants, ground stability, and the drilling, hauling and hoisting of equipment, to identify and correct any deficiencies.

Training requirements

All employees involved in underground construction must be trained to recognize and respond to hazards associated with this type of work. Training should be tailored to the specific requirements of the jobsite and include any unique issues or requirements.

The following topics should be part of an underground construction employee training program:

- Air monitoring and ventilation
- Illumination
- Communications
- Flood control
- Personal protective equipment
- Emergency procedures, including evacuation plans
- Check-in/check-out procedures
- Explosives
- Fire prevention and protection
- Mechanical equipment

Notification and communication requirements

Any time an employer receives a notification of a hazardous condition, all oncoming shifts must be notified of occurrences or conditions that either have affected or might affect their safety. Examples of this type of situation include equipment failures, earth or rockslides, cave-ins, flooding, fires, explosions, or release of gas.

The employer must also maintain open lines of communication with other employers at the worksite to ensure a rapid and complete exchange of information concerning events or situations that may impact worker safety.

Employers must maintain lines of communication with employees during underground construction activities. To ensure effective communications are always available, communication systems must be tested upon initial entry of each shift to the underground and as often as necessary at a later time to ensure they are in working order. Powered communication systems must operate on an independent power supply and be installed so that the use of or disruption of any single communication device or signal location will not disrupt the operation of the system in any other location.

If natural unassisted voice communication is ineffective at any time, a power-assisted means must be used to ensure communication between the work face, the bottom of the shaft, and the surface. In the case of an individual employee working alone underground in a hazardous location who is out of range of natural unassisted voice communication and not able to be observed by other employees, the employer must provide an effective means of obtaining assistance in the event of an emergency.

All shafts being developed or used for personnel access or hoisting require two effective means of communication. In addition, hoist operators must have a closed-circuit voice communication system connected to each landing station, with speaker-microphones located so that the operator can communicate with individual stations while the hoist is in use. (See the section on cranes and hoists later in this booklet for more specific information.)

Site control procedures

Check-in/check-out procedures

The employer must maintain a check-in/check-out procedure to ensure that above ground personnel maintain an accurate accounting of the number of persons underground and to prevent unauthorized persons from gaining access to the site. This is especially important in the event of an emergency but is a common sense requirement at all times.

The only time this procedure is not required is when an underground construction project designed for human occupancy is completed to the point that permanent environmental controls are effective and any remaining construction activity does not have the potential to create an environmental hazard or structural failure in the construction area.

Any time an employee is working underground, at least one designated person must be on duty above ground. This person is responsible for calling for immediate assistance and keeping an accurate count of employees who remain underground in the event of an emergency.

Control of access and egress

In addition to establishing a check-in/check-out procedure, the employer must ensure safe access to and egress from all workstations at the construction site to protect employees from potential hazards, such as being struck by excavators, haulage machines, or other moving equipment.

To help control access, all unused openings, including chutes and man ways, must be tightly covered, bulk headed, barricaded, or fenced off, and posted with warning signs that read, "Keep Out" or similar language.

Ground support of portal and subsidence areas

Portal openings and access areas must be guarded by shoring, fencing, head walls, shotcreting or equivalent protection to ensure that employees and equipment have a safe means to access these areas. Subsidence areas must be similarly guarded by shoring, filling in, or placing barricades and warning signs to prevent entry. Adjacent areas must be scaled or secured to prevent loose soil, rock, or fractured materials from endangering portal, subsidence, and access areas.

Ground support of underground areas

A competent person must inspect the roof, face, and walls of the work areas at the beginning of each shift and as often as necessary to ensure ground stability. The competent person tasked with such inspection responsibilities must be protected from loose ground by location, ground support, or equivalent means. The ground conditions along all haulage ways and travel ways must also be inspected as frequently as necessary to ensure safe passage and loose ground considered to be hazardous to employees must be scaled, supported, or taken down.

A competent person must determine how often rock bolts need to be tested to ensure that they meet the necessary torque, taking into consideration ground conditions, distance from vibration sources, and the specific bolt system in use. Only torque wrenches should be used when torsion-dependent bolts are used for ground support.

Employees involved in installing ground support systems must be adequately protected from the hazards of loose ground. The bottoms of any support sets installed must have sufficient anchorage to prevent ground pressures from dislodging the support base. Lateral bracing (including collar bracing, tie rods, or spreaders) must be provided between immediately adjacent sets to increase stability.

Any dislodged or damaged ground supports that create a hazardous condition must be promptly repaired or replaced. The new supports must be installed before removing the damaged supports. Some type of support, such as a shield, must be used to maintain a safe travel way for employees working in dead-end areas ahead of any support replacement operations.

Ground support of shafts

Shafts and wells more than 5 feet in depth (1.53 m) entered by employees must be supported by steel casing, concrete pipe, timber, solid rock, or other suitable material. The full depth of the shaft must be supported except where it penetrates into solid rock that will not change as a result of exposure. Where the potential for shear exists, where the shaft passes through earth into solid rock in either direction, or where the shaft ends in solid rock, the casing or bracing must extend at least 5 feet (1.53 m) into the solid rock.

The casing or bracing must also extend 42 (± 3) inches above ground level unless a standard railing is installed, the adjacent ground slopes away from the shaft collar, and barriers exist to prevent mobile equipment operating near the shaft from jumping over the bracing. If these conditions are met, the casing or bracing may be reduced to 12 inches above ground.

Fire prevention and control

In addition to the basic fire prevention and control guidance set forth in 29 CFR 1926 Subpart F, underground construction operations are subject to several specific requirements.

Open flames and fires are prohibited in underground construction areas except as permitted for welding, cutting, or other hot work operations. Smoking is prohibited unless an area is free of fire and explosion hazards. Signage prohibiting smoking and open flames should be placed throughout work areas. Fire extinguishers of at least 4A:40B:C rating or equivalent extinguishing means must be available at the head and tail pulleys of underground belt conveyers.

All underground structures and those within 100 feet (30.48 m) of an opening to the underground must be constructed of materials with a fire resistance rating of at least one hour. Also, no flammable or combustible material may be stored above ground within 100 feet (30.48 m) of any access point to an underground operation. If space limitations make this unfeasible, the material must be positioned as far as possible from the entrance with a fire-resistant barrier that has at least a one-hour rating between the material and the opening. Alternative precautionary measures may be adopted from industry practices used under similar working conditions or measures recommended under industry consensus standards. A site hazard analysis may be helpful to determine the effectiveness of precautionary measures. Any spill of flammable or combustible material must be cleaned up immediately.

Gasoline may not be underground at any time for any purpose due to its volatile qualities. Internal combustion engines (except diesel-powered engines on mobile equipment) are prohibited underground. Acetylene, liquefied petroleum gas, and methyl acetylene propadiene stabilized gas may be used underground for welding, cutting, and other hot work if all requirements of OSHA regulations pertaining to such activities are met. (See 29 CFR 1926 Subpart J and 29 CFR 1926.800(j)(k)(m)(n) for a complete explanation of these requirements.) Only enough fuel gas and oxygen cylinders for welding, cutting, or hot work during a 24-hour period are allowed underground. Noncombustible barriers must be installed below such activities if they are performed in or over a shaft or rise.

Oil, grease, and diesel fuel stored underground must be kept in tightly sealed containers in fire-resistant areas at least 300 feet (91.44 m) from underground explosive magazines, and at least 100 feet (30.48 m) from shaft stations and steeply inclined passageways. Storage areas must be positioned or diked to ensure that if a container breaks open, any fluids will not flow out of the storage area. Any hydraulically-actuated underground machinery must use fire-resistant hydraulic fluids unless it is protected by a fire suppression system or multi-purpose fire extinguisher rated at least 4A:40B:C and of sufficient capacity for the type and size of equipment involved.

Several specific requirements apply to the use of diesel fuel in underground construction operations, as follows:

- A surface level tank holding diesel fuel to be pumped to an underground storage site must have a maximum capacity no greater than the amount of fuel required to supply underground equipment for 24 hours.
- A surface level tank must be connected to the underground fueling station by an acceptable pipe or hose system controlled at the surface by a valve and at the bottom by a hose nozzle.
- The transfer pipe must remain empty at all times except when transferring diesel fuel.
- All hoisting operations in the shaft must be suspended during refueling operations if the supply piping in the shaft is not protected from potential damage.

Ventilation requirements

Fresh air must be supplied to all underground work areas in sufficient amounts to prevent any dangerous or harmful accumulation of dusts, fumes, mists, vapors, or gases. If natural ventilation does not provide the necessary air quality through sufficient air volume and air flow, the employer must provide mechanical ventilation to ensure that each employee working underground has at least 200 cubic feet (5.7m3) of fresh air per minute.

When performing work that is likely to produce dust, fumes, mists, vapors, or gases (such as blasting or rock drilling), the linear velocity of air flow in the tunnel bore, shafts, and all other underground work areas must be at least 30 feet (9.15 m) per minute. When such operations are complete, the ventilation systems must exhaust smoke and fumes to the outside atmosphere before resuming work in all affected areas. When drilling rock or concrete, dust control measures such as wet drilling, vacuum collectors, and water mix spray systems must be used to maintain dust levels within limits set in 29 CFR 1926.55, which includes gases, vapors, fumes, dusts, and mists.

The direction of mechanical airflow must be reversible but ventilation doors must be designed and installed to remain closed when in use, regardless of the direction of the airflow. If the ventilation system has been shut down and all employees are removed from the underground area, only competent persons authorized to test for air contaminants may be allowed underground until the ventilation system has been restored and all affected areas have tested at acceptable limits for air contaminants.

Illumination requirements

As in all construction operations, OSHA requires that proper illumination be provided during tunneling operations (see 29 CFR 1926.56 for details). When explosives are handled, only acceptable portable lighting equipment may be used within 50 feet of any underground heading.

For general tunneling operations, a minimum illumination intensity of 5 foot-candles must be maintained, although 10 foot-candles must be provided for shaft heading during drilling, mucking, and scaling.

Special air monitoring requirements

The employer must assign a “competent person” to perform air monitoring. If this individual determines that air contaminants may present a danger to life at any time, the employer must immediately take all necessary precautions and post a notice at all entrances to the underground site about the hazardous condition.

In performing air monitoring duties, the competent person must take into consideration the location of the jobsite (its proximity to fuel tanks, sewers, gas lines, etc.); the geology of the site, including soil type and permeability; the history of the site and the construction operation (changes in levels of substances monitored over time); and work practices at the jobsite (use of diesel engines, explosives, and fuel gas; hot work, welding, and cutting; and the physical reactions of employees to working underground.

Test for oxygen first

The competent person charged with air monitoring must test for oxygen content before testing for air contaminants. All underground work areas must be tested as often as necessary to verify that the atmosphere at normal atmospheric pressure remains within the acceptable parameters of 19.5 and 22 percent oxygen.

After verifying oxygen levels, the competent person must test all underground work areas for carbon monoxide, nitrogen dioxide, hydrogen sulfide, and other toxic gases, dusts, vapors, mists, and fumes as often as necessary to ensure that levels remain within permissible exposure limits (see 29 CFR 1926.55 for detailed information on these limits).

Testing for methane and other flammable gases

The competent person must also test all underground work areas for methane and other flammable gases to determine whether the operation must be classified as potentially gassy or gassy. If the atmosphere meets the criteria for these designations, the precautions listed in the section discussing gassy or potentially gassy operations later in this booklet must be followed. Other precautions to take when testing for methane or other flammable gases include:

- If 20 percent or more of the lower explosive limit for methane or other flammable gases is detected in any underground work area or in the air return, all employees must be evacuated to a safe location above ground (except those employees required to eliminate the hazard). Electrical power (except for acceptable pumping and ventilation equipment) must be cut off to the area until concentrations reach less than 20 percent of the lower explosive limit.
- If 10 percent or more of the lower explosive limit for methane gas or other flammable gases is detected near any welding,

cutting, or other hot work, the work must be suspended until the concentration is reduced to below 10 percent of the lower explosive limit.

- When 5 percent or more of the lower explosive limit for methane or other flammable gases is detected in an underground work area or in the air return, steps should be taken to increase ventilation air volume or otherwise control the gas concentration (unless all requirements of operating under potentially gassy or gassy operations are met).

Hydrogen sulfide levels

When air monitoring reveals the presence of 5 ppm or more of hydrogen sulfide, the affected underground areas must be tested at the beginning and midpoint of each shift until the concentration is measured at less than 5 ppm for three consecutive days.

Employees must be notified if hydrogen sulfide is detected in amounts exceeding 10 ppm and a continuous sampling and indicating monitor must be used to keep track of levels. If the concentration of hydrogen sulfide reaches 20 ppm, the monitor must be designed to provide both visual and audible alarms to warn that additional measures (respirator use, increased ventilation, evacuation) may be appropriate.

Special conditions for drilling and blasting underground

Before initiating any drilling operation underground, a “competent person” must inspect all drilling and associated equipment as well as the drilling area and correct any hazards. Employees are not allowed on a drill mast when a drill bit is in operation or a drill machine is being moved. Also, when moving a drill machine, all associated equipment and tools must be secured and the mast placed in a safe position.

Working on or around jumbo decks involves special safety precautions, including the following:

- Locate all receptacles or racks to store drill steel on jumbos.

- Warn employees working below jumbo decks when drilling is about to begin.
- The top deck of a jumbo must have a mechanical way to lift unwieldy or heavy items.
- Only employees assisting the operator may ride on the jumbo unless it is equipped with seating for each passenger and protection from crushing or catching hazards.
- Jumbo decks more than 10 feet high must be equipped with guardrails on all open sides unless an adjacent surface provides fall protection. Jumbo decks and stair treads must be slip-resistant, secured, and maintained to prevent slip, trip, and fall hazards.
- Jumbos must be chocked so they will not move when employees are working on them.

Whenever an underground blasting operation in a shaft is complete, a "competent person" must check the air quality and make sure that no walls, ladders, timbers, blocking, and wedges have been loosened as a result of the activity. If repairs are required, only employees involved in repair activity may be in or below affected areas until repairs are complete.

All blasting wires must be kept clear of electrical lines, pipes, rails and other conductive material (except earth), to prevent explosions or exposure of employees to electric current.

Special requirements for using cranes and hoists underground

The OSHA standard has provisions for the use of cranes or hoists that are unique to underground construction. In addition to provisions that apply to all construction activities using cranes or hoists (29 CFR 1926.550 and 29 CFR 1926.552), cranes used in underground construction must be equipped with a limit switch to prevent overtravel at the top and bottom of the hoist way. The limit switch should only be used when operational controls malfunction. Hoist controls must be arranged so the operator can reach all controls and the emergency power cutoff without reaching beyond his/her normal operating position.

Underground hoists must be designed to allow powering of the hoist drum in both directions and so that brakes are automatically applied upon power release or failure. The hoist operator must have a closed-circuit voice communication system with speaker microphones to communicate with individual landing stations. Also, hoists must be equipped with landing level indicators (marking the hoist rope is not adequate) and fire extinguishers (rated at least 2A:10B:C) in each hoist house.

Before using a hoist that has been out of operation for a complete shift or after repair or service, the operator must test run the equipment and correct any unsafe conditions before use. Inspections and load testing to 100 percent of capacity must be performed at least annually and after any repairs or alterations affecting the structural integrity of the hoist.

For material hoists, wire rope used in load lines must support at least five times the maximum intended load or the factor recommended by the rope manufacturer, whichever is greater. Personnel hoists must have at least two means to stop the load, each able to stop and hold 150 percent of the hoists' rated line pull. For personnel hoisting, a broken-rope safety, safety catch, or arrestment device are not adequate means of stopping.

Other aspects of hoist safety that apply to underground construction include:

- Employees may not ride on top of any cage, skip, or bucket unless inspecting or maintaining the system and wearing a safety belt or harness.
- Personnel and materials must be hoisted separately (except small tools and supplies secured in a nonhazardous manner).
- When sinking shafts 75 feet (22.86 m) or less, cages, skips, and buckets that may swing, bump, or snag against shaft sides must be guided by fenders, rails, ropes, or a combination. If the shaft is more than 75 feet, hoisted objects must be rope- or rail-guided for the full length of travel.

Additional safety requirements for personnel hoists in underground operations include:

- The operator must be able to see and hear signals at the operator's station.
- All cages must be equipped with a steel-plate protective canopy that slopes to the outside and can be pushed up for emergency egress and have a locking door that opens only inward.
- The sides of personnel cages must be enclosed by 1/2 inch wire mesh to a height of at least 6 feet (1.83 m). If the cage is being used as a work platform and is not in motion, the sides may be reduced to 42 inches (1.07 m).
- During sinking operations in shafts where guides and safeties are not used, the personnel platform may not exceed 200 feet (60.96 m) per minute and governors must be used during personnel hoisting. The speed may increase to 600 feet (182.88 m) per minute when guides and safeties are used and greater speeds when shafts are complete.

Potential hazards that require special precautions

Gassy or potentially gassy operations

Gassy or potentially gassy operations present specific hazards to underground construction workers. It is essential that employers understand the terms "gassy" and "potentially gassy" and to know what precautions to take when dealing with such environments. Operations that meet the criteria for this hazardous classification must be equipped with ventilation systems constructed with fire-resistant materials; have acceptable electrical systems, including fan motors; and have above ground controls to reverse the air flow. When using a mine-type ventilation system with an offset main fan on the surface, the system must be equipped with explosion doors or a weak-wall with an area at least equivalent to the cross-sectional area of the airway.

Gassy operations occur under the following conditions:

- When air monitoring discloses 10 percent or more of the lower explosive limit for methane or other flammable gases measured at 12 inches (304.8 mm) ± 0.25 inch (6.35 mm) from the roof, face, floor, or walls in any underground work area for three consecutive days; or
- There has been an ignition of methane or other flammable gases emanating from the strata that indicates the presence of such gases; or
- The underground construction operation is connected to an underground work area classified as gassy and subject to a continuous course of air that contains the flammable gas concentration.

The underground construction standard requires that gassy operations meet several special requirements, including both personnel and equipment safety concerns. These requirements include:

- Entrances to a gassy operation must be marked with prominently posted signage that identifies the area as gassy.
- Maintain a fire watch when performing hot work (welding, cutting, heating) in a gassy area and for a sufficient period after completing the work to ensure no possibility of fire remains. (See 29 CFR 1926.352(e))
- Use only acceptable equipment in well-maintained condition. Any mobile diesel-powered equipment must either be approved by MSHA and meet the requirements of 30 CFR part 36 (formerly Schedule 31) or the employer must demonstrate that the equipment is fully equivalent to MSHA-approved equipment and operated according to these regulations.
- Smoking is prohibited in all gassy operations; the employer must collect all possible sources of ignition (matches, lighters, etc.) from any person entering a gassy operation area.
- All operations in the affected area must stop when an operation is classified as gassy until full compliance with gassy operation requirements is confirmed or the operation is downgraded to a potentially gassy operation (see the following section). The only

exceptions are operations to control the gas concentration, installation of above ground equipment to reverse the airflow, or actions to comply with gassy operation requirements.

Gassy operations can be downgraded to potentially gassy when air monitoring results remain below 10 percent of the lower explosive limit for methane or other flammable gases for three consecutive days.

Potentially gassy operations, such as an unexpected pocket of gas, occur when the following conditions exist:

- Air monitoring shows 10 percent or more of the lower explosive limit for methane or other flammable gases measured at 12 inches (304.8 mm) ± 0.25 inch (6.35 mm) from the roof, face, floor or walls in any underground work area for more than a 24-hour period.
- The history of the geographical area, geological formation, or past experience indicates that 10 percent or more of the lower explosive limit for methane or other flammable gases is likely to be encountered in such underground operations.

Both gassy and potentially gassy operations require special air monitoring actions under the guidance of a "competent person," including testing for oxygen and flammable gas content in the affected underground work areas and adjacent work areas at the beginning and midpoint of each work shift. A manual flammable gas monitor should be used for gas testing and a manual electrical shut down control must be provided near the heading for the gas monitor.

The use of rapid excavation machines requires continuous automatic flammable gas monitoring to monitor the air at the heading, on the rib, and in the return air duct. If 20 percent or more of the lower explosive limit for methane or other flammable gases is encountered, the continuous monitor alert should signal the heading and shut down electrical power in the affected underground work area (except for required pumping and ventilation equipment).

Local gas tests must be conducted before and throughout welding, cutting or other hot work. In underground operations driven by drill-and-blast methods, the air in the affected area must be continuously tested for flammable gas when employees are working in the area as well as before reentering after blasting operations.

Emergency procedures

Whenever an employee is working underground at least one designated person must be on duty above ground, responsible for maintaining an accurate count of the number of employees underground and summoning emergency aid if needed. Every employee working underground must have a portable hand lamp or cap lamp for emergency use unless natural light or an emergency lighting system provides adequate illumination for escape. Employers must provide self-rescuers approved by the National Institute for Occupational Safety and Health (NIOSH) in all underground work areas where employees might be trapped by smoke or gas. (See CFR 1926.103 for more information.)

If 25 or more employees work underground at one time, the employer must provide at least two 5-person rescue teams, one at the jobsite or within 30 minutes travel time from the entry point to the site and the other team within two hours travel time. If less than 25 employees work underground, the employer must have one 5-person rescue team at the jobsite or within 30 minutes travel time. In both situations, advance arrangements can be made for local rescue services to meet this requirement. Rescue team members must be trained in rescue procedures, the use and limitations of breathing apparatus, and the use of firefighting equipment with qualifications reviewed annually. When flammable or noxious gases are anticipated at a jobsite, rescue teams must practice using self-contained breathing apparatus once a month. The rescue teams must be available through the duration of a construction project.

If a shaft is used as the means of egress, the employer must arrange for a readily available power-assisted hoisting capability in case of emergency, unless the regular hoisting means will function in the event of a power failure.

Recordkeeping requirements

Records of all air quality tests must be maintained above ground at the worksite and be available on request to the Secretary of Labor or his or her representative. The record must include the location, date, time, substance and amount monitored. Records of exposures to toxic substances must be kept for 30 years. (See 29 CFR 1910.1020 for more detailed information on access to employee exposure and medical records.) All other air quality test records must be retained until the project is complete.

Inspection certification records for all hoist equipment indicating the date of the most recent inspection and load-test, the signature of the person performing the inspection and test, and a serial number or other identifier for the hoist must be maintained on file until the project is complete.

OSHA assistance

OSHA can provide extensive help through a variety of programs, including technical assistance about effective safety and health programs, state plans, workplace consultations, voluntary protection programs, strategic partnerships, and training and education, and more. An overall commitment to workplace safety and health can add value to your business, to your workplace, and to your life.

Safety and health management system guidelines

Effective management of worker safety and health protection is a decisive factor in reducing the extent and severity of work-related injuries and illnesses and their related costs. To assist employers and employees in developing effective safety and health programs, OSHA published recommended Safety and Health Program Management Guidelines (Federal Register 54 (16): 3904-3916, January 26, 1989). These voluntary guidelines can be applied to all places of employment covered by OSHA.

The guidelines identify four general elements critical to the development of a successful safety and health management system:

- Management leadership and employee involvement.
- Worksite analysis.
- Hazard prevention and control.
- Safety and health training.

The guidelines recommend specific actions, under each of these general elements, to achieve an effective safety and health program. The Federal Register notice is available online at www.osha.gov.

State programs

The Occupational Safety and Health Act of 1970 (OSH Act) encourages states to develop and operate their own job safety and health plans. OSHA approves and monitors these plans. There are currently 26 state plans: 23 cover both private and public (state and local government) employment; 3 states, Connecticut, New Jersey, and New York, cover the public sector only. States and territories with their own OSHA-approved occupational safety and health plans must adopt standards identical to, or at least as effective as, the federal standards.

OSHA consultation services

Consultation assistance is available on request to employers who want help in establishing and maintaining a safe and healthful workplace. Largely funded by OSHA, the service is provided at no cost to the employer. Primarily developed for smaller employers with more hazardous operations, the consultation service is delivered by state governments employing professional safety and health consultants. Comprehensive assistance includes an appraisal of all-mechanical systems, work practices, and occupational safety and health hazards of the workplace and all aspects of the employer's present job safety and health program. In addition, the service offers assistance to employers in developing and implementing an effective safety and health program. No penalties are proposed or citations issued for hazards identified by the consultant. OSHA provides consultation assistance to the employer with the assurance that his or her name and firm and any information about the workplace will not be routinely reported to OSHA enforcement staff.

Under the consultation program, certain exemplary employers may request participation in OSHA's Safety and Health Achievement Recognition Program (SHARP). Eligibility for participation in SHARP includes receiving a comprehensive consultation visit, demonstrating exemplary achievements in workplace safety and health by abating all identified hazards, and developing an excellent safety and health program.

Employers accepted into SHARP may receive an exemption from programmed inspections (not complaint or accident investigation inspections) for one year. For more information concerning consultation assistance, call 800-321-OSHA or visit www.osha.gov.

The OSHA Voluntary Protection Program (VPP)

Voluntary Protection Programs and onsite consultation services, when coupled with an effective enforcement program, expand worker protection to help meet the goals of the OSH Act. The three levels of VPP, Star, Merit, and Demonstration, are designed to recognize outstanding achievements by companies that have successfully incorporated comprehensive safety and health programs into their total management system. The VPP motivates others to achieve excellent safety and health results and establish a cooperative relationship between employers, employees, and OSHA.

For additional information on VPP and how to apply, contact the OSHA regional offices listed at the end of this publication or call 800-321-OSHA or visit www.osha.gov.

Strategic Partnership Programs

OSHA's Strategic Partnership Program, the newest member of OSHA's cooperative programs, helps encourage, assist, and recognize the efforts of partners to eliminate serious workplace hazards and achieve a high level of worker safety and health. Whereas OSHA's Consultation Program and VPP entail one-on-one relationships between OSHA and individual work sites, most strategic partnerships seek to have a broader impact by building cooperative relationships with groups of employers and employees. These partnerships are voluntary, cooperative relationships between OSHA, employers, employee representatives, and others (e.g., trade unions, trade and professional associations, universities, and other government agencies).

For more information on this and other cooperative programs, contact your nearest OSHA office, call 800-321-OSHA, or visit www.osha.gov.

The OSHA Alliance Program

Alliances enable organizations committed to workplace safety and health to collaborate with OSHA to prevent injuries and illnesses in the workplace. OSHA and its allies work together to reach out to, educate, and lead the nation's employers and their employees in improving and advancing workplace safety and health.

Alliances are open to all, including trade or professional organizations, businesses, labor organizations, educational institutions, and government agencies. In some cases, organizations may be building on existing relationships with OSHA through other cooperative programs.

There are few formal program requirements for alliances, which are less structured than other cooperative agreements, and the agreements do not include an enforcement component. However, OSHA and the participating organizations must define, implement, and meet a set of short- and long-term goals that fall into three categories: training and education; outreach and communication; and promotion of the national dialogue on workplace safety and health.

OSHA training and education

OSHA area offices offer a variety of information services, such as compliance assistance, technical advice, publications, audiovisual aids and speakers for special engagements. OSHA's Training Institute in Des Plaines, IL, provides basic and advanced courses in safety and health for federal and state compliance officers, state consultants, federal agency personnel, and private sector employers, employees, and their representatives.

The OSHA Training Institute also has established OSHA Training Institute Education Centers to address the increased demand for its courses from the private sector and from other federal agencies. These centers are nonprofit colleges, universities, and other organizations that have been selected after a competition for participation in the program.

OSHA also provides funds to nonprofit organizations, through grants, to conduct workplace training and education in subjects where OSHA believes there is a lack of workplace training. Grants are awarded annually. Grant recipients are expected to contribute 20 percent of the total grant cost.

For more information on grants, training, and education, contact the OSHA Training Institute, Office of Training and Education, 1555 Times Drive, Des Plaines, IL 60018, (847) 297-4810. For further information on any OSHA program, contact your nearest OSHA office.

Information available electronically

OSHA has a variety of materials and tools available on its website at www.osha.gov. These include e-Tools such as Expert Advisors, Electronic Compliance Assistance Tools (e-cats), Technical Links; regulations, directives, publications; videos, and other information for employers and employees. OSHA's software programs and compliance assistance tools walk you through challenging safety and health issues and common problems to find the best solutions for your workplace.

OSHA publications

OSHA has an extensive publications program. For a listing of free or sales items, visit OSHA's website at www.osha.gov or contact the OSHA Publications Office, U.S. Department of Labor, 200 Constitution Avenue NW, N-3101, Washington, DC 20210. Telephone (202) 693-1888 or fax to (202) 693-2498.

Contacting OSHA

To report an emergency, file a complaint, or seek OSHA advice, assistance, or products, call (800) 321-OSHA or contact the nearest OSHA regional or area office listed at the end of this publication. The teletypewriter (TTY) number is (877) 889-5627.

You can also file a complaint online and obtain more information on OSHA federal and state programs by visiting OSHA's website at www.osha.gov.

For more information on grants, training, and education, contact the OSHA Training Institute, Office of Training and Education, 1555 Times Drive, Des Plaines, IL 60018, (847) 297-4810, or see Outreach on OSHA's website at www.osha.gov.

OSHA Regional Offices

Region I
(CT,* ME, MA, NH, RI, VT*)
Boston, MA 02203
(617) 565-9860

Region II
(NJ,* NY,* PR,* VI*)
201 Varick Street, Room 670
New York, NY 10014
(212) 337-2378

Region III
(DE, DC, MD,* PA,* VA,* WV)
The Curtis Center
170 S. Independence Mall West
Suite 740 West
Philadelphia, PA 19106-3309
(215) 861-4900

Region IV
(AL, FL, GA, KY,* MS, NC,* SC,* TN*)
Atlanta Federal Center
61 Forsyth Street SW, Room 6T50
Atlanta, GA 30303
(404) 562-2300

Region V
(IL, IN,* MI,* MN,* OH, WI)
230 South Dearborn Street, Room 3244
Chicago, IL 60604
(312) 353-2220

Region VI
(AR, LA, NM,* OK, TX)
525 Griffin Street, Room 602
Dallas, TX 75202
(214) 767-4731 or 4736 x224

Region VII
(IA,* KS, MO, NE)
City Center Square
1100 Main Street, Suite 800
Kansas City, MO 64105
(816) 426-5861

Region VIII
(CO, MT, ND, SD, UT,* WY*)
1999 Broadway, Suite 1690
PO Box 46550
Denver, CO 80202-5716
(303) 844-1600

Region IX
(American Samoa, AZ,* CA,* HI, NV,* Northern Mariana Islands)
71 Stevenson Street, Room 420
San Francisco, CA 94105
(415) 975-4310

Region X
(AK,* ID, OR,* WA*)
1111 Third Avenue, Suite 715
Seattle, WA 98101-3212
(206) 553-5930

*These states and territories operate their own OSHA-approved job safety and health programs (Connecticut, New Jersey, and New York plans cover public employees only). States with approved programs must have a standard that is identical to, or at least as effective as, the federal standard.

Note: To get contact information for OSHA Area Offices, OSHA-approved state plans, and OSHA Consultation Projects, please visit us online at www.osha.gov or call us at (800) 321-OSHA.

OSHA®

Occupational
Safety and Health
Administration
www.osha.gov

Lead in Construction

OSHA 3142 12R 2004

www.osha.gov

Employers are responsible for providing a safe and healthy workplace for their employees. OSHA's role is to promote the safety and health of America's working men and women by setting and enforcing standards; providing training, outreach and education; establishing partnerships; and encouraging continual improvement in workplace safety and health.

This publication provides a general overview of a particular standards-related topic. This publication does not alter or determine compliance responsibilities which are set forth in OSHA standards, and the *Occupational Safety and Health Act of 1970*. Moreover, because interpretations and enforcement policy may change over time, for additional guidance on OSHA compliance requirements the reader should consult current OSHA administrative interpretations and decisions by the Occupational Safety and Health Review Commission and the courts.

This information is available to sensory impaired individuals upon request. Voice phone: (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

Lead in Construction

U.S. Department of Labor

Occupational Safety and Health Administration

OSHA 3142-12R
2004

Contents

Health Hazards of Lead Exposure...3

Worker Exposure...5

Construction Workers and Lead Exposure...5

OSHA's Lead Standard...6

Employer Responsibilities...8

- Hazard Assessment...9
- Medical Surveillance...12
- Medical Removal Provisions...14
- Recordkeeping...16

Exposure Reduction and Employee Protection...18

- Engineering Controls...18
- Housekeeping and Personal Hygiene...21
- Protective Clothing and Equipment...24
- Respiratory Protection...26
- Employee Information and Training...29

OSHA Assistance...30

OSHA Regional Offices...36

Health Hazards of Lead Exposure

Pure lead (Pb) is a heavy metal at room temperature and pressure. A basic chemical element, it can combine with various other substances to form numerous lead compounds.

Lead has been poisoning workers for thousands of years. Lead can damage the central nervous system, cardiovascular system, reproductive system, hematological system, and kidneys. When absorbed into the body in high enough doses, lead can be toxic.

In addition, workers' lead exposure can harm their children's development.

Short-term (acute) overexposure–as short as days--can cause acute encephalopathy, a condition affecting the brain that develops quickly into seizures, coma, and death from cardiorespiratory arrest. Short-term occupational exposures of this type are highly unusual but not impossible.

Extended, long-term (chronic) overexposure can result in severe damage to the central nervous system, particularly the brain. It can also damage the blood-forming, urinary, and reproductive systems. There is no sharp dividing line between rapidly developing acute effects of lead and chronic effects that take longer to develop.

SYMPTOMS OF CHRONIC OVEREXPOSURE

Some of the common symptoms include:

- Loss of appetite;
- Constipation;
- Nausea;
- Excessive tiredness;
- Headache;
- Fine tremors;
- Colic with severe abdominal pain;
- Metallic taste in the mouth;
- Weakness;
- Nervous irritability;
- Hyperactivity;

- Muscle and joint pain or soreness;
- Anxiety;
- Pallor;
- Insomnia;
- Numbness; and
- Dizziness.

REPRODUCTIVE RISKS

Lead is toxic to both male and female reproductive systems. Lead can alter the structure of sperm cells and there is evidence of miscarriage and stillbirth in women exposed to lead or whose partners have been exposed. Children born to parents who were exposed to excess lead levels are more likely to have birth defects, mental retardation, or behavioral disorders or to die during the first year of childhood.

Workers who desire medical advice about reproductive issues related to lead should contact qualified medical personnel to arrange for a job evaluation and medical followup--particularly if they are pregnant or actively seeking to have a child. Employers whose employees may be exposed to lead and who have been contacted by employees with concerns about reproductive issues must make medical examinations and consultations available.

CHELATING AGENTS

Under certain limited circumstances, a physician may prescribe special drugs called chelating agents to reduce the amount of lead absorbed in body tissues. Using chelation as a preventive measure--that is, to lower blood level but continue to expose a worker--is prohibited and therapeutic or diagnostic chelations of lead that are required must be done under the supervision of a licensed physician in a clinical setting, with thorough and appropri-ate medical monitoring. The employee must be notified in writing before treatment of potential consequences and allowed to obtain a second opinion.

Worker Exposure

Lead is most commonly absorbed into the body by inhalation. When workers breathe in lead as a dust, fume, or mist, their lungs and upper respiratory tract absorb it into the body. They can also absorb lead through the digestive system if it enters the mouth and is ingested.

A significant portion of the lead inhaled or ingested gets into the bloodstream. Once in the bloodstream, lead circulates through the body and is stored in various organs and body tissues. Some of this lead is filtered out of the body quickly and excreted, but some remains in the blood and tissues. As exposure continues, the amount stored will increase if the body absorbs more lead than it excretes. The lead stored in the tissue can slowly cause irreversible damage, first to individual cells, then to organs and whole body systems.

Construction Workers and Lead Exposure

HOW LEAD IS USED

In construction, lead is used frequently for roofs, cornices, tank linings, and electrical conduits. In plumbing, soft solder, used chiefly for soldering tinplate and copper pipe joints, is an alloy of lead and tin. Soft solder has been banned for many uses in the United States. In addition, the Consumer Product Safety Commission bans the use of lead-based paint in residences. Because lead-based paint inhibits the rusting and corrosion of iron and steel, however, lead continues to be used on bridges, railways, ships, lighthouses, and other steel structures, although substitute coatings are available.

Construction projects vary in their scope and potential for exposing workers to lead and other hazards. Projects such as removing paint from a few interior residential doors may involve limited exposure. Others projects, however, may involve removing or stripping substantial quantities of lead-based paints on large bridges and other structures.

MOST VULNERABLE WORKERS

Workers potentially at risk for lead exposure include those involved in iron work; demolition work; painting; lead-based paint abatement; plumbing; heating and air conditioning maintenance and repair; electrical work; and carpentry, renovation, and remodeling work. Plumbers, welders, and painters are among those workers most exposed to lead. Significant lead exposures also can arise from removing paint from surfaces previously coated with lead-based paint such as bridges, residences being renovated, and structures being demolished or salvaged. With the increase in highway work, bridge repair, residential lead abatement, and residential remodeling, the potential for exposure to lead-based paint has become more common.

Workers at the highest risk of lead exposure are those involved in:

- Abrasive blasting and
- Welding, cutting, and burning on steel structures.

Other operations with the potential to expose workers to lead include:

- Lead burning;
- Using lead-containing mortar;
- Power tool cleaning without dust collection systems;
- Rivet busting;
- Cleanup activities where dry expendable abrasives are used;
- Movement and removal of abrasive blasting enclosures;
- Manual dry scraping and sanding;
- Manual demolition of structures;
- Heat-gun applications;
- Power tool cleaning with dust collection systems; and
- Spray painting with lead-based paint.

OSHA's Lead Standard

OSHA's Lead Standard for the Construction Industry, Title 29 Code of Federal Regulations 1926.62, covers lead in a variety of forms, including metallic lead, all inorganic lead compounds, and organic lead soaps.

EXPOSURE LIMITS

The standard establishes maximum limits of exposure to lead for all workers covered, including a permissible exposure limit (PEL) and action level (AL).

The PEL sets the maximum worker exposure to lead: 50 micrograms of lead per cubic meter of air (50µg/m3) averaged over an eight-hour period. If employees are exposed to lead for more than eight hours in a workday, their allowable exposure as a TWA for that day must be reduced according to this formula:

Employee exposure (in µg/m3) = 400 divided by the hours worked in the day.

The AL, regardless of respirator use, is an airborne concentration of 30µg/m3, averaged over an eight-hour period. The AL is the level at which an employer must begin specific compliance activities outlined in the standard.

APPLICABILITY TO CONSTRUCTION

OSHA's lead in construction standard applies to all construction work where an employee may be exposed to lead. All work related to construction, alteration, or repair, including painting and decorating, is included. Under this standard, construction includes, but is not limited to:

- Demolition or salvage of structures where lead or materials containing lead are present;
- Removal or encapsulation of materials containing lead;
- New construction, alteration, repair, or renovation of structures, substrates, or portions or materials containing lead;
- Installation of products containing lead;
- Lead contamination from emergency cleanup;
- Transportation, disposal, storage, or containment of lead or materials containing lead where construction activities are performed; and
- Maintenance operations associated with these construction activities.

Employer Responsibilities

WORKER PROTECTIONS

Employers of construction workers are responsible for develop-ing and implementing a worker protection program. At a minimum, the employer's worker protection program for employees exposed to lead above the PEL should include:

- Hazard determination, including exposure assessment;
- Medical surveillance and provisions for medical removal;
- Job-specific compliance programs;
- Engineering and work practice controls;
- Respiratory protection;
- Protective clothing and equipment;
- Housekeeping;
- Hygiene facilities and practices;
- Signs;
- Employee information and training; and
- Recordkeeping.

Because lead is a cumulative and persistent toxic substance and health effects may result from exposure over prolonged periods, employers must use these precautions where feasible to minimize employee exposure to lead.

The employer should, as needed, consult a qualified safety and health professional to develop and implement an effective, site-specific worker protection program. These professionals may work independently or may be associated with an insurance carrier, trade organization, or on-site consultation program.

ELEMENTS OF A COMPLIANCE PROGRAM

For each job where employee exposure exceeds the PEL, the employer must establish and implement a written compliance program to reduce employee exposure to the PEL or below. The compliance program must provide for frequent and regular inspections of job sites, materials, and equipment by a competent person. Written programs, which must be reviewed and updated at least every six months, must include:

- A description of each activity in which lead is emitted (such as equipment used, material involved, controls in place, crew size, employee job responsibilities, operating procedures, and maintenance practices);
- The means to be used to achieve compliance and engineering plans and studies used to determine the engineering controls selected where they are required;
- Information on the technology considered to meet the PEL;
- Air monitoring data that document the source of lead emissions;
- A detailed schedule for implementing the program, including copies of documentation (such as purchase orders for equipment, construction contracts);
- A work practice program;
- An administrative control schedule, if applicable; and
- Arrangements made among contractors on multi-contractor sites to inform employees of potential lead exposure.

Hazard Assessment

An employer is required to conduct an initial employee exposure assessment of whether employees are exposed to lead at or above the AL based on:

- Any information, observation, or calculation that indicates employee exposure to lead;
- Any previous measurements of airborne lead; and
- Any employee complaints of symptoms attributable to lead exposure.

Objective data and historical measurements of lead may be used to satisfy the standard's initial monitoring requirements.

INITIAL EMPLOYEE EXPOSURE ASSESSMENT

Initial monitoring may be limited to a representative sample of those employees exposed to the greatest concentrations of airborne lead. Representative exposure sampling is permitted when there are a number of employees performing the same job, with lead exposure of similar duration and level, under essentially the same conditions. For employees engaged in similar work, the standard requires that the members of the group reasonably expected to have the highest exposure levels be monitored. This result is then attributed to the other employees of the group.

The employer must establish and maintain an accurate record documenting the nature and relevancy of previous exposure data. Instead of performing initial monitoring, the employer may in some cases rely on objective data that demonstrate that a particular lead-containing material or product cannot result in employee exposure at or above the action level when it is processed, used, or handled.

BIOLOGICAL MONITORING TESTS

Analysis of blood lead samples must be conducted by an OSHA-approved lab and be accurate (to a confidence level of 95 percent) within plus or minus 15 percent, or 6 µg/dl, whichever is greater. If an employee's airborne lead level is at or above the AL for more than 30 days in any consecutive 12 months, the employer must make biological monitoring available on the following schedule:

- At least every two months for the first six months and every six months thereafter for employees exposed at or above the action level for more than 30 days annually;
- At least every two months for employees whose last blood sampling and analysis indicated a blood lead level at or above 40 µg/dl; and
- At least monthly while an employee is removed from exposure due an elevated blood lead level.

PENDING EMPLOYEE EXPOSURE ASSESSMENT

Until the employer performs an exposure assessment and documents that employees are not exposed above the PEL, OSHA requires some degree of interim protection for employees. This means providing respiratory protection, protective work clothing and equipment, hygiene facilities, biological monitoring, and training—as specified by the standards—for certain tasks prone to produce high exposure. These include:

- Manual demolition of structures such as dry wall, manual scraping, manual sanding, and use of a heat gun where lead-containing coatings or paints are present;
- Power tool cleaning with or without local exhaust ventilation;
- Spray painting with lead-containing paint;
- Lead burning;
- Use of lead-containing mortar;
- Abrasive blasting, rivet busting, welding, cutting, or torch-burning on any structure where lead-containing coatings or paint are present;
- Abrasive blasting enclosure movement and removal;
- Cleanup of activities where dry expendable abrasives are used; and
- Any other task the employer believes may cause exposures in excess of the PEL.

TEST RESULTS SHOWING NO OVEREXPOSURES

If the initial assessment indicates that no employee is exposed above the AL, the employer may discontinue monitoring. Further exposure testing is not required unless there is a change in processes or controls that may result in additional employees being exposed to lead at or above the AL, or may result in employees already exposed at or above the AL being exposed above the PEL. The employer must keep a written record of the determination, including the date, location within the work site, and the name and social security number of each monitored employee.

EMPLOYEE NOTIFICATION OF MONITORING RESULTS

The employer must notify each employee in writing of employee exposure assessment results within five working days of receiving them. Whenever the results indicate that the representative employee exposure, without the use of respirators, is above the PEL, the employer must include a written notice stating that the employee's exposure exceeded the PEL and describing corrective action taken or to be taken to reduce exposure to or below the PEL.

Medical Surveillance

When an employee's airborne exposure is at or above the AL for more than 30 days in any consecutive 12 months, an immediate medical consultation is required when the employee notifies the employer that he or she:

- Has developed signs or symptoms commonly associated with lead-related disease;
- Has demonstrated difficulty in breathing during respirator use or a fit test;
- Desires medical advice concerning the effects of past or current lead exposure on the employee's ability to have a healthy child; and
- Is under medical removal and has a medically appropriate need.

MEDICAL EXAMS

The best indicator of personal lead exposure is through a blood test to indicate elevated blood lead levels. A medical exam must also include:

- Detailed work and medical histories, with particular attention to past lead exposure (occupational and nonoccupational), personal habits (smoking and hygiene), and past gastro-intestinal, hematologic, renal, cardiovascular, reproductive, and neurological problems;
- A thorough physical exam, with particular attention to gums, teeth, hematologic, gastrointestinal, renal, cardiovascular, and neurological systems; evaluation of lung function if respirators are used;
- A blood pressure measurement;
- A blood sample and analysis to determine blood lead level;

  • Hemoglobin and hematocrit determinations, red cell indices, and an exam of peripheral smear morphology; and

  • Zinc protopor-phyrin; blood urea nitrogen; and serum creatinine;
- A routine urinalysis with microscopic exam; and
- Any lab or other test the examining physician deems necessary.

INFORMATION FOR THE EXAMINING PHYSICIAN

The employer must provide all examining physicians with a copy of the lead in construction standard, including all appendices, a description of the affected employee's duties as they relate to the employee's exposure, the employee's lead exposure level or anticipated exposure level, a description of personal protective equipment used or to be used, prior blood lead determinations, and all prior written medical opinions for the employee.

WHEN MONITORING SHOWS EMPLOYEE EXPOSURES ABOVE THE AL

Employers must make available, at no cost to the employee, initial medical surveillance for employees exposed to lead on the job at or above the action level on any one day per year. This initial medical surveillance consists of biological monitoring in the form of blood sampling and analysis for lead and zinc protoporyrin (ZPP) levels. In addition, a medical surveillance program with biological monitoring must be made available to any employee exposed at or above the action level for more than 30 days in any consecutive 12 months.

AFTER THE MEDICAL EXAMINATION

Employers must obtain and provide the employee a copy of a written opinion from each examining or consulting physician that contains only information related to occupational exposure to lead and must include:

- Whether the employee has any detected medical condition that would increase the health risk from lead exposure;
- Any special protective measures or limitations on the worker's exposure to lead,
- Any limitation on respirator use; and
- Results of the blood lead determinations.

In addition, the written statement may include a statement that the physician has informed the employee of the results of the consultation or medical examination and any medical condition that may require further examination or treatment.

The employer must instruct the physician that findings, including lab results or diagnoses unrelated to the worker's lead exposure, must not be revealed to the employer or included in the written opinion to the employer. The employer must also instruct the physician to advise employees of any medical condition, occupational or non-occupational, that necessitates further evaluation or treatment. In addition, some states also require laboratories and health care providers to report cases of elevated blood lead concentrations to their state health departments.

Medical Removal Provisions

Temporary medical removal can result from an elevated blood level or a written medical opinion. More specifically, the employer is required to remove from work an employee with a lead exposure at or above the AL each time periodic and follow-up (within two weeks of the periodic test) blood sampling tests indicate that the employee's blood level is at or above 50 μg /dl. The employer also must remove from work an employee with lead exposure at or above the AL each time a final medical determination indicates that the employee needs reduced lead exposure for medical reasons. If the physician who is implementing the employer's medical program makes a final written opinion recommending the employee's removal or other special protective measures, the employer must implement the physician's recommendation.

For an employee removed from exposure to lead at or above the AL due to a blood lead level at or above 50 μg/dl, the employer may return that employee to former job status when two consecutive blood sampling tests indicate that the employee's blood lead level is below 40 μg /dl. For an employee removed from exposure to lead due to a final medical determination, the employee must be returned when a subsequent final medical determination results in a medical finding, determination, or opinion that the employee no longer has a detected medical condition that places the employee at increased risk of lead exposure.

The employer must remove any limitations placed on employees or end any special protective measures when a subsequent final medical determination indicates they are no longer necessary. If the former position no longer exists, the employee is returned consistent with whatever job assignment discretion the employer would have had if no removal occurred.

WORKER PROTECTIONS AND BENEFITS

The employer must provide up to 18 months of medical removal protection (MRP) benefits each time an employee is removed from lead exposure or medically limited. As long as the position/job exists, the employer must maintain the earnings, seniority, and other employment rights and benefits as though the employee had not been removed from the job or otherwise medically limited. The employer may condition medical removal protection benefits on the employee's participation in followup medical surveillance.

If a removed employee files a worker's compensation claim or other compensation for lost wages due to a lead-related disability, the employer must continue medical removal protection benefits until the claim is resolved. However, the employer's MRP benefits obligation will be reduced by the amount that the employee receives from these sources. Also, the employer’s MRP benefits obligation will be reduced by any income the employee receives from employment with another employer made possible by virtue of the employee’s removal.

RECORDS REQUIREMENTS INVOLVING MEDICAL REMOVAL

In the case of medical removal, the employer’s records must include:

- The worker’s name and social security number,
- The date of each occasion that the worker was removed from current exposure to lead,
- The date when the worker was returned to the former job status,
- A brief explanation of how each removal was or is being accomplished, and
- A statement indicating whether the reason for the removal was an elevated blood lead level.

Recordkeeping

EMPLOYER REQUIREMENTS

The employer must maintain any employee exposure and medical records to document ongoing employee exposure, medical monitoring, and medical removal of workers. This data provides a baseline to evaluate the employee's health properly. Employees or former employees, their designated representatives, and OSHA must have access to exposure and medical records in accordance with 29 CFR 1910.1020. Rules of agency practice and procedure governing OSHA access to employee medical records are found in 29 CFR 1913.10.

EXPOSURE ASSESSMENT RECORDS

The employer must establish and maintain an accurate record of all monitoring and other data used to conduct employee exposure assessments as required by this standard and in accordance with 29 CFR 1910.1020. The exposure assessment records must include:

- The dates, number, duration, location, and results of each sample taken, including a description of the sampling procedure used to determine representative employee exposure;
- A description of the sampling and analytical methods used and evidence of their accuracy;
- The type of respiratory protection worn, if any;
- The name, social security number, and job classification of the monitored employee and all others whose exposure the measurement represents; and
- Environmental variables that could affect the measurement of employee exposure.

MEDICAL SURVEILLANCE RECORDS

The employer must maintain an accurate record for each employee subject to medical surveillance, including:

- The name, social security number, and description of the employee's duties;
- A copy of the physician's written opinions;

- The results of any airborne exposure monitoring done for the employee and provided to the physician; and
- Any employee medical complaints related to lead exposure.

In addition, the employer must keep or ensure that the examining physician keeps the following medical records:

- A copy of the medical examination results including medical and work history;
- A description of the laboratory procedures and a copy of any guidelines used to interpret the test results; and
- A copy of the results of biological monitoring.

The employer or physician or both must maintain medical records in accordance with 29 CFR 1910.1020.

DOCUMENTS FOR EMPLOYEES SUBJECT TO MEDICAL REMOVAL

The employer must maintain--for at least the duration of employment–an accurate record for each employee subject to medical removal, including:

- The name and social security number of the employee;
- The date on each occasion that the employee was removed from current exposure to lead and the corresponding date which the employee was returned to former job status;
- A brief explanation of how each removal was or is being accomplished; and
- A statement about each removal indicating whether the reason for removal was an elevated blood level.

EMPLOYER REQUIREMENTS RELATED TO OBJECTIVE DATA

The employer must establish and maintain an accurate record documenting the nature and relevancy of objective data relied on to assess initial employee exposure in lieu of exposure monitoring. The employer must maintain the record of objective data relied on for at least 30 years.

DOCUMENTS FOR OSHA AND NIOSH REVIEW

The employer must make all records--including exposure moni-toring, objective data, medical removal, and medical records--

available upon request to affected employees, former employees, and their designated representatives and to the OSHA Assistant Secretary and the Director of the National Institute for Occupational Safety and Health (NIOSH) for examination and copying in accordance with 29 CFR 1910.1020.

WHEN CLOSING A BUSINESS

When an employer ceases to do business, the successor employer must receive and retain all required records. If no successor is available, these records must be sent to the Director of NIOSH.

Exposure Reduction and Employee Protection

The most effective way to protect workers is to minimize their exposure through engineering controls, good work practices and training, and use of personal protective clothing and equipment, including respirators, where required. The employer needs to designate a competent person capable of identifying existing and predictable lead hazards and who is authorized to take prompt corrective measures to eliminate such problems. The employer should, as needed, consult a qualified safety and health professional to develop and implement an effective worker protection program. These professionals may work independently or may be associated with an insurance carrier, trade organization, or on-site consultation program.

Engineering Controls

Engineering measures include local and general exhaust ventilation, process and equipment modification, material substitution, component replacement, and isolation or automation. Examples of recommended engineering controls that can help reduce worker exposure to lead are described as follows.

EXHAUST VENTILATION

Equip power tools used to remove lead-based paint with dust collection shrouds or other attachments so that paint is exhausted through a high-efficiency particulate air (HEPA) vacuum system. For operations such as welding, cutting/burning, or heating, use local exhaust ventilation. Use HEPA vacuums during cleanup operations.

For abrasive blasting operations, build a containment structure that is designed to optimize the flow of clean ventilation air past the workers' breathing zones. This will help reduce the exposure to airborne lead and increase visibility. Maintain the affected area under negative pressure to reduce the chances that lead dust will contaminate areas outside the enclosure. Equip the containment structure with an adequately sized dust collector to control emissions of particulate matter into the environment.

ENCLOSURE OR ENCAPSULATION

One way to reduce the lead inhalation or ingestion hazard posed by lead-based paint is to encapsulate it with a material that bonds to the surface, such as acrylic or epoxy coating or flexible wall coverings. Another option is to enclose it using systems such as gypsum wallboard, plywood paneling, and aluminum, vinyl, or wood exterior siding. Floors coated with lead-based paint can be covered using vinyl tile or linoleum.

The building owner or other responsible person should oversee the custodial and maintenance staffs and contractors during all activities involving enclosed or encapsulated lead-based paint. This will minimize the potential for an inadvertent lead release during maintenance, renovation, or demolition.

SUBSTITUTION

Choose materials and chemicals that do not contain lead for construction projects. Among the options are:

- Use zinc-containing primers covered by an epoxy intermediate coat and polyurethane topcoat instead of lead-containing coatings.
- Substitute mobile hydraulic shears for torch cutting under certain circumstances.
- Consider surface preparation equipment such as needle guns with multiple reciprocating needles completely enclosed within an adjustable shroud, instead of abrasive blasting under certain

conditions. The shroud captures dust and debris at the cutting edge and can be equipped with a HEPA vacuum filtration with a self-drumming feature. One such commercial unit can remove lead-based paint from flat steel and concrete surfaces, outside edges, inside corners, and pipes.

- Choose chemical strippers in lieu of hand scraping with a heat gun for work on building exteriors, surfaces involving carvings or molding, or intricate iron work. Chemical removal generates less airborne lead dust. (Be aware, however, that these strippers themselves can be hazardous and that the employer must review the material safety data sheets (MSDSs) for these stripping agents to obtain information on their hazards.)

COMPONENT REPLACEMENT

Replace lead-based painted building components such as windows, doors, and trim with new components free of lead-containing paint. Another option is to remove the paint off site and then repaint the components with zinc-based paint before replacing them.

PROCESS OR EQUIPMENT MODIFICATION

When applying lead paints or other lead-containing coatings, use a brush or roller rather than a sprayer. This application method introduces little or no paint mist into the air to present a lead inhalation hazard. (Note that there is a ban on the use of lead-based paint in residential housing.)

Use non-silica-containing abrasives such as steel or iron shot/grit sand instead of sand in abrasive blasting operations when practical. The free silica portion of the dust presents a respiratory health hazard.

When appropriate for the conditions, choose blasting techniques that are less dusty than open-air abrasive blasting. These include hydro- or wet-blasting using high-pressure water with or without an abrasive or surrounding the blast nozzle with a ring of water, and vacuum blasting where a vacuum hood for material removal is positioned around the exterior of the blasting nozzle.

When using a heat gun to remove lead-based paints in residential housing units, be sure it is of the flameless electrical softener type. Heat guns should have electronically controlled temperature settings to allow usage below 700 degrees F. Equip heat guns with various nozzles to cover all common applications and to limit the size of the heated work area.

When using abrasive blasting with a vacuum hood on exterior building surfaces, ensure that the configuration of the heads on the blasting nozzle match the configuration of the substrate so that the vacuum is effective in containing debris.

Ensure that HEPA vacuum cleaners have the appropriate attachments for use on unusual surfaces. Proper use of brushes of various sizes, crevice and angular tools, when needed, will enhance the quality of the HEPA-vacuuming process and help reduce the amount of lead dust released into the air.

ISOLATION

Although it is not feasible to enclose and ventilate some abrasive blasting operations completely, it is possible to isolate many operations to help reduce the potential for lead exposure. Isolation consists of keeping employees not involved in the blasting operations as far away from the work area as possible, reducing the risk of exposure.

Housekeeping and Personal Hygiene

Lead is a cumulative and persistent toxic substance that poses a serious health risk. A rigorous housekeeping program and the observance of basic personal hygiene practices will minimize employee exposure to lead. In addition, these two elements of the worker protection program help prevent workers from taking lead-contaminated dust out of the worksite and into their homes where it can extend the workers' exposures and potentially affect their families' health.

HOUSEKEEPING PRACTICES

An effective housekeeping program involves a regular schedule to remove accumulations of lead dust and lead-containing debris. The schedule should be adapted to exposure conditions at a particular worksite. OSHA's Lead Standard for Construction requires employers to maintain all surfaces as free of lead contamination as practicable. Vacuuming lead dust with HEPA-filtered equipment or wetting the dust with water before sweeping are effective control measures. Compressed air may not be used to remove lead from contaminated surfaces unless a ventilation system is in place to capture the dust generated by the compressed air.

In addition, put all lead-containing debris and contaminated items accumulated for disposal into sealed, impermeable bags or other closed impermeable containers. Label bags and containers as lead-containing waste. These measures provide additional help in controlling exposure.

PERSONAL HYGIENE PRACTICES

Emphasize workers' personal hygiene such as washing their hands and face after work and before eating to minimize their exposure to lead. Provide and ensure that workers use washing facilities. Provide clean change areas and readily accessible eating areas. If possible, provide a parking area where cars will not be contaminated with lead. These measures:

- Reduce workers' exposure to lead and the likelihood that they will ingest lead,
- Ensure that the exposure does not extend beyond the worksite,
- Reduce the movement of lead from the worksite, and
- Provide added protection to employees and their families.

CHANGE AREAS

The employer must provide a clean change area for employees whose airborne exposure to lead is above the PEL. The area must be equipped with storage facilities for street clothes and a separate area with facilities for the removal and storage of lead-contaminated protective work clothing and equipment. This separation prevents cross-contamination of the employee's street and work clothing.

Employees must use a clean change area for taking off street clothes, suiting up in clean protective work clothing, donning respirators before beginning work, and dressing in street clothes after work. No lead-contaminated items should enter this area.

Work clothing must not be worn away from the jobsite. Under no circumstances should lead-contaminated work clothes be laundered at home or taken from the worksite, except to be laundered professionally or for disposal following applicable federal, state, and local regulations.

SHOWERS AND WASHING FACILITIES

When feasible, showers must be provided for use by employees whose airborne exposure to lead is above the permissible exposure limit so they can shower before leaving the worksite. Where showers are provided, employees must change out of their work clothes and shower before changing into their street clothes and leaving the worksite. If employees do not change into clean clothing before leaving the worksite, they may contaminate their homes and automobiles with lead dust, extending their exposure and exposing other members of their household to lead.

In addition, employers must provide adequate washing facilities for their workers. These facilities must be close to the worksite and furnished with water, soap, and clean towels so employees can remove lead contamination from their skin.

Contaminated water from washing facilities and showers must be disposed of in accordance with applicable local, state, or federal regulations.

PERSONAL PRACTICES

The employer must ensure that employees do not enter lunchroom facilities or eating areas with protective work clothing or equipment unless surface lead dust has been removed. HEPA vacuuming and use of a downdraft booth are examples of cleaning methods that limit the dispersion of lead dust from contaminated work clothing.

In all areas where employees are exposed to lead above the PEL, employees must observe the prohibition on the presence and consumption or use of food, beverages, tobacco products, and cosmetics. Employees whose airborne exposure to lead is above the PEL must wash their hands and face before eating, drinking, smoking, or applying cosmetics.

END-OF-DAY PROCEDURES

Employers must ensure that workers who are exposed to lead above the permissible exposure limit follow these procedures at the end of their workday:

- Place contaminated clothes, including work shoes and personal protective equipment to be cleaned, laundered, or disposed of, in a properly labeled closed container.
- Take a shower and wash their hair. Where showers are not provided, employees must wash their hands and face at the end of the workshift.
- Change into street clothes in clean change areas.

Protective Clothing and Equipment

EMPLOYER REQUIREMENTS

Employers must provide workers who are exposed to lead above the PEL or for whom the possibility of skin or eye irritation exists with clean, dry protective work clothing and equipment that are appropriate for the hazard. Employers must provide these items at no cost to employees. Appropriate protective work clothing and equipment used on construction sites includes:

- Coveralls or other full-body work clothing;
- Gloves, hats, and shoes or disposable shoe coverlets;
- Vented goggles or face shields with protective spectacles or goggles;
- Welding or abrasive blasting helmets; and
- Respirators.

Clean work clothing must be issued daily for employees whose exposure levels to lead are above 200 µg/m3, weekly if exposures are above the PEL but at or below 200 µg/m3 or where the possibility of skin or eye irritation exists.

HANDLING CONTAMINATED PROTECTIVE CLOTHING

Workers must not be allowed to leave the worksite wearing lead-contaminated protective clothing or equipment. This is an essential step in reducing the movement of lead contamination from the workplace into the worker's home and provides added protection for employees and their families.

Disposable coveralls and separate shoe covers may be used, if appropriate, to avoid the need for laundering. Workers must remove protective clothing in change rooms provided for that purpose.

Employers must ensure that employees leave the respirator use area to wash their faces and respirator facepieces as necessary. In addition, employers may require their employees to use HEPA vacuuming, damp wiping, or another suitable cleaning method before removing a respirator to clear loose particle contamination on the respirator and at the face-mask seal.

Place contaminated clothing that is to be cleaned, laundered, or disposed of by the employer in closed containers. Label containers with the warning: "Caution: Clothing contaminated with lead. Do not remove dust by blowing or shaking. Dispose of lead-contaminated wash water in accordance with applicable local, state, or federal regulations."

Workers responsible for handling contaminated clothing, including those in laundry services or subcontractors, must be informed in writing of the potential health hazard of lead exposure. At no time shall lead be removed from protective clothing or equipment by brushing, shaking, or blowing. These actions disperse the lead into the work area.

PREVENTING HEAT STRESS

Workers wearing protective clothing, particularly in hot environ-ments or within containment structures, can face a risk from heat stress if proper control measures are not used.

Heat stress is caused by several interacting factors, including environmental conditions, type of protective clothing worn, the work activity required and anticipated work rate, and individual employee characteristics such as age, weight, and fitness level. When heat stress is a concern, the employer should choose lighter, less insulating protective clothing over heavier clothing, as long as it provides adequate protection. Other measures the employer can take include: discussing the possibility of heat stress and its signs and symptoms with all workers; using appropriate work/rest regimens; and providing heat stress monitoring that includes measuring employees' heart rates, body temperatures, and weight loss. Employers must provide a source of water or electrolyte drink in a non-contaminated eating and drinking area close to the work area so workers can drink often throughout the day. Workers must wash their hands and face before drinking any fluid if their airborne exposure is above the PEL.

Respiratory Protection

Although engineering and work practice controls are the primary means of protecting workers from exposure to lead, source control at construction sites sometimes is insufficient to control exposure. In these cases, airborne lead concentrations may be high or may vary widely. Respirators often must be used to supplement engi-neering controls and work practices to reduce worker lead exposures below the PEL. When respirators are required, employers must provide them at no cost to workers.

The standard requires that respirators be used during periods when an employee's exposure to lead exceeds the PEL, including

- Periods necessary to install or implement engineering or work practice controls, and
- Work operations for which engineering and work practice controls are insufficient to reduce employee exposures to or below the PEL.

Respirators also must be provided upon employee request. A requested respirator is included as a requirement to provide increased protection for those employees who wish to reduce their lead burden below what is required by the standard, particularly if they intend to have children in the near future. In addition, respirators must be used when performing previously indicated high exposure or "trigger" tasks, before completion of the initial assessment.

PROVIDING ADEQUATE RESPIRATORY PROTECTION

Before any employee first starts wearing a respirator in the work environment, the employer must perform a fit test. For all employees wearing negative or positive pressure tight-fitting facepiece respirators, the employer must perform either qualitative or quantitative fit tests using an OSHA-accepted fit testing protocol. In addition, employees must be fit tested whenever a different respirator facepiece is used, and at least annually thereafter.

Where daily airborne exposure to lead exceeds 50 µg/m3, affected workers must don respirators before entering the work area and should not remove them until they leave the high-exposure area or have completed a decontamination procedure. Employers must assure that the respirator issued to the employee is selected and fitted properly to ensure minimum leakage through the facepiece-to-face seal.

RESPIRATORY PROTECTION PROGRAMS

When respirators are required at a worksite, the employer must establish a respiratory protection program in accordance with the OSHA standard on respiratory protection, 29 CFR 1910.134. At a minimum, an acceptable respirator program for lead must include:

- Procedures for selecting respirators appropriate to the hazard;
- Fit testing procedures;
- Procedures for proper use of respirators in routine and reasonably foreseeable emergency situations, including cartridge change schedules;
- Procedures and schedules for cleaning, disinfecting, storing, inspecting, repairing, discarding, and otherwise maintaining respirators;
- Training of employees in the respiratory hazard to which they are potentially exposed during routine and emergency situations;
- Training of employees in the proper use of respirators, including putting on and removing them, any limitations of their use, and their maintenance;

- Procedures for regularly evaluating the effectiveness of the program;
- Procedures to ensure air quality when supplied air is used;
- A written program and designation of a program administrator; and
- Recordkeeping procedures.

In addition, the construction industry lead standard stipulates medical evaluations of employees required to use respirators.

If an employee has difficulty in breathing during a fit test or while using a respirator, the employer must make a medical examination available to that employee to determine whether he or she can wear a respirator safely.

SELECTING A RESPIRATOR

The employer must select the appropriate respirator from Table 1 of the lead standard, 29 CFR 1926.62(f)(3)(i). The employer must provide a powered air-purifying respirator when an employee chooses to use this respirator and it will provide the employee adequate protection. A NIOSH-certified respirator must be selected and used in compliance with the conditions of its certification. In addition, if exposure monitoring or experience indicates airborne exposures to contaminants other than lead such as silica, solvents, or polyurethane coatings, these exposures must be considered when selecting respiratory protection.

Select type CE respirators approved by NIOSH for abrasive blasting operations. Currently, there are two kinds of CE respirators with the following assigned protection factors (APFs): a continuous-flow respirator with a loose-fitting hood, APF 25; and a full facepiece supplied-air respirator operated in a positive-pressure mode, APF 2,000. (Note: OSHA recognizes Bullard Helmets, Models 77 and 88 (1995); Clemco Appollo, Models 20 and 60 (1997); and 3M Model 8100 (1998) as having APFs of 1,000.)

For any airline respirator, it is important to follow the manufacturer's instructions regarding air quality, air pressure, and inside diameter and length of hoses. Be aware that using longer hoses or smaller inside diameter hoses than the manufacturer specifies or hoses with bends or kinks may reduce or restrict the airflow to a respirator.

Employee Information and Training

The employer must inform employees about lead hazards according to the requirement of OSHA's Hazard Communication standard for the construction industry, 29 CFR 1926.59, including--but not limited to--the requirements for warning signs and labels, material safety data sheets (MSDSs), and employee information and training. (Refer to 29 CFR 1910.1200.)

PROGRAM REQUIREMENTS

Employers must institute an information and training program and ensure that all employees subject to exposure to lead or lead compounds at or above the action level on any day participate. Also covered under information and training are employees who may suffer skin or eye irritation from lead compounds. Initial training must be provided before the initial job assignment. Training must be repeated at least annually and, in brief summary, must include:

- The content of the OSHA lead standard and its appendices;
- The specific nature of operations that could lead to lead exposure above the action level;
- The purpose, proper selection, fit, use, and limitations of respirators;
- The purpose and a description of the medical surveillance program, and the medical removal protection program;
- Information concerning the adverse health effects associated with excessive lead exposure;
- The engineering and work practice controls associated with employees' job assignments;
- The contents of any lead-related compliance plan in effect;
- Instructions to employees that chelating agents must not be used routinely to remove lead from their bodies and when necessary only under medical supervision and at the direction of a licensed physician; and

- The right to access records under "Access to Employee Exposure and Medical Records," 29 CFR 1910.1020.

All materials relating to the training program and a copy of the standard and its appendices must be made readily available to all affected employees.

WARNING SIGNS

Employers are required to post these warning signs in each work area where employee exposure to lead is above the PEL:

- WARNING
- LEAD WORK AREA
- POISON
- NO SMOKING OR EATING

All signs must be well lit and kept clean so that they are easily visible. Statements that contradict or detract from the signs' meaning are prohibited. Signs required by other statutes, regulations, or ordinances, however, may be posted in addition to, or in combination with, this sign.

OSHA Assistance

OSHA can provide extensive help through a variety of programs, including technical assistance about effective safety and health programs, state plans, workplace consultations, voluntary protection programs, strategic partnerships, training and education, and more. An overall commitment to workplace safety and health can add value to your business, to your workplace and to your life.

SAFETY AND HEALTH PROGRAM MANAGEMENT GUIDELINES

Effective management of employee safety and health protection is a decisive factor in reducing the extent and severity of work-related injuries and illnesses and their related costs. In fact, an effective safety and health program forms the basis of good employee protection can save time and money, increase productivity, reduce employee injuries, illnesses and related workers' compensation costs.

To assist employers and employees in developing effective safety and health programs, OSHA published recommended Safety and Health Program Management Guidelines (54 Federal Register (16): 3904-3916, January 26, 1989). These voluntary guidelines apply to all places of employment covered by OSHA.

The guidelines identify four general elements critical to the development of a successful safety and health management system:

- Management leadership and employee involvement,
- Worksite analysis,
- Hazard prevention and control, and
- Safety and health training.

The guidelines recommend specific actions, under each of these general elements, to achieve an effective safety and health program. The Federal Register notice is available online at www.osha.gov.

STATE PROGRAMS

The Occupational Safety and Health Act of 1970 (OSH Act) encourages states to develop and operate their own job safety and health plans. OSHA approves and monitors these plans. Twenty-four states, Puerto Rico, and the Virgin Islands currently operate approved state plans: 22 cover both private and public (state and local government) employment; Connecticut, New Jersey, New York and the Virgin Islands cover the public sector only. States and territories with their own OSHA-approved occupational safety and health plans must adopt standards identical to, or at least as effective as, the Federal OSHA standards.

CONSULTATION SERVICES

Consultation assistance is available on request to employers who want help in establishing and maintaining a safe and healthful workplace. Largely funded by OSHA, the service is provided at no cost to the employer. Primarily developed for smaller employers with more hazardous operations, the consultation service is delivered by state governments employing professional safety and health consultants. Comprehensive assistance includes an appraisal of all mechanical systems, work practices and occupational safety and health hazards of the workplace and all aspects of the employer's present job safety and health program. In addition, the service offers assistance to employers in developing and implementing an effective safety and health program. No penalties are proposed or citations issued for hazards identified by the consultant. OSHA provides consultation assistance to the employer with the assurance that his or her name and firm and any information about the workplace will not be routinely reported to OSHA enforcement staff.

Under the consultation program, certain exemplary employers may request participation in OSHA's Safety and Health Achievement Recognition Program (SHARP). Eligibility for participation in SHARP includes receiving a comprehensive consultation visit, demonstrating exemplary achievements in workplace safety and health by abating all identified hazards, and developing an excellent safety and health program.

Employers accepted into SHARP may receive an exemption from programmed inspections (not complaint or accident investigation inspections) for a period of one year. For more information concerning consultation assistance, see the OSHA website at www.osha.gov.

VOLUNTARY PROTECTION PROGRAMS

Voluntary Protection Programs and on-site consultation services, when coupled with an effective enforcement program, expand employee protection to help meet the goals of the OSH Act. The VPPs motivate others to achieve excellent safety and health results in the same outstanding way as they establish a cooperative rela-tionship between employers, employees and OSHA.

For additional information on VPP and how to apply, contact the OSHA regional offices listed at the end of this publication.

STRATEGIC PARTNERSHIP PROGRAM

OSHA's Strategic Partnership Program, the newest member of OSHA's cooperative programs, helps encourage, assist and recognize the efforts of partners to eliminate serious workplace hazards and achieve a high level of employee safety and health. Whereas OSHA's Consultation Program and VPP entail one-on-one relationships between OSHA and individual worksites, most strategic partnerships seek to have a broader impact by building cooperative relationships with groups of employers and employees. These partnerships are voluntary, cooperative relationships between OSHA, employers, employee representatives and others (e.g., trade unions, trade and professional associations, universities and other government agencies).

For more information on this and other cooperative programs, contact your nearest OSHA office, or visit OSHA's website at www.osha.gov.

ALLIANCE PROGRAM

Through the Alliance Program, OSHA works with groups committed to safety and health, including businesses, trade or professional organizations, unions and educational institutions, to leverage resources and expertise to develop compliance assistance tools and resources and share information with employers and employees to help prevent injuries, illnesses and fatalities in the workplace.

Alliance program agreements have been established with a wide variety of industries including meat, apparel, poultry, steel, plastics, maritime, printing, chemical, construction, paper and telecommunications. These agreements are addressing many safety and health hazards and at-risk audiences, including silica, fall protection, amputations, immigrant workers, youth and small businesses. By meeting the goals of the Alliance Program agreements (training and education, outreach and communication, and promoting the national dialogue on workplace safety and health), OSHA and the Alliance Program participants are developing and disseminating compliance assistance information and resources for employers and employees such as electronic assistance tools, fact sheets, toolbox talks, and training programs.

OSHA TRAINING AND EDUCATION

OSHA area offices offer a variety of information services, such as compliance assistance, technical advice, publications, audiovisual aids and speakers for special engagements. OSHA's Training Institute in Arlington Heights, IL, provides basic and advanced courses in safety and health for Federal and state compliance officers, state consultants, Federal agency personnel, and private sector employers, employees and their representatives.

The OSHA Training Institute also has established OSHA Training Institute Education Centers to address the increased demand for its courses from the private sector and from other federal agencies. These centers include colleges, universities and nonprofit training organizations that have been selected after a competition for participation in the program.

OSHA also provides funds to nonprofit organizations, through grants, to conduct workplace training and education in subjects where OSHA believes there is a lack of workplace training. Grants are awarded annually. Grant recipients are expected to contribute 20 percent of the total grant cost.

For more information on grants, training and education, contact the OSHA Training Institute, Directorate of Training and Education, 2020 South Arlington Heights Road, Arlington Heights, IL 60005, (847) 297-4810 or see Training on OSHA's website at www.osha.gov. For further information on any OSHA program, contact your nearest OSHA regional office listed at the end of this publication.

INFORMATION AVAILABLE ELECTRONICALLY

OSHA has a variety of materials and tools available on its website at www.osha.gov. These include electronic compliance assistance tools, such as *Safety and Health Topics Pages, eTools, Expert Advisors;* regulations, directives, publications and videos; and other information for employers and employees. OSHA's software programs and compliance assistance tools walk you through challenging safety and health issues and common problems to find the best solutions for your workplace.

A wide variety of OSHA materials, including standards, interpretations, directives, and more can be purchased on CD-ROM from the U.S. Government Printing Office, Superintendent of Documents, toll-free phone (866) 512-1800.

OSHA PUBLICATIONS

OSHA has an extensive publications program. For a listing of free or sales items, visit OSHA's website at www.osha.gov or contact the OSHA Publications Office, U.S. Department of Labor, 200 Constitution Avenue, NW, N-3101, Washington, DC 20210. Telephone (202) 693-1888 or fax to (202) 693-2498.

CONTACTING OSHA

To report an emergency, file a complaint or seek OSHA advice, assistance or products, call (800) 321-OSHA or contact your nearest OSHA regional or area office listed at the end of this publication. The teletypewriter (TTY) number is (877) 889-5627.

Written correspondence can be mailed to the nearest OSHA Regional or Area Office listed at the end of this publication or to OSHA's national office at: U.S. Department of Labor, Occupational Safety and Health Administration, 200 Constitution Avenue, N.W., Washington, DC 20210.

By visiting OSHA's website at www.osha.gov, you can also:

- File a complaint online,
- Submit general inquiries about workplace safety and health electronically, and
- Find more information about OSHA and occupational safety and health.

OSHA Regional Offices

Region I
(CT,* ME, MA, NH, RI, VT*)
JFK Federal Building, Room E340
Boston, MA 02203
(617) 565-9860

Region II
(NJ,* NY,* PR,* VI*)
201 Varick Street, Room 670
New York, NY 10014
(212) 337-2378

Region III
(DE, DC, MD,* PA,* VA,* WV)
The Curtis Center
170 S. Independence Mall West
Suite 740 West
Philadelphia, PA 19106-3309
(215) 861-4900

Region IV
(AL, FL, GA, KY,* MS, NC,* SC,* TN*)
61 Forsyth Street, SW, Room 6T50
Atlanta, GA 30303
(404) 562-2300

Region V
(IL, IN,* MI,* MN,* OH, WI)
230 South Dearborn Street, Room 3244
Chicago, IL 60604
(312) 353-2220

Region VI
(AR, LA, NM,* OK, TX)
525 Griffin Street, Room 602
Dallas, TX 75202
(972) 850-4145

Region VII
(IA,* KS, MO, NE)
Two Pershing Square
2300 Main Street, Suite 1010
Kansas City, MO 64108-2416
(816) 283-8745

Region VIII
(CO, MT, ND, SD, UT,* WY*)
1999 Broadway, Suite 1690
PO Box 46550
Denver, CO 80202-5716
(720) 264-6550

Region IX
(AZ,* CA,* HI, NV,* and American Samoa, Guam
and the Northern Mariana Islands)
90 7th Street, Suite 18-100
San Francisco, CA 94103
(415) 625-2547

Region X
(AK,* ID, OR,* WA*)
1111 Third Avenue, Suite 715
Seattle, WA 98101-3212
(206) 553-5930

* These states and territories operate their own OSHA-approved job safety and health programs and cover state and local government employees as well as private sector employees. The Connecticut, New Jersey, New York and Virgin Islands plans cover public employees only. States with approved programs must have standards that are identical to, or at least as effective as, the Federal OSHA standards.

Note: To get contact information for OSHA Area Offices, OSHA-approved State Plans and OSHA Consultation Projects, please visit us online at www.osha.gov or call us at 1-800-321-0SHA.

www.osha.gov

Occupational Safety
and Health Administration

U.S. Department of Labor

www.osha.gov

Occupational Safety and Health Administration

www.osha.gov

Fall Protection in Construction

OSHA 3146-05R 2015

OSHA®
www.osha.gov

Occupational Safety and Health Act of 1970

"To assure safe and healthful working conditions for working men and women; by authorizing enforcement of the standards developed under the Act; by assisting and encouraging the States in their efforts to assure safe and healthful working conditions; by providing for research, information, education, and training in the field of occupational safety and health..."

This informational booklet is intended to provide an overview of frequently cited OSHA standards in the construction industry. This publication does not alter or determine compliance responsibilities, which are set forth in OSHA standards and the *Occupational Safety and Health Act*.

Employers and workers in the 27 states and territories that operate their own OSHA-approved workplace safety and health plans should check with their state safety and health agency. Their state may be enforcing standards and other procedures that, while "at least as effective as" Federal OSHA standards, are not always identical to the federal requirements. For more information on states with OSHA-approved state plans, please visit: www.osha.gov/dcsp/osp.

This information will be made available to sensory-impaired individuals upon request. Voice phone: (202) 693-1999; teletypewriter (TTY) number: 1-877-889-5627.

Cover photo: Dona File

Fall Protection in Construction

U.S. Department of Labor
Occupational Safety and Health Administration

OSHA 3146-05R 2015

DEPARTMENT OF LABOR • UNITED STATES OF AMERICA •

U.S. Department of Labor

Contents

The Continuing Need for Fall Protection 1

Why Does OSHA Have a Standard for Fall Protection? 1

What Subpart M – Fall Protection Covers 1

What is Subpart M? 1

What are Employers' Responsibilities to provide Fall Protection? 2

When must employers provide Fall Protection? 2

What construction areas and activities does Subpart M cover? 2

What kinds of Fall Protection should employers use? 3

Examples of Fall Protection Requirements for Certain Construction Activities 3

Leading Edges 3

Overhand Bricklaying and Related Work 4

Roofing Work on Low-Slope Roofs. 4

Working on Steep Roofs. 4

Residential Construction 5

Other Walking or Working Surfaces 5

Conventional Fall Protection Systems 6

Guardrail Systems 6

Safety Net Systems 8

Personal Fall Arrest Systems 10

Personal Fall Arrest System Components 11

Positioning Device Systems 13

Fall Restraint Systems. 13

Additional Fall Protection Systems. 14

Warning Line Systems 14

Controlled Access Zones 16

Safety Monitoring Systems 18

Other Hazards that Require Fall Protection 19
Hoist Areas 19
Holes 19
Ramps, Runways, and Other Walkways 20
Excavations 20
Dangerous Equipment 20
Wall Openings 20
Protection from Falling Objects 21
Guardrails 21
Overhand Bricklaying and Related Work 21
Roofing Work 21
Toeboards 21
Canopies 22
Fall Protection Plans 22
Presumption of Feasibility 22
When Can I Use a Fall Protection Plan? 22
Elements of a Fall Protection Plan 23
Fall Protection Training 24
Requirements 24
Verification of Training 25
Fall Protection Requirements in Other OSHA Construction Standards 25
Subpart M – Fall Protection: Non-mandatory Appendices . . 26
Definitions 27
Workers' Rights 34
OSHA Assistance, Services and Programs 34
NIOSH Health Hazard Evaluation Program 37
OSHA Regional Offices 37
How to Contact OSHA 41

The Continuing Need for Fall Protection

Why Does OSHA Have a Standard for Fall Protection?

Historically, falls are the leading cause of fatalities in construction, accounting for about one-third of all fatalities in the industry. For example, the Bureau of Labor Statistics reported that there were 291 fatal falls to a lower level in construction in 2013, out of 828 total fatalities.

OSHA recognizes that incidents involving falls are generally complex events, frequently involving a variety of factors. Consequently, the standard for fall protection deals with both the human and equipment-related issues in protecting workers from fall hazards. This publication is intended to help workers and employers better understand the Fall Protection in Construction standard's requirements and the reasons behind them.

What Subpart M – Fall Protection Covers

What is Subpart M?

Subpart M lays out the requirements and criteria for fall protection in construction workplaces. For example, it applies when workers are working at heights of 6 feet or more above a lower level. It also covers protection from falling objects, falls from tripping over or falling through holes, and protection when walking and working around dangerous equipment without regard to height. Subpart M provisions do not apply, however, to workers inspecting, investigating, or assessing workplace conditions prior to the actual start of work or after all construction work has been completed. The provisions of Subpart M can be found in Title 29 Code of Federal Regulations (CFR) Subpart M - Fall Protection, 29 CFR 1926.500, 29 CFR 1926.501, 29 CFR 1926.502, and 29 CFR 1926.503.

What are Employers' Responsibilities to provide Fall Protection?

Initially, employers must assess the workplace to determine if walking or working surfaces have the necessary strength and structural integrity to safely support the workers. Once it is determined that the work surfaces will safely support the work activity, the employer must determine whether fall protection is required (using the requirements set forth in 29 CFR 1926.501) and, if so, select and provide workers with fall protection systems that comply with the criteria found in 29 CFR 1926.502.

When must employers provide Fall Protection? The 6-foot rule.

Subpart M requires the use of fall protection when construction workers are working at heights of 6 feet or greater above a lower level. It applies at heights of less than 6 feet when working near dangerous equipment, for example, working over machinery with open drive belts, pulleys or gears or open vats of degreasing agents or acid.

What construction areas and activities does Subpart M cover?

The standard identifies certain areas and activities where fall protection or falling object protection may be needed. For example, it might require fall protection for a worker who is: on a ramp, runway, or another walkway; at the edge of an excavation; in a hoist area; on a steep roof; on, at, above, or near wall openings; on a walking or working surface with holes (including skylights) or unprotected sides or edges; above dangerous equipment; above a lower level where leading edges are under construction; on the face of formwork and reinforcing steel; or otherwise on a walking or working surface 6 feet or more above a lower level. The standard may also require fall protection where a worker is: constructing a leading edge; performing overhand bricklaying and related work; or engaged in roofing work on low-slope roofs, precast concrete erection, or residential construction. In addition, the standard requires falling object protection when a worker is exposed to falling objects.

What kinds of Fall Protection should employers use?

Generally, fall protection can be provided through the use of guardrail systems, safety net systems, or personal fall arrest systems. OSHA refers to these systems as conventional fall protection. Other systems and methods of fall protection may be used when performing certain activities. For example, when working on formwork, a positioning device system could be used. OSHA encourages employers to select systems that prevent falls of any kind, such as guardrails designed to keep workers from falling over the edge of a building.

Examples of Fall Protection Requirements for Certain Construction Activities

Leading Edges – 29 CFR 1926.501(b)(2)

Each worker constructing a leading edge 6 feet or more above a lower level must be protected by guardrail systems, safety net systems, or personal fall arrest systems. 29 CFR 1926.501(b)(2)(i).

Exception: When the employer can demonstrate that it is infeasible or creates a greater hazard to use these systems, the employer must develop and implement a fall protection plan which meets the requirements of 29 CFR 1926.502(k). See the section below on Fall Protection Plans.

Workers must be protected by guardrail systems, safety net systems, or personal fall arrest systems, *even if they are not engaged in leading edge work*, if they are on a walking or working surface that is 6 feet or more above a level where leading edges are under construction. 29 CFR 1926.501(b)(2)(ii).

Overhand Bricklaying and Related Work – 29 CFR 1926.501(b)(9)

When workers perform overhand bricklaying and related work 6 feet or more above a lower level:

- They must be protected by guardrail systems, safety net systems, or personal fall arrest systems, or
- They must work in a **controlled access zone (CAZ).**

All workers reaching more than 10 inches below the level of the walking or working surface on which they are working must be protected by a guardrail system, safety net system, or personal fall arrest system.

Roofing Work on Low-Slope Roofs – 29 CFR 1926.501(b)(10)

A low-slope roof has a slope less than or equal to 4 in 12 (vertical to horizontal). When engaged in roofing work on a low-slope roof that has one or more unprotected side or edge 6 feet or more above lower levels, workers must be protected from falling by:

- Guardrail systems,
- Safety net systems,
- Personal fall arrest systems,
- A combination of conventional fall protection systems and warning line systems, or
- A warning line system and a safety monitoring system.

When engaged in roofing work on low-slope roofs 50 feet or less in width, the use of a safety monitoring system without a warning line system is permitted.

Working on Steep Roofs – 29 CFR 1926.501(b)(11)

A steep roof has a slope greater than 4 in 12 (vertical to horizontal). When working on a steep roof that has one or more unprotected side or edge 6 feet or more above lower levels, each worker must be protected by:

- Guardrail systems with toeboards,
- Safety net systems, or
- Personal fall arrest systems.

Residential Construction – 29 CFR 1926.501(b)(13)

Workers engaged in residential construction 6 feet or more above lower levels must be protected by conventional fall protection (i.e., guardrail systems, safety net systems, or personal fall arrest systems) unless another provision in 29 CFR 1926.501(b) provides for an alternative fall protection measure.

Exception: When the employer can demonstrate that it is infeasible or creates a greater hazard to use these systems, the employer must develop and implement a site-specific fall protection plan which meets the requirements of 29 CFR 1926.502(k). See the section on Fall Protection Plans, below.

Note: For purposes of determining the applicability of section 1926.501(b)(13), the term "residential construction" is interpreted as covering construction work that satisfies the following two elements: (1) the end-use of the structure being built must be as a home, i.e., a dwelling; and (2) the structure being built must be constructed using traditional wood frame construction materials and methods. The limited use of structural steel in a predominantly wood-framed home, such as a steel I-beam to help support wood framing, does not disqualify a structure from being considered residential construction. For more information see OSHA's Compliance Guidance for Residential Construction, STD 03-11-002.

Other Walking or Working Surfaces – 29 CFR 1926.501(b)(15)

As a general matter, each worker on a walking or working surface 6 feet or more above a lower level must be protected from falling by a guardrail system, a safety net system, or a personal fall arrest system.

Exceptions: For exceptions to this rule that specify different requirements, see 29 CFR 1926.500(a)(2) and 29 CFR 1926.501(b)(1) through (b)(14).

Conventional Fall Protection Systems

Guardrail Systems – 29 CFR 1926.502(b)

Guardrail systems are barriers erected to prevent workers from falling to lower levels. If the employer chooses to use guardrail systems to protect workers from falls, the following provisions apply:

- Top rails, or equivalent guardrail system members, must be 42 inches plus or minus 3 inches above the walking or working level. When workers are using stilts, the top edge of the top rail, or equivalent member, must be increased an amount equal to the height of the stilts. 29 CFR 1926.502(b)(1).
- Screens, midrails, mesh, intermediate vertical members, or equivalent intermediate structural members must be installed between the top edge of the guardrail system and the walking or working surface when there are no walls or parapet walls at least 21 inches high. 29 CFR 1926.502(b)(2).
- When midrails are used, they must be installed at a height midway between the top edge of the guardrail system and the walking or working level. 29 CFR 1926.502(b)(2)(i).
- When screens and mesh are used, they must extend from the top rail to the walking or working level and along the entire opening between top rail supports. 29 CFR 1926.502(b)(2)(ii). When necessary, screens and/or mesh must be installed in a manner to prevent a worker from falling underneath.

Properly installed guardrail system.

- When intermediate members (such as balusters) are used between posts, they must not be more than 19 inches apart. 29 CFR 1926.502(b)(2)(iii).

- Other structural members (such as additional midrails and architectural panels) must be installed so that there are no openings in the guardrail system more than 19 inches wide. 29 CFR 1926.502(b)(2)(iv).
- Guardrail systems must be capable of withstanding a force of at least 200 pounds applied within 2 inches of the top edge, in any outward or downward direction, at any point along the top edge. 29 CFR 1926.502(b)(3).
- Midrails, screens, mesh, intermediate vertical members, solid panels, and equivalent structural members must be capable of withstanding a force of at least 150 pounds applied in any downward or outward direction at any point along the midrail or other member. 29 CFR 1926.502(b)(5).
- Guardrail systems must have a surface to protect workers from punctures or lacerations and to prevent clothing from snagging. 29 CFR 1926.502(b)(6).
- The ends of top rails and midrails must not overhang terminal posts, except where an overhang poses no projection hazard. 29 CFR 1926.502(b)(7).
- Steel and plastic banding cannot be used as top rails or midrails. 29 CFR 1926.502(b)(8).
- Top rails and midrails of guardrail systems must have a nominal diameter or thickness of at least 1/4 inch to prevent cuts and lacerations. 29 CFR 1926.502(b)(9).
- If wire rope is used for top rails, it must be flagged at not more than 6-foot intervals with high-visibility material. 29 CFR 1926.502(b)(9).
- When guardrail systems are used at hoisting areas, a chain, gate, or removable guardrail section must be placed across the access opening between guardrail sections during those times when hoisting operations are not taking place. 29 CFR 1926.502(b)(10).
- When guardrail systems are used at holes, they must be set up on all unprotected sides or edges. When a hole is used for the passage of materials, it must not have more

than two sides with removable guardrail sections. When the hole is not in use, it must be covered or provided with a guardrail system along all unprotected sides or edges. 29 CFR 1926.502(b)(11) & (12).

- If guardrail systems are used around holes being used as access points (such as ladderways), gates must be used. Alternatively, the point of access must be offset to prevent workers from accidentally walking straight into the hole. 29 CFR 1926.502(b)(13).
- If guardrails are used on ramps and runways, they must be erected on each unprotected side or edge. 29 CFR 1926.502(b)(14).
- Manila, plastic, or synthetic rope used for top rails or midrails must be inspected as frequently as necessary to ensure its strength and stability. 29 CFR 1926.502(b)(15).

Safety Net Systems – 29 CFR 1926.502(c)

When safety nets are used, they must be installed as close as practicable under the walking or working surface on which workers are working and never more than 30 feet below that level. 29 CFR 1926.502(c)(1). When nets are used on bridges, the potential fall area from the walking or working surface to the net must be unobstructed. 29 CFR 1926.502(c)(1). All safety nets must be installed with sufficient clearance underneath to prevent a falling body from hitting the surface or structure below the net. 29 CFR 1926.502(c)(3). If the employer chooses to use nets, the following criteria apply:

Vertical distance from a working level to the horizontal plane of the net	**Minimum required horizontal distance from the edge of a working surface to the outer edge of the net**
Up to 5 feet	8 feet
More than 5 feet up to 10 feet	10 feet
More than 10 feet	13 feet

Drop-testing is required to ensure that safety nets and safety net installations are working properly. See 29 CFR 1926.502(c)(4)(i) for more details. If an employer can demonstrate that it is unreasonable to perform a drop-test, then the employer or a designated competent person must certify that the net and its installation is in compliance with the standard. See 29 CFR 1926.502(c)(4)(ii) for more details on certification and certification records.

Safety nets used in construction sites.

- Do not use defective nets. Inspect nets at least once a week for wear, damage, or deterioration of components such as net connection points. 29 CFR 1926.502(c)(5).
- Remove materials, tools, and other items as soon as possible from the net and at least before the next work shift. 29 CFR 1926.502(c)(6).
- To work properly, a safety net must have safe openings. Mesh openings must not exceed 36 square inches, and must not be longer than 6 inches on any side. Each opening, measured center-to-center of mesh ropes or webbing, must not exceed 6 inches. 29 CFR 1926.502(c)(7).
- All mesh crossings must be secured to prevent the openings from enlarging. 29 CFR 1926.502(c)(7).
- Use safety net (or section of net) with a border rope possessing a minimum breaking strength of 5,000 pounds. 29 CFR 1926.502(c)(8).
- Do not allow one weak link to compromise a safety net. Use connections between safety net panels that are as strong as integral net components and spaced no more than 6 inches apart. 29 CFR 1926.502(c)(9).

Personal Fall Arrest Systems – 29 CFR 1926.502(d)

A personal fall arrest system is a system used to safely stop (arrest) a worker who is falling from a working level. It consists of an anchorage, connectors, and a body harness. It also may include a lanyard, deceleration device, lifeline, or suitable combinations of these. Under Subpart M, body belts (safety belts) **are prohibited** for use as part of a personal fall arrest system.*

Know the A, B, Cs of Personal Fall Arrest Systems

Anchorages

Body harness

Components (connectors like snaphooks or Dee-rings, connection points, lanyards, deceleration devices, lifelines, etc.)

When employers choose to use a personal fall arrest system as a means of worker fall protection they must:

- Limit the maximum arresting force on a worker to 1,800 pounds when used with a body harness. 29 CFR 1926.502(d)(16)(ii).
- Be rigged so that a worker can neither free fall more than 6 feet nor contact any lower level. 29 CFR 926.502(d)(16)(iii).
- Bring a worker to a complete stop and limit the maximum deceleration distance a worker travels to 3.5 feet. 29 CFR 1926.502(d)(16)(iv).
- Have sufficient strength to withstand twice the potential impact energy of a worker free falling a distance of 6 feet or the free fall distance permitted by the system, whichever is less. 29 CFR 1926.502(d)(16)(v).
- Be inspected prior to each use for wear, damage, and other deterioration. Defective components must be removed from service. 29 CFR 1926.502(d)(21).

*__Note__: Limited use of body belts (safety belts) can still be used as part of a positioning device system or fall restraint system See more information under Positioning Device Systems and Fall Restraint Systems, below.

Personal Fall Arrest System Components

Snaphooks

- Snaphooks must be the locking type and designed and used to prevent disengagement from any component part of the personal fall arrest system. 29 CFR 1926.502(d)(5).
- Locking type snaphooks may also be used when designed for the following connections:
    - directly to webbing, rope, or wire rope;
    - to each other;
    - to a Dee-ring to which another snaphook or other connector is attached;
    - to a horizontal lifeline; or
    - to any object which is incompatibly shaped or dimensioned in relation to the snaphook, such that unintentional disengagement could occur by the connected object being able to depress the snaphook keeper and release itself. 29 CFR 1926.502(d)(6).

Horizontal Lifelines

- On suspended scaffolds or similar work platforms with horizontal lifelines that may become vertical lifelines, the devices used to connect to a horizontal lifeline must be capable of locking in both directions on the lifeline. 29 CFR 1926.502(d)(7).
- Horizontal lifelines must be designed, installed, and used under the supervision of a qualified person, as part of a complete personal fall arrest system that maintains a safety factor of at least two. 29 CFR 1926.502(d)(8).

Vertical Lifelines and Lanyards

- Vertical lifelines and lanyards must have a minimum breaking strength of 5,000 pounds. 29 CFR 1926.502(d)(9).
- Lifelines must be protected against being cut or abraded. 29 CFR 1926.502(d)(11).

Self-retracting Lifelines and Lanyards

- Self-retracting lifelines and lanyards that automatically limit free fall distance to 2 feet or less must be capable of sustaining a minimum tensile load of 3,000 pounds applied to the device with the lifeline or lanyard in the fully extended position. 29 CFR 1926.502(d)(12).
- Self-retracting lifelines and lanyards which do not limit free fall distance to 2 feet or less, ripstitch lanyards, and tearing and deforming lanyards must be capable of sustaining a minimum tensile load of 5,000 pounds applied to the device with the lifeline or lanyard in the fully extended position. 29 CFR 1926.502(d)(13).

Ropes and Straps

- Ropes and straps (webbing) used in lanyards, lifelines, and strength components of body belts and body harnesses must be made of synthetic fibers. 29 CFR 1926.502(d)(14).

Anchorages

- Anchorages used to attach personal fall arrest systems must be designed, installed, and used under the supervision of a qualified person, as part of a complete personal fall arrest system which maintains a safety factor of at least two. Alternatively, the anchorages must be independent of any anchorage being used to support or suspend platforms and must be capable of supporting at least 5,000 pounds per worker attached or be capable of supporting at least twice the expected impact load. 29 CFR 1926.502(d)(15).

Positioning Device Systems – 29 CFR 1926.502(e)

OSHA defines a positioning device system as a body belt or body harness system rigged to allow a worker to be supported on an elevated vertical surface, such as a wall, and work with both hands free while leaning.

- Body belt or body harness systems are to be set up so that a worker can free fall no farther than 2 feet. 29 CFR 1926.502(e)(1).
- Body belts or harnesses must be secured to an anchorage capable of supporting at least twice the potential impact load of a worker's fall or 3,000 pounds, whichever is greater. 29 CFR 1926.502(e)(2).

Positioning Device System Components

Snaphooks, Dee-rings, and Other Connectors

Requirements for components are similar or identical to provisions relating to Personal Fall Arrest System components found in 29 CFR 1926.502(d).

For strength and safe use requirements of snaphooks, Dee-rings, and other connectors when used with positioning device systems, see 29 CFR 1926.502(e)(3) through (10).

Fall Restraint Systems

While fall restraint systems are not mentioned in Subpart M, OSHA recognizes a fall restraint system as a means of prevention. The system, if properly used, tethers a worker in a manner that **will not allow a fall of any distance.** This system is comprised of a body belt or body harness, an anchorage, connectors, and other necessary equipment. Other components typically include


Photo: Skip Pennington

a lanyard, a lifeline, and other devices. For a restraint system to work, the anchorage must be strong enough to prevent the worker from moving past the point where the system is fully extended, including an appropriate safety factor.

**In a November 2, 1995 interpretation letter to Mr. Dennis Gilmore, OSHA suggested that, at a minimum, a fall restraint system must have the capacity to withstand at least 3,000 pounds or twice the maximum expected force that is needed to restrain the person from exposure to the fall hazard. In determining this force, consideration should be given to site-specific factors such as the force generated by a person (including his/her tools, equipment, and materials) walking, slipping, tripping, leaning, or sliding along the work surface.*

Letters of Interpretation

There are a number of Letters of Interpretation pertinent to fall protection that may affect your operation. OSHA Letters of Interpretation do not create new or additional requirements but rather explain these requirements and how they apply to particular circumstances. The letters constitute OSHA's interpretation of the requirements discussed. From time to time, letters are affected when the Agency updates a standard, a legal decision impacts a standard, or changes in technology affect the interpretation. To assure that you are using the correct information and guidance, please consult OSHA's website at www.osha.gov. If you have further questions, contact the Directorate of Construction at (202) 693-2020.

Additional Fall Protection Systems

Warning Line Systems – 29 CFR 1926.502(f)

OSHA defines a warning line system as a barrier erected on a roof to warn workers that they are approaching an unprotected roof side or edge, and to designate an area in which roofing work may take place without the use of guardrails, body harnesses, or safety net systems to protect workers in the area. Warning line systems consist of ropes, wires, or chains, plus supporting stanchions. If an employer chooses to use warning line systems, the following provisions apply:

- The warning line must be erected around all sides of roof work areas. 29 CFR 1926.502(f)(1).
- When mechanical equipment is not being used, the warning line must be erected at least 6 feet from the roof edge. 29 CFR 1926.502(f)(1)(i).
- When mechanical equipment is being used the warning line must be erected:
  - At least 6 feet from the roof edge parallel to the direction of mechanical equipment operation; and
  - At least 10 feet from the roof edge perpendicular to the direction of mechanical equipment operation. 29 CFR 1926.502(f)(1)(ii).
- The rope, wire, or chain must be flagged at not more than 6-foot intervals with high-visibility material. 29 CFR 1926.502(f)(2)(i).
- The rope, wire, or chain must be rigged and supported so that:
  - The lowest point (including sag) is at least 34 inches from the walking or working surface; and
  - Its highest point is no more than 39 inches from the walking or working surface. 29 CFR 1926.502(f)(2)(ii).
- Stanchions, after being rigged with warning lines, must be capable of resisting, without tipping over, a force of at least 16 pounds applied horizontally against the stanchion, 30 inches above the walking or working surface, perpendicular to the warning line and in the direction of the floor, roof, or platform edge. 29 CFR 1926.502(f)(2)(iii).
- The rope, wire, or chain must have a minimum tensile strength of 500 pounds. After being attached to the stanchions, it must support, without breaking, the loads applied to the stanchions as prescribed in 29 CFR 1926.502(f)(2)(iii) & 29 CFR 1926.502(f)(2)(iv).

- The rope, wire, or chain must be attached to each stanchion in such a way that pulling on one section of the line between stanchions will not result in slack being taken up in the adjacent section before the stanchion tips over. 29 CFR 1926.502(f)(2)(v).

Controlled Access Zones – 29 CFR 1926.502(g)

- A controlled access zone is a work area in which certain types of work may take place without using conventional fall protection systems. Worker access to these areas must be carefully controlled. For example, a controlled access zone would be designated where overhand bricklaying was occurring without the protection of guardrails. In this example, only masons and other workers actually engaged in the bricklaying would be allowed in the controlled access zone.
- When used to control access to areas where leading edge and other operations are taking place, the controlled access zones must be defined by a control line or by any other means that restricts access. 29 CFR 1926.502(g)(1).
- When control lines are used to define a controlled access zone, they must be erected at least 6 feet and no more than 25 feet from the unprotected or leading edge, except when precast concrete members are being erected. In the latter case, the control line is to be erected at least 6 feet and no more than 60 feet or half the length of the member being erected, whichever is less, from the leading edge. 29 CFR 1926.502(g)(1)(i) and (ii).
- The control line must extend along the entire length of and approximately parallel to the unprotected side or leading edge and be connected on each side to a guardrail system or wall. 29 CFR 1926.502(g)(1)(iii) and (iv).
- When controlled access zones are used to limit access to areas where overhand bricklaying and related work are taking place:
    - A control line must be erected to define the work zone and must be erected at least 10 feet and no more than 15 feet from the working edge. 29 CFR 1926.502(g)(2)(i).

The control lines must be erected approximately parallel to the working edge and must extend for a distance sufficient to enclose all workers performing overhand bricklaying and related work at the working edge. 29 CFR 1926.502(g)(2)(ii).

  - Additional control lines must be erected at each end of the controlled access zone to enclose the work area. 29 CFR 1926.502(g)(2)(iii).
  - Only workers engaged in overhand bricklaying or related work are permitted in the controlled access zone. 29 CFR 1926.502(g)(2)(iv).

- Control lines must consist of ropes, wires, tapes, or equivalent materials, and supporting stanchions. When used, each control line must:
  - Be flagged or otherwise clearly marked at not more than 6-foot intervals with high-visibility material. 29 CFR 1926.502(g)(3)(i).
  - Be rigged and supported in such a way that the lowest point (including sag) is not less than 39 inches from the walking or working surface; and the highest point is not more than 45 inches, or more than 50 inches when overhand bricklaying operations are being performed, from the walking or working surface. 29 CFR 1926.502(g)(3)(ii).
  - Have a breaking strength of at least 200 pounds. 29 CFR 1926.502(g)(3)(iii).
- On floors and roofs where guardrail systems are not in place prior to the beginning of overhand bricklaying operations, controlled access zones must be enlarged as necessary to enclose all points of access, material handling areas, and storage areas. 29 CFR 1926.502(g)(4).
- On floors and roofs where guardrail systems are in place but need to be removed to allow overhand bricklaying work or leading edge work to take place, only that portion of the guardrail necessary to accomplish that day's work is allowed to be removed. 29 CFR 1926.502(g)(5).

Safety Monitoring Systems – 29 CFR 1926.502(h)

A safety monitoring system is an alternative fall protection option for low-slope roofing work under 29 CFR 1926.501(b)(10). If employers elect to use a safety monitoring system, they must designate a competent person to monitor the safety of workers and to warn them when their work puts them close to a fall hazard.

The safety monitor must:

- Be competent in the recognition of fall hazards. 29 CFR 1926.502(h)(1)(i);
- Warn workers when it appears that they are unaware of fall hazards or when the workers are acting in an unsafe manner. 29 CFR 1926.502(h)(1)(ii);
- Be on the same walking or working surfaces as the workers and be able to see them. 29 CFR 1926.502(h)(1)(iii);
- Be close enough to the work operations to speak directly with workers. 29 CFR 1926.502(h)(1)(iv); and
- Have no other duties to distract them from their monitoring function. 29 CFR 1926.502(h)(1)(v).

Employers must ensure that:

- Mechanical equipment is not used or stored in areas where safety monitoring systems are being used to monitor workers engaged in roofing operations on low-slope roofs. 29 CFR 1926.502(h)(2);
- No worker, other than one engaged in roofing work on low-slope roofs or one covered by a fall protection plan, enters an area where a worker is being protected by a safety monitoring system. 29 CFR 1926.502(h)(3); and
- All workers in a controlled access zone have been instructed to promptly comply with fall hazard warnings issued by safety monitors. 29 CFR 1926.502(h)(4).

Safety monitoring systems must also be used as part of a fall protection plan under 29 CFR 1926.502(k), where no other alternative measure has been implemented. As explained in more detail below, the use of a fall protection plan is limited to residential construction work, precast concrete work, and leading edge work (see 29 CFR 1926.501(b)(2), (b)(12) and (b)(13)). The employer must first demonstrate that it is infeasible or creates a greater hazard to use conventional fall protection equipment.

Other Hazards that Require Fall Protection

A construction environment poses many hazards requiring protection. Below are some fall hazards that cannot be overlooked.

Hoist Areas – 29 CFR 1926.501(b)(3)

Each worker in a hoist area must be protected from falling 6 feet or more by guardrail systems or personal fall arrest systems. There may be times when the guardrail systems (or chain, gate, or guardrail) must be removed in whole or part to facilitate hoisting operations. For example, during the landing of materials, a worker may need to lean through the access opening or out over the edge of the access opening to receive or guide equipment and materials. At such times a personal fall arrest system must be used to protect the worker from falling through the unprotected opening.

Holes – 29 CFR 1926.501(b)(4)

- Each worker on walking or working surfaces must be protected from falling through holes (including skylights) that are more than 6 feet above lower levels, by personal fall arrest systems, covers, or guardrail systems erected around such holes. 29 CFR 1926.501(b)(4)(i).
- Each worker on a walking or working surface must be protected from tripping in or stepping into or through holes (including skylights) by covers. 29 CFR 1926.501(b)(4)(ii).

Covered floor hole marked, and with a guardrail surrounding it.

Ramps, Runways, and Other Walkways – 29 CFR 1926.501(b)(6)

Each worker on a ramp, runway, or other walkway must be protected by guardrail systems against falling 6 feet or more.

Excavations – 29 CFR 1926.501(b)(7)

- Each worker at the edge of an excavation 6 feet or more deep must be protected from falling by guardrail systems, fences, or barricades when the excavation cannot be readily seen because of plant growth or other visual barrier. 29 CFR 1926.501(b)(7)(i).
- Each worker at the edge of a well, pit, shaft, and similar excavation 6 feet or more deep must be protected from falling by guardrail systems, fences, or barricades, or covers. 29 CFR 1926.502(b)(7)(ii).

Dangerous Equipment – 29 CFR 1926.501(b)(8)

- When working 6 feet or more above dangerous equipment, each worker must be protected by guardrail systems, safety net systems, or personal fall arrest systems. 29 CFR 1926.502(b)(8)(ii).
- When working <u>less</u> than 6 feet above dangerous equipment, each worker must be protected from falling into or onto the dangerous equipment by a guardrail system or equipment guards. 29 CFR 1926.502(b)(8)(i).

Wall Openings – 29 CFR 1926.501(b)(14)

Each worker working on, at, above, or near wall openings (including those with chutes attached), where the outside bottom edge of the wall opening is 6 feet or more above lower levels and the inside bottom edge of the wall opening is less than 39 inches above the walking or working surface, must be protected with a guardrail system, a safety net system, or a personal fall arrest system.

Protection from Falling Objects

Falling objects can also pose a hazard to workers. Falling object protection must comply with the following provisions:

Guardrails – 29 CFR 1926.502(j)(5)

When guardrail systems are used to prevent materials from falling from one level to another, any openings must be small enough to prevent passage of falling objects.

Overhand Bricklaying and Related Work – 29 CFR 1926.502(j)(6)

During overhand bricklaying and related work, no materials or equipment except masonry and mortar may be stored within 4 feet of working edges. Excess mortar, broken or scattered masonry units, and all other materials and debris must be kept clear of the working area by removal at regular intervals.

Roofing Work – 29 CFR 1926.502(j)(7)

During roofing work, materials and equipment must not be stored within 6 feet of a roof edge unless guardrail systems are erected at the edge. Any materials piled, grouped, or stacked near a roof edge must be stable and self-supporting.

Toeboards – 29 CFR 1926.502(j)(1) through (4)

When toeboards are used as protection from falling objects, they must be erected along the edges of the overhead walking or working surface for a distance sufficient to protect workers working below. 29 CFR 1926.502(j)(1). Other criteria include:

- Toeboards must be capable of withstanding, without failure, a force of at least 50 pounds applied in any downward or outward direction at any point along the toeboard. 29 CFR 1926.502(j)(2).
- Toeboards must be at least 3.5 inches tall from their top edge to the level of the walking or working surface, must have no

more than 0.25 inch clearance above the walking or working surface, and must be solid or have openings no larger than one inch in its greatest dimension. 29 CFR 1926.502(j)(3).

- Where tools, equipment, or materials are piled higher than the top edge of a toeboard, paneling or screening must be erected from the walking or working surface or toeboard to the top of a guardrail system's top rail or midrail, for a distance sufficient to protect workers below. 29 CFR 1926.502(j)(4).

Canopies – 29 CFR 1926.502(j)(8)

When used as protection from falling objects, canopies must be strong enough to prevent collapse and to prevent penetration by any objects that may fall onto them.

Fall Protection Plans

Presumption of Feasibility

As a general matter, OSHA presumes that using conventional fall protection (that is, guardrails, personal fall arrest systems, or safety nets) is feasible and will not create a greater hazard to use. However, as outlined below, there are a few circumstances when an employer can use a site-specifc fall protection plan instead of conventional fall protection.

When Can I Use a Fall Protection Plan?

It is possible that during leading edge work (29 CFR 1926.501(b)(2)), precast concrete erection (29 CFR 1926.501(b)(12)), or residential construction (29 CFR 1926.501(b)(13)), it may be infeasible or may create a greater hazard to use conventional fall protection for a specific task. In those circumstances, employers may implement a fall protection plan that complies with 29 CFR 1926.502(k).

IMPORTANT: The employer has the burden of establishing that it is appropriate to implement a fall protection plan instead of implementing conventional fall protection systems.

Elements of a Fall Protection Plan – 29 CFR 1926.502(k)

- A fall protection plan must be prepared by a qualified person and developed specifically for the site where the work is being performed. 29 CFR 1926.502(k)(1).
- The fall protection plan must be maintained and kept up to date. 29 CFR 1926.502(k)(1).
- Any changes to the fall protection plan must be approved by a qualified person. 29 CFR 1926.502(k)(2).
- A copy of the fall protection plan with all approved changes must be maintained at the job site. 29 CFR 1926.502(k)(3).
- A competent person must supervise the implementation of the fall protection plan. 29 CFR 1926.502(k)(4).
- The plan must document the reasons why the use of conventional fall protection is infeasible or would create a greater hazard. 29 CFR 1926.502(k)(5).
- The plan must include a written discussion of other measures that will be taken to reduce or eliminate the fall hazard for workers who cannot be provided with protection using conventional fall protection systems. For example, the employer must discuss the extent to which scaffolds, ladders, or vehicle-mounted work platforms can be used to provide a safer working surface and thereby reduce the hazard of falling. 29 CFR 1926.502(k)(6).
- The plan must identify each location where conventional fall protection methods cannot be used. These locations must then be classified as controlled access zones, and the employer must comply with the criteria in 29 CFR 1926.502(g) and 29 CFR 1926.502(k)(7).
- Where no other alternative measure has been implemented, the employer must implement a safety monitoring system that complies with 29 CFR 1926.502(h) and 29 CFR 1926.502(k)(8).
- The plan must include a statement which provides the name or other method of identification for each worker who is authorized to work in controlled access zones. No other workers may enter controlled access zones. 29 CFR 1926.502(k)(9).

- In the event that a worker falls, or some other related, serious incident occurs (for example, a near miss), the employer must investigate the circumstances to determine if the fall protection plan needs to be changed. For example, the plan may need to add new practices, procedures, or training. The employer must implement the needed changes to prevent similar types of falls or incidents. 29 CFR 1926.502(k)(10).

Fall Protection Training

Requirements – 29 CFR 1926.503

Employers must provide a fall protection training program to workers who might be exposed to fall hazards. Training must include how to recognize fall hazards and how to minimize them. 29 CFR 1926.503(a)(1).

The employer must assure that each worker has been trained as necessary, by a competent person who is qualified in the following areas:

- The nature of fall hazards in the work area. 29 CFR 1926.503(a)(2)(i).
- The correct procedures for erecting, maintaining, disassembling, and inspecting the fall protection systems to be used. 29 CFR 1926.503(a)(2)(ii).
- The use and operation of controlled access zones; guardrail, personal fall arrest, safety net, warning line, and safety monitoring systems; and other protection to be used. 29 CFR 1926.503(a)(2)(iii).
- The role of each worker in the safety monitoring system when the system is used. 29 CFR 1926.503(a)(2)(iv).
- The limitations on the use of mechanical equipment during the performance of roofing work on low-slope roofs. 29 CFR 1926.503(a)(2)(v).
- The correct procedures for equipment and materials handling and storage and the erection of overhead protection. 29 CFR 1926.503(a)(2)(vi).

- The role of workers in fall protection plans. 29 CFR 1926.503(a)(2)(vii).
- OSHA's fall protection requirements, published as Subpart M. 29 CFR 1926.503(a)(2)(viii).

Verification of Training

Employers must verify worker training by preparing a written certification record. The record must contain the name or other identity of the worker trained, the dates of the training, and the signature of either the person who conducted the training or the employer. 29 CFR 1926.503(b)(1).

When an employer has reason to believe that an affected worker does not recognize existing fall hazards at some point after the initial training, the employer is required to provide retraining for that worker. For example, workers must be retrained when:

- Changes in the workplace render previous training obsolete. 29 CFR 1926.503(c)(1).
- Fall protection equipment or systems have changed. 29 CFR 1926.503(c)(2).
- Inadequacies in workers' knowledge or use of fall protection systems or equipment indicate that they have not adequately understood or retained previous training. 29 CFR 1926.503(c)(3).

Fall Protection Requirements in Other OSHA Construction Standards

Other OSHA construction standards also contain fall protection requirements. Employers covered by another standard may have to comply with the requirements in the other standard and those in Subpart M, unless one of the exceptions listed in 29 CFR 1926.500(a)(2), 1926.500(a)(3), or 1926.500(a)(4) applies. OSHA included these exceptions because other means of providing fall protection (for example, when using ladders and scaffolds) may eliminate the need for providing fall protection under Subpart M. For example, employers with workers engaged in the construction of electric transmission or distribution lines or equipment should refer to Subpart V – Power Transmission and Distribution for specific fall protection requirements. However, employers should be aware that their workers are still covered by Subpart M when the workers are engaged in activities not covered by Subpart V or another of the exceptions under 29 CFR 1926.500.

The following subparts of OSHA's Construction standards address fall protection requirements and performance criteria outside of Subpart M:

- Personal Protective and Life Saving Equipment – Subpart E (applies to belts, lanyards, lifelines, nets for work on tanks, communication and broadcast towers);
- Scaffolds – Subpart L;
- Steel Erection – Subpart R;
- Underground Construction, Caissons, Cofferdams, and Compressed Air – Subpart S (applies to certain types of equipment in tunneling operations);
- Power Transmission and Distribution – Subpart V;
- Stairways and Ladders – Subpart X; and
- Cranes and Derricks in Construction – Subpart CC.

Subpart M – Fall Protection: Non-mandatory Appendices

Appendix A to Subpart M – Determining Roof Widths – Non-mandatory Guidelines for Complying with 1926.501(b)(10)
This appendix serves as a guideline to help employers comply with the requirements of 1926.501(b)(10). Section 1926.501(b)(10) allows the use of a safety monitoring system alone as a means of providing fall protection during the performance of roofing operations on low-sloped roofs 50 feet (15.25 m) or less in width.

Appendix B to Subpart M – Guardrail Systems – Non-mandatory Guidelines for Complying with 1926.502(b)
This appendix serves as a guideline to assist employers in designing and building guardrail systems in compliance with 1926.502(b)(3), (4), and (5).

Appendix C to Subpart M – Personal Fall Arrest Systems – Non-mandatory Guidelines for Complying with 1926.502(d) This appendix serves as a non-mandatory guideline to help employers comply with the requirements in 1926.502(d). Section I, paragraphs (b), (c), (d) and (e) describe methods for testing personal fall arrest systems and positioning device systems.

Appendix D to Subpart M – Positioning Device Systems – Non-mandatory Guidelines for Complying with 1926.502(e) This appendix serves as a non-mandatory guideline to help employers comply with the requirements for positioning device systems in 1926.502(e). The procedures listed here, along with those in Appendix C (above), describe methods for testing positioning device systems to comply with 1926.502(e)(3) and (4) of Subpart M.

Appendix E to Subpart M – Sample Fall Protection Plan – Non-mandatory Guidelines for Complying with 1926.502(k) This appendix provides sample fall protection plans for employers engaged in leading edge work, precast concrete construction, or residential construction work. The employer must be able to demonstrate that it is infeasible or creates a greater hazard to use conventional fall protection systems.

Definitions

The definitions in this section that affect Subpart M are found in 29 CFR 1926.32; 29 CFR 1926.500; and STD 03-11-002 Compliance Guidance for Residential Construction.

Anchorage – a secure point of attachment for lifelines, lanyards, or deceleration devices.

Body belt (safety belt) – a strap with means both for securing it about the waist and for attaching it to a lanyard, lifeline, or deceleration device. *Note: Since January 1, 1998, OSHA has prohibited the use of a body belt as part of a* ***personal fall arrest system****. Exception: When used correctly, body belts are recognized by OSHA as an acceptable fall protection component when used as a part of either a restraining device which prevents a fall or a positioning device which limits a free fall to 2 feet.*

Body harness – straps which may be secured about the worker in a manner that will distribute the fall arrest forces over at least the thighs, pelvis, waist, chest, and shoulders, with means for attaching it to other components of a personal fall arrest system.

Buckle – any device for holding the body belt or body harness closed around the worker's body.

Competent person – one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to workers, and who has authorization to take prompt corrective measures to eliminate them.

Connector – a device which is used to couple (connect) parts of the personal fall arrest system and positioning device systems together. It may be an independent component of the system, such as a carabiner, or it may be an integral component of part of the system (such as a buckle or Dee-ring sewn into a body belt or body harness, or a snaphook spliced or sewn to a lanyard or self-retracting lanyard).

Controlled access zone (CAZ) – an area in which certain work (for example, overhand bricklaying) may take place without the use of guardrail systems, personal fall arrest systems, or safety net systems; and where access to the zone is controlled.

Dangerous equipment – equipment (such as pickling or galvanizing tanks, degreasing units, machinery, electrical equipment, and other units) which, as a result of form or function, may be hazardous to workers who fall onto or into such equipment.

Deceleration device – any mechanism (such as a rope grab, rip-stitch lanyard, specially-woven lanyard, tearing or deforming lanyards, automatic self-retracting lifelines/lanyards, etc.) which serves to dissipate a substantial amount of energy during a fall arrest, or otherwise limit the energy imposed on a worker during fall arrest.

Deceleration distance – the additional vertical distance a falling employee travels, excluding lifeline elongation and free fall distance, before stopping, from the point at which the deceleration device begins to operate. It is measured as the distance between the location of a worker's body belt or body harness attachment point at the moment of activation (at the onset of fall arrest forces) of the deceleration device during a fall, and the location of that attachment point after the worker comes to a full stop.

Equivalent – alternative designs, materials, or methods to protect against a hazard, which the employer can demonstrate will provide an equal or greater degree of safety for workers than the methods, materials, or designs specified in the standard.

Failure – load refusal, breakage, or separation of component parts. Load refusal is the point where the ultimate strength is exceeded.

Free fall – the act of falling before a personal fall arrest system begins to apply force to arrest the fall.

Free fall distance – the vertical displacement of the fall arrest attachment point on the worker's body belt or body harness between onset of the fall and just before the system begins to apply force to arrest the fall. This distance excludes deceleration distance and lifeline/lanyard elongation, but includes any deceleration device slide distance or self-retracting lifeline/lanyard extension before they operate and fall arrest forces occur.

Guardrail system – a barrier erected to prevent workers from falling to lower levels.

Hole – a gap or void 2 inches or more in its least dimension, in a floor, roof, or other walking or working surface.

Infeasible – impossible to perform the construction work using a conventional fall protection system (that is, guardrail system, safety net system, or personal fall arrest system); or technologically impossible to use any one of these systems to provide fall protection.

Lanyard – a flexible line of rope, wire rope, or strap which generally has a connector at each end for connecting the body belt or body harness to a deceleration device, lifeline, or anchorage.

Leading edge – the edge of a floor, roof, or formwork for a floor or other walking or working surface (such as the deck) which changes location as additional floor, roof, decking, or formwork sections are placed, formed, or constructed. A leading edge is considered to be an "unprotected side and edge" during periods when it is not actively and continuously under construction.

Lifeline – a component consisting of a flexible line for connection to an anchorage at one end to hang vertically (vertical lifeline), or for connection to anchorages at both ends to stretch horizontally (horizontal lifeline), and which serves as a means for connecting other components of a personal fall arrest system to the anchorage.

Low-slope roof – a roof having a slope less than or equal to 4 in 12 (vertical to horizontal).

Lower levels – those areas or surfaces to which a worker can fall. Such areas or surfaces include, but are not limited to, ground levels, floors, platforms, ramps, runways, excavations, pits, tanks, material, water, equipment, structures, or portions thereof.

Mechanical equipment – all motor- or human-propelled wheeled equipment used for roofing work, except wheelbarrows and mop carts.

Opening – a gap or void 30 inches or more high and 18 inches or more wide, in a wall or partition, through which workers can fall to a lower level.

Overhand bricklaying and related work – the process of laying bricks and masonry units such that the surface of the wall to be jointed is on the opposite side of the wall from the mason, requiring the mason to lean over the wall to complete the work. Related work includes mason tending and electrical installation incorporated into the brick wall during the overhand bricklaying process.

Personal fall arrest system – a system used to arrest a worker in a fall from a working level. It consists of an anchorage, connectors, and a body harness. It may include a lanyard, deceleration device, lifeline, or suitable combinations of these. *Note: Since January 1, 1998, the use of a body belt for fall arrest has been prohibited.*

Positioning device system – a body belt or body harness system rigged to allow a worker to be supported on an elevated vertical surface, such as a wall, and work with both hands free while leaning.

Qualified – one who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training, and experience, has successfully demonstrated his ability to solve or resolve problems relating to the subject matter, the work, or the project.

Rope grab – a deceleration device which travels on a lifeline and automatically, by friction, engages the lifeline and locks so as to arrest the fall of a worker. A rope grab usually employs the principles of inertial locking, cam/level locking, or both.

Roof – the exterior surface on the top of a building. This does not include floors or formwork which, because a building has not been completed, temporarily become the top surface of a building.

Roofing work – the hoisting, storage, application, and removal of roofing materials and equipment, including related insulation, sheet metal, and vapor barrier work, but not including the construction of the roof deck.

Safety-monitoring system – a safety system in which a competent person is responsible for recognizing and warning workers of fall hazards.

Self-retracting lifeline/lanyard – a deceleration device containing a drum-wound line which can be slowly extracted from, or retracted onto, the drum under slight tension during normal worker movement, and which, after onset of a fall, automatically locks the drum and arrests the fall.

Snaphook – a connector comprised of a hook-shaped member with a normally closed keeper, or similar arrangement, which may be opened to permit the hook to receive an object and, when released, automatically closes to retain the object. Snaphooks are generally one of two types:

(1) The *locking* type with a self-closing, self-locking keeper which remains closed and locked until unlocked and pressed open for connection or disconnection; or

(2) The *non-locking* type with a self-closing keeper which remains closed until pressed open for connection or disconnection. As of January 1, 1998, the use of a non-locking snaphook as part of personal fall arrest systems and positioning device systems is prohibited.

Steep roof – a roof having a slope greater than 4 in 12 (vertical to horizontal).

Toeboard – a low protective barrier that will prevent the fall of materials and equipment to lower levels and provide workers protection from falls.

Unprotected sides and edges – any side or edge (except at entrances to points of access) of a walking or working surface (for example, floor, roof, ramp, or runway) where there is no wall or guardrail system at least 39 inches high.

Walking/working (walking or working) surface – any surface (whether horizontal or vertical) on which a worker walks or works, including but not limited to floors, roofs, ramps, bridges, runways, formwork and concrete reinforcing steel; but not including ladders, vehicles, or trailers, on which workers must be located in order to perform their job duties.

Warning line system – a barrier erected on a roof to warn workers that they are approaching an unprotected roof side or edge, and which designates an area in which roofing work may take place without the use of guardrail, body harness, or safety net systems to protect workers in the area.

Work area – that portion of a walking or working surface where job duties are being performed.

Workers' Rights

Workers have the right to:

- Working conditions that do not pose a risk of serious harm.
- Receive information and training (in a language and vocabulary the worker understands) about workplace hazards, methods to prevent them, and the OSHA standards that apply to their workplace.
- Review records of work-related injuries and illnesses.
- File a complaint asking OSHA to inspect their workplace if they believe there is a serious hazard or that their employer is not following OSHA's rules. OSHA will keep all identities confidential.
- Exercise their rights under the law without retaliation, including reporting an injury or raising health and safety concerns with their employer or OSHA. If a worker has been retaliated against for using their rights, they must file a complaint with OSHA as soon as possible, but no later than 30 days.

For more information, see OSHA's Workers page.

OSHA Assistance, Services and Programs

OSHA has a great deal of information to assist employers in complying with their responsibilities under OSHA law. Several OSHA programs and services can help employers identify and correct job hazards, as well as improve their injury and illness prevention program.

Establishing an Injury and Illness Prevention Program

The key to a safe and healthful work environment is a comprehensive injury and illness prevention program.

Injury and illness prevention programs are systems that can substantially reduce the number and severity of workplace injuries and illnesses, while reducing costs to employers. Thousands of employers across the United States already manage safety using injury and illness prevention programs, and OSHA believes that all employers can and should do the same. Thirty-four states have requirements or voluntary guidelines for workplace injury and illness prevention programs. Most successful injury and illness prevention programs are based on a common set of key elements. These include management leadership, worker participation, hazard identification, hazard prevention and control, education and training, and program evaluation and improvement. Visit OSHA's Injury and Illness Prevention Programs web page at www.osha.gov/dsg/topics/safetyhealth for more information.

Compliance Assistance Specialists

OSHA has compliance assistance specialists throughout the nation located in most OSHA offices. Compliance assistance specialists can provide information to employers and workers about OSHA standards, short educational programs on specific hazards or OSHA rights and responsibilities, and information on additional compliance assistance resources. For more details, visit www.osha.gov/dcsp/compliance_assistance/cas.html or call 1-800-321-OSHA (6742) to contact your local OSHA office.

Free On-site Safety and Health Consultation Services for Small Business

OSHA's On-site Consultation Program offers free and confidential advice to small and medium-sized businesses in all states across the country, with priority given to high-hazard worksites. Each year, responding to requests from small employers looking to create or improve their safety and health management programs, OSHA's On-site Consultation Program conducts over 29,000 visits to small business worksites covering over 1.5 million workers across the nation.

On-site consultation services are separate from enforcement and do not result in penalties or citations. Consultants from state agencies or universities work with employers to identify workplace hazards, provide advice on compliance with OSHA standards, and assist in establishing safety and health management programs.

For more information, to find the local On-site Consultation office in your state, or to request a brochure on Consultation Services, visit www.osha.gov/consultation, or call 1-800-321-OSHA (6742).

Under the consultation program, certain exemplary employers may request participation in OSHA's **Safety and Health Achievement Recognition Program (SHARP).** Eligibility for participation includes, but is not limited to, receiving a full-service, comprehensive consultation visit, correcting all identified hazards and developing an effective safety and health management program. Worksites that receive SHARP recognition are exempt from programmed inspections during the period that the SHARP certification is valid.

Occupational Safety and Health Training Courses

The OSHA Training Institute partners with 27 OSHA Training Institute Education Centers at 42 locations throughout the United States to deliver courses on OSHA standards and occupational safety and health topics to thousands of students a year. For more information on training courses, visit www.osha.gov/otiec.

OSHA Educational Materials

OSHA has many types of educational materials in English, Spanish, Vietnamese and other languages available in print or online. These include:

- Brochures/booklets;
- Fact Sheets;
- Guidance documents that provide detailed examinations of specific safety and health issues;
- Online Safety and Health Topics pages;
- Posters;
- Small, laminated QuickCards™ that provide brief safety and health information; and
- *QuickTakes*, OSHA's free, twice-monthly online newsletter with the latest news about OSHA initiatives and products to assist employers and workers in finding and preventing

workplace hazards. To sign up for *QuickTakes* visit www.osha.gov/quicktakes.

To view materials available online or for a listing of free publications, visit www.osha.gov/publications. You can also call 1-800-321-OSHA (6742) to order publications.

OSHA's web site also has information on job hazards and injury and illness prevention for employers and workers. To learn more about OSHA's safety and health resources online, visit www.osha.gov. Use the A-Z index to help find information and assistance.

NIOSH Health Hazard Evaluation Program

Getting Help with Health Hazards

The National Institute for Occupational Safety and Health (NIOSH) is a federal agency that conducts scientific and medical research on workers' safety and health. At no cost to employers or workers, NIOSH can help identify health hazards and recommend ways to reduce or eliminate those hazards in the workplace through its Health Hazard Evaluation (HHE) Program.

Workers, union representatives and employers can request a NIOSH HHE. An HHE is often requested when there is a higher than expected rate of a disease or injury in a group of workers. These situations may be the result of an unknown cause, a new hazard, or a mixture of sources. To request a NIOSH Health Hazard Evaluation go to www.cdc.gov/niosh/hhe/request.html. To find out more about the Health Hazard Evaluation Program:

- Call (513) 841-4382, or to talk to a staff member in Spanish, call (513) 841-4439; or
- Send an email to HHERequestHelp@cdc.gov.

OSHA Regional Offices

Region I
Boston Regional Office

(CT*, ME, MA, NH, RI, VT*)
JFK Federal Building, Room E340
Boston, MA 02203
(617) 565-9860 (617) 565-9827 Fax

Region II
New York Regional Office
(NJ*, NY*, PR*, VI*)
201 Varick Street, Room 670
New York, NY 10014
(212) 337-2378 (212) 337-2371 Fax

Region III
Philadelphia Regional Office
(DE, DC, MD*, PA, VA*, WV)
The Curtis Center
170 S. Independence Mall West
Suite 740 West
Philadelphia, PA 19106-3309
(215) 861-4900 (215) 861-4904 Fax

Region IV
Atlanta Regional Office
(AL, FL, GA, KY*, MS, NC*, SC*, TN*)
61 Forsyth Street, SW, Room 6T50
Atlanta, GA 30303
(678) 237-0400 (678) 237-0447 Fax

Region V
Chicago Regional Office
(IL*, IN*, MI*, MN*, OH, WI)
230 South Dearborn Street
Room 3244
Chicago, IL 60604
(312) 353-2220 (312) 353-7774 Fax

Region VI
Dallas Regional Office
(AR, LA, NM*, OK, TX)

525 Griffin Street, Room 602
Dallas, TX 75202
(972) 850-4145 (972) 850-4149 Fax
(972) 850-4150 FSO Fax

Region VII
Kansas City Regional Office
(IA*, KS, MO, NE)
Two Pershing Square Building
2300 Main Street, Suite 1010
Kansas City, MO 64108-2416
(816) 283-8745 (816) 283-0547 Fax

Region VIII
Denver Regional Office
(CO, MT, ND, SD, UT*, WY*)
Cesar Chavez Memorial Building
1244 Speer Boulevard, Suite 551
Denver, CO 80204
(720) 264-6550 (720) 264-6585 Fax

Region IX
San Francisco Regional Office
(AZ*, CA*, HI*, NV*, and American Samoa,
Guam and the Northern Mariana Islands)
90 7th Street, Suite 18100
San Francisco, CA 94103
(415) 625-2547 (415) 625-2534 Fax

Region X
Seattle Regional Office
(AK*, ID, OR*, WA*)
300 Fifth Avenue, Suite 1280
Seattle, WA 98104
(206) 757-6700 (206) 757-6705 Fax

* These states and territories operate their own OSHA-approved job safety and health plans and cover state and local government employees as well as private sector employees. The Connecticut, Illinois, New Jersey, New York and Virgin

Islands programs cover public employees only. (Private sector workers in these states are covered by Federal OSHA). States with approved programs must have standards that are identical to, or at least as effective as, the Federal OSHA standards.

Note: To get contact information for OSHA area offices, OSHA-approved state plans and OSHA consultation projects, please visit us online at www.osha.gov or call us at 1-800-321-OSHA (6742).

How to Contact OSHA

For questions or to get information or advice, to report an emergency, report a fatality or catastrophe, order publications, sign up for OSHA's e-newsletter *QuickTakes*, or to file a confidential complaint, contact your nearest OSHA office, visit www.osha.gov or call OSHA at 1-800-321-OSHA (6742), TTY 1-877-889-5627.

For assistance, contact us.
We are OSHA. We can help.

OSHA®
www.osha.gov

U.S. Department of Labor

For more information:

Occupational Safety and Health Administration

www.osha.gov (800) 321-OSHA (6742)

OSHA POCKET GUIDE

Occupational Safety and Health Administration

www.osha.gov

OSHA 3252-05N 2005

WORKER SAFETY SERIES

Construction

Nearly 6.5 million people work at approximately 252,000 construction sites across the nation on any given day. The fatal injury rate for the construction industry is higher than the national average in this category for all industries.

Potential hazards for workers in construction include:

- Falls (from heights);
- Trench collapse;
- Scaffold collapse;
- Electric shock and arc flash/arc blast;
- Failure to use proper personal protective equipment; and
- Repetitive motion injuries.

OSHA

Occupational Safety and Health Administration
U.S. Department of Labor
www.osha.gov

Hazards & Solutions

For construction, the 10 OSHA standards most frequently included in the agency's citations in FY 2004 were:

1. **Scaffolding**
2. **Fall protection (scope, application, definitions)**
3. **Excavations (general requirements)**
4. **Ladders**
5. **Head protection**
6. **Excavations (requirements for protective systems)**
7. **Hazard communication**
8. **Fall protection (training requirements)**
9. **Construction (general safety and health provisions)**
10. **Electrical (wiring methods, design and protection)**

OSHA
Occupational Safety and Health Administration

Scaffolding

Hazard: When scaffolds are not erected or used properly, fall hazards can occur. About 2.3 million construction workers frequently work on scaffolds. Protecting these workers from scaffold-related accidents would prevent an estimated 4,500 injuries and 50 fatalities each year.

Solutions:

- Scaffold must be sound, rigid and sufficient to carry its own weight plus four times the maximum intended load without settling or displacement. It must be erected on solid footing.
- Unstable objects, such as barrels, boxes, loose bricks or concrete blocks must not be used to support scaffolds or planks.
- Scaffold must not be erected, moved, dismantled or altered except under the supervision of a competent person.
- Scaffold must be equipped with guardrails, midrails and toeboards.
- Scaffold accessories such as braces, brackets, trusses, screw legs or ladders that are damaged or weakened from any cause must be immediately repaired or replaced.
- Scaffold platforms must be tightly planked with scaffold plank grade material or equivalent.
- A "competent person" must inspect the scaffolding and, at designated intervals, reinspect it.
- Rigging on suspension scaffolds must be inspected by a competent person before each shift and after any occurrence that could affect structural integrity to ensure that all connections are tight and that no

damage to the rigging has occurred since its last use.

- Synthetic and natural rope used in suspension scaffolding must be protected from heat-producing sources.
- Employees must be instructed about the hazards of using diagonal braces as fall protection.
- Scaffold can be accessed by using ladders and stairwells.
- Scaffolds must be at least 10 feet from electric power lines at all times.

OSHA
Occupational Safety and
Health Administration

Fall Protection

Hazard: Each year, falls consistently account for the greatest number of fatalities in the construction industry. A number of factors are often involved in falls, including unstable working surfaces, misuse or failure to use fall protection equipment and human error. Studies have shown that using guardrails, fall arrest systems, safety nets, covers and restraint systems can prevent many deaths and injuries from falls.

Solutions:

- Consider using aerial lifts or elevated platforms to provide safer elevated working surfaces;
- Erect guardrail systems with toeboards and warning lines or install control line systems to protect workers near the edges of floors and roofs;
- Cover floor holes; and/or
- Use safety net systems or personal fall arrest systems (body harnesses).

OSHA
Occupational Safety and Health Administration

Ladders

Hazard: Ladders and stairways are another source of injuries and fatalities among construction workers. OSHA estimates that there are 24,882 injuries and as many as 36 fatalities per year due to falls on stairways and ladders used in construction. Nearly half of these injuries were serious enough to require time off the job.

Solutions:

- Use the correct ladder for the task.
- Have a competent person visually inspect a ladder before use for any defects such as:
  - Structural damage, split/bent side rails, broken or missing rungs/steps/cleats and missing or damaged safety devices;
  - Grease, dirt or other contaminants that could cause slips or falls;
  - Paint or stickers (except warning labels) that could hide possible defects.
- Make sure that ladders are long enough to safely reach the work area.
- Mark or tag (“Do Not Use”) damaged or defective ladders for repair or replacement, or destroy them immediately.
- Never load ladders beyond the maximum intended load or beyond the manufacturer’s rated capacity.
- Be sure the load rating can support the weight of the user, including materials and tools.
- Avoid using ladders with metallic components near electrical work and overhead power lines.

Stairways

Hazard: Slips, trips and falls on stairways are a major source of injuries and fatalities among construction workers.

Solutions:

- Stairway treads and walkways must be free of dangerous objects, debris and materials.
- Slippery conditions on stairways and walkways must be corrected immediately.
- Make sure that treads cover the entire step and landing.
- Stairways having four or more risers or rising more than 30 inches must have at least one handrail.

OSHA
Occupational Safety and Health Administration

Trenching

Hazard: Trench collapses cause dozens of fatalities and hundreds of injuries each year. Trenching deaths rose in 2003.

Solutions:

- Never enter an unprotected trench.
- Always use a protective system for trenches 5 feet deep or greater.
- Employ a registered professional engineer to design a protective system for trenches 20 feet deep or greater.
- Protective Systems:
  - Sloping to protect workers by cutting back the trench wall at an angle inclined away from the excavation not steeper than a height/depth ratio of $1\frac{1}{2}$:1, according to the sloping requirements for the type of soil.

SLOPING. Maximum allowable slopes for excavations less than 20 ft. (6.09 m) based on soil type and angle to the horizontal are as follows:

TABLE V:2-1. ALLOWABLE SLOPES

Soil type	Height/Depth ratio	Slope angle
Stable Rock (granite or sandstone)	Vertical	90°
Type A (clay)	$\frac{3}{4}$:1	53°
Type B (gravel, silt)	1:1	45°
Type C (sand)	$1\frac{1}{2}$:1	34°
Type A (short-term) (For a maximum excavation depth of 12 ft.)	$\frac{1}{2}$:1	63°

Source: OSHA Technical Manual, Section V, Chap. 2, Excavations: Hazard Recognition in Trenching and Shoring (Jan. 1999).

- Shoring to protect workers by installing supports to prevent soil movement for trenches that do not exceed 20 feet in depth.
- Shielding to protect workers by using trench boxes or other types of supports to prevent soil cave-ins.

- Always provide a way to exit a trench--such as a ladder, stairway or ramp--no more than 25 feet of lateral travel for employees in the trench.
- Keep spoils at least two feet back from the edge of a trench.
- Make sure that trenches are inspected by a competent person prior to entry and after any hazard-increasing event such as a rain-storm, vibrations or excessive surcharge loads.

Cranes

Hazard: Significant and serious injuries may occur if cranes are not inspected before use and if they are not used properly. Often these injuries occur when a worker is struck by an overhead load or caught within the crane's swing radius. Many crane fatalities occur when the boom of a crane or its load line contact an overhead power line.

Solutions:

- Check all crane controls to insure proper operation before use.
- Inspect wire rope, chains and hook for any damage.
- Know the weight of the load that the crane is to lift.
- Ensure that the load does not exceed the crane's rated capacity.
- Raise the load a few inches to verify balance and the effectiveness of the brake system.
- Check all rigging prior to use; do not wrap hoist ropes or chains around the load.
- Fully extend outriggers.
- Do not move a load over workers.
- Barricade accessible areas within the crane's swing radius.
- Watch for overhead electrical distribution and transmission lines and maintain a safe working clearance of at least 10 feet from energized electrical lines.

Hazard Communication

Hazard: Failure to recognize the hazards associated with chemicals can cause chemical burns, respiratory problems, fires and explosions.

Solutions:

- Maintain a Material Safety Data Sheet (MSDS) for each chemical in the facility.
- Make this information accessible to employees at all times in a language or formats that are clearly understood by all affected personnel.
- Train employees on how to read and use the MSDS.
- Follow manufacturer's MSDS instructions for handling hazardous chemicals.
- Train employees about the risks of each hazardous chemical being used.
- Provide spill clean-up kits in areas where chemicals are stored.
- Have a written spill control plan.
- Train employees to clean up spills, protect themselves and properly dispose of used materials.
- Provide proper personal protective equipment and enforce its use.
- Store chemicals safely and securely.

OSHA
Occupational Safety and
Health Administration

Forklifts

Hazard: Approximately 100 employees are fatally injured and approximately 95,000 employees are injured every year while operating powered industrial trucks. Forklift turnover accounts for a significant number of these fatalities.

Solutions:

- Train and certify all operators to ensure that they operate forklifts safely.
- Do not allow any employee under 18 years old to operate a forklift.
- Properly maintain haulage equipment, including tires.
- Do not modify or make attachments that affect the capacity and safe operation of the forklift without written approval from the forklift's manufacturer.
- Examine forklift truck for defects before using.
- Follow safe operating procedures for picking up, moving, putting down and stacking loads.

- Drive safely--never exceed 5 mph and slow down in congested or slippery surface areas.
- Prohibit stunt driving and horseplay.
- Do not handle loads that are heavier than the capacity of the industrial truck.
- Remove unsafe or defective forklift trucks from service.
- Operators shall always wear seatbelts.
- Avoid traveling with elevated loads.
- Assure that rollover protective structure is in place.
- Make certain that the reverse signal alarm is operational and audible above the surrounding noise level.

Head Protection

Hazard: Serious head injuries can result from blows to the head.

Solution:

- Be sure that workers wear hard hats where there is a potential for objects falling from above, bumps to their heads from fixed objects, or accidental head contact with electrical hazards.

Safety Checklists

The following checklists may help you take steps to avoid hazards that cause injuries, illnesses and fatalities. As always, be cautious and seek help if you are concerned about a potential hazard.

Personal Protective Equipment (PPE)

Eye and Face Protection

- ☐ Safety glasses or face shields are worn anytime work operations can cause foreign objects getting into the eye such as during welding, cutting, grinding, nailing (or when working with concrete and/or harmful chemicals or when exposed to flying particles).
- ☐ Eye and face protectors are selected based on anticipated hazards.
- ☐ Safety glasses or face shields are worn when exposed to any electrical hazards including work on energized electrical systems.

Foot Protection

- ☐ Construction workers should wear work shoes or boots with slip-resistant and puncture-resistant soles.
- ☐ Safety-toed footwear is worn to prevent crushed toes when working around heavy equipment or falling objects.

Hand Protection

- ☐ Gloves should fit snugly.

- ❑ Workers wear the right gloves for the job (for example, heavy-duty rubber gloves for concrete work, welding gloves for welding, insulated gloves and sleeves when exposed to electrical hazards).

Head Protection

- ❑ Workers shall wear hard hats where there is a potential for objects falling from above, bumps to their heads from fixed objects, or of accidental head contact with electrical hazards.
- ❑ Hard hats are routinely inspected for dents, cracks or deterioration.
- ❑ Hard hats are replaced after a heavy blow or electrical shock.
- ❑ Hard hats are maintained in good condition.

Scaffolding

- ❑ Scaffolds should be set on sound footing.
- ❑ Damaged parts that affect the strength of the scaffold are taken out of service.
- ❑ Scaffolds are not altered.
- ❑ All scaffolds should be fully planked.
- ❑ Scaffolds are not moved horizontally while workers are on them unless they are designed to be mobile and workers have been trained in the proper procedures.
- ❑ Employees are not permitted to work on scaffolds when covered with snow, ice, or other slippery materials.
- ❑ Scaffolds are not erected or moved within 10 feet of power lines.
- ❑ Employees are not permitted to work on scaffolds in bad weather or high winds

unless a competent person has determined that it is safe to do so.

- ☐ Ladders, boxes, barrels, buckets or other makeshift platforms are not used to raise work height.
- ☐ Extra material is not allowed to build up on scaffold platforms.
- ☐ Scaffolds should not be loaded with more weight than they were designed to support.

Electrical Safety

- ☐ Work on new and existing energized (hot) electrical circuits is prohibited until all power is shut off and grounds are attached.
- ☐ An effective Lockout/Tagout system is in place.
- ☐ Frayed, damaged or worn electrical cords or cables are promptly replaced.
- ☐ All extension cords have grounding prongs.
- ☐ Protect flexible cords and cables from damage. Sharp corners and projections should be avoided.
- ☐ Use extension cord sets used with portable electric tools and appliances that are the three-wire type and designed for hard or extra-hard service. (Look for some of the following letters imprinted on the casing: S, ST, SO, STO.)
- ☐ All electrical tools and equipment are maintained in safe condition and checked regularly for defects and taken out of service if a defect is found.
- ☐ Do not bypass any protective system or device designed to protect employees from contact with electrical energy.

- ❑ Overhead electrical power lines are located and identified.
- ❑ Ensure that ladders, scaffolds, equipment or materials never come within 10 feet of electrical power lines.
- ❑ All electrical tools must be properly grounded unless they are of the double insulated type.
- ❑ Multiple plug adapters are prohibited.

Floor and Wall Openings

- ❑ Floor openings (12 inches or more) are guarded by a secured cover, a guardrail or equivalent on all sides (except at entrances to stairways).
- ❑ Toeboards are installed around the edges of permanent floor openings (where persons may pass below the opening).

Elevated Surfaces

- ❑ Signs are posted, when appropriate, showing the elevated surface load capacity.
- ❑ Surfaces elevated more than 48 inches above the floor or ground have standard guardrails.
- ❑ All elevated surfaces (beneath which people or machinery could be exposed to falling objects) have standard 4-inch toeboards.
- ❑ A permanent means of entry and exit with handrails is provided to elevated storage and work surfaces.
- ❑ Material is piled, stacked or racked in a way that prevents it from tipping, falling, collapsing, rolling or spreading.

Hazard Communication

- [ ] A list of hazardous substances used in the workplace is maintained and readily available at the worksite.
- [ ] There is a written hazard communication program addressing Material Safety Data Sheets (MSDS), labeling and employee training.
- [ ] Each container of a hazardous substance (vats, bottles, storage tanks) is labeled with product identity and a hazard warning(s) (communicating the specific health hazards and physical hazards).
- [ ] Material Safety Data Sheets are readily available at all times for each hazardous substance used.
- [ ] There is an effective employee training program for hazardous substances.

Crane Safety

- [ ] Cranes and derricks are restricted from operating within 10 feet of any electrical power line.
- [ ] The upper rotating structure supporting the boom and materials being handled is provided with an electrical ground while working near energized transmitter towers.
- [ ] Rated load capacities, operating speed and instructions are posted and visible to the operator.
- [ ] Cranes are equipped with a load chart.
- [ ] The operator understands and uses the load chart.
- [ ] The operator can determine the angle and length of the crane boom at all times.

- ☐ Crane machinery and other rigging equipment is inspected daily prior to use to make sure that it is in good condition.
- ☐ Accessible areas within the crane's swing radius are barricaded.
- ☐ Tag lines are used to prevent dangerous swing or spin of materials when raised or lowered by a crane or derrick.
- ☐ Illustrations of hand signals to crane and derrick operators are posted on the job site.
- ☐ The signal person uses correct signals for the crane operator to follow.
- ☐ Crane outriggers are extended when required.
- ☐ Crane platforms and walkways have anti-skid surfaces.
- ☐ Broken, worn or damaged wire rope is removed from service.
- ☐ Guardrails, hand holds and steps are provided for safe and easy access to and from all areas of the crane.
- ☐ Load testing reports/certifications are available.
- ☐ Tower crane mast bolts are properly torqued to the manufacturer's specifications.
- ☐ Overload limits are tested and correctly set.
- ☐ The maximum acceptable load and the last test results are posted on the crane.
- ☐ Initial and annual inspections of all hoisting and rigging equipment are performed and reports are maintained.
- ☐ Only properly trained and qualified operators are allowed to work with hoisting and rigging equipment.

Forklifts

- [ ] Forklift truck operators are competent to operate these vehicles safely as demonstrated by their successful completion of training and evaluation.
- [ ] No employee under 18 years old is allowed to operate a forklift.
- [ ] Forklifts are inspected daily for proper condition of brakes, horns, steering, forks and tires.
- [ ] Powered industrial trucks (forklifts) meet the design and construction requirements established in American National Standards Institute (ANSI) for Powered Industrial Trucks, Part II ANSI B56.1-1969.
- [ ] Written approval from the truck manufacturer is obtained for any modification or additions which affect capacity and safe operation of the vehicle.
- [ ] Capacity, operation and maintenance instruction plates, tags or decals are changed to indicate any modifications or additions to the vehicle.
- [ ] Battery charging is conducted in areas specifically designated for that purpose.
- [ ] Material handling equipment is provided for handling batteries, including conveyors, overhead hoists or equivalent devices.
- [ ] Reinstalled batteries are properly positioned and secured in the truck.
- [ ] Smoking is prohibited in battery charging areas.
- [ ] Precautions are taken to prevent open flames, sparks or electric arcs in battery charging areas.
- [ ] Refresher training is provided and an evaluation is conducted whenever a fork-

lift operator has been observed operating the vehicle in an unsafe manner and when an operator is assigned to drive a different type of truck.

- ☐ Load and forks are fully lowered, controls neutralized, power shut off and brakes set when a powered industrial truck is left unattended.
- ☐ There is sufficient headroom for the fork-lift and operator under overhead installations, lights, pipes, sprinkler systems, etc.
- ☐ Overhead guards are in place to protect the operator against falling objects.
- ☐ Trucks are operated at a safe speed.
- ☐ All loads are kept stable, safely arranged and fit within the rated capacity of the truck.
- ☐ Unsafe and defective trucks are removed from service.

OSHA
Occupational Safety and Health Administration

Construction Safety & Health Resources

Most resource materials can be found on the OSHA website: www.osha.gov

Publications

Publications can be downloaded or ordered at:
http://www.osha.gov/pls/publications/pubindex.list

A Guide to Scaffold Use in the Construction Industry
OSHA Publication 3150 (Revised 2002), 2.1 MB PDF, 73 pages.
Booklet in question-and-answer format highlights information about scaffold safety.
http://www.osha.gov/Publications/osha3150.pdf

Concrete and Masonry Construction
OSHA Publication 3106 (Revised 1998), 414 KB PDF, 32 pages.
Details information on OSHA's Concrete and Masonry standard.
http://www.osha.gov/Publications/osha3106.pdf

Crystalline Silica Exposure Card for Construction
OSHA Publication 3177 (Revised 2002), 2 pages.
Discusses silica hazards, and what employers and employees can do to protect against exposures to silica.
A Spanish version is also available. OSHA Publication 3179 (Revised 2003), 2 pages.

Excavations
OSHA Publication 2226 (Revised 2002), 533 KB PDF, 44 pages.
A detailed explanation of all aspects of excavation and trenching.
http://www.osha.gov/Publications/osha2226.pdf

Fall Protection in Construction
OSHA Publication 3146 (Revised 1998), 177 KB PDF, 43 pages.
http://www.osha.gov/Publications/osha3146.pdf

Ground-Fault Protection on Construction Sites
OSHA Publication 3007 (Revised 1998), 100 KB PDF, 31 pages.
Booklet on ground-fault circuit interrupters for safe use of portable tools.
http://www.osha.gov/Publications/osha3007.pdf

Lead in Construction
OSHA Publication 3142 (Revised 2003), 610 KB PDF, 38 pages.
Describes hazards and safe work practices concerning lead.
http://www.osha.gov/Publications/osha3142.pdf

OSHA Assistance for the Residential Construction Industry
Many OSHA standards apply to residential construction for the prevention of possible fatalities. This web page provides information about those standards and the hazards present in residential construction. It was developed in cooperation with the National Association of Home Builders (NAHB) as part of the OSHA-NAHB Alliance.
http://www.osha.gov/SLTC/residential/index.html

Selected Construction Regulations (SCOR) for the Home Building Industry (29 CFR 1926)
OSHA Publication (Revised 1997), 1.2 MB PDF, 224 pages.
Provides information on safe and healthful work practices for residential construction employers; identifies OSHA standards applicable to hazards found at worksites in the residential construction industry.
http://www.osha.gov/Publications/scor1926.pdf

Stairways and Ladders
OSHA Publication 3124 (Revised 2003), 155 KB PDF, 15 pages.
Explains OSHA requirements for stairways and ladders.
http://www.osha.gov/Publications/osha3124.pdf

Working Safely in Trenches
OSHA Publication 3243 (2005), 2 pages.
Provides safety tips for workers in trenches. A Spanish version is on the reverse side.
http://www.osha.gov/Publications/trench/trench_safety_tips_card.pdf

Crane Safety

Safety and Health Topics: Crane, Derrick and Hoist Safety -- Hazards and Possible Solutions
December 2003. One page.
OSHA website index provides references to aid in identifying crane, derrick and hoist hazards in the workplace.
http://www.osha.gov/SLTC/cranehoistsafety/recognition.html

Electrical Hazards

Control of Hazardous Energy (Lockout/Tagout)
OSHA Publication 3120 (Revised 2002), 174 KB PDF, 45 pages.
This booklet presents OSHA's general requirements for controlling hazardous energy during service or maintenance of machines or equipment.
http://www.osha.gov/Publications/osha3120.pdf

Controlling Electrical Hazards
OSHA Publication 3075 (Revised 2002), 349 KB PDF, 71 pages.
This publication provides an overview of basic electrical safety on the job.
http://www.osha.gov/Publications/osha3075.pdf

Safety and Health Topics: Lockout /Tagout
OSHA website index to information about lockout/tagout, including hazard recognition, compliance, standards and directives, Review Commission and Administrative Law Judge Decisions, standard interpretations and compliance letters, compliance assistance and training.
http://www.osha.gov/SLTC/controlhazardousenergy/index.html

Hazard Communication

Hazard Communication: Foundation of Workplace Chemical Safety Programs
OSHA website index for resources on hazard communication.
http://www.osha.gov/SLTC/hazardcommunications/index.html

Frequently Asked Questions for Hazard Communication
OSHA, 6 pages.
Website questions and answers on hazard communication.
http://www.osha.gov/html/faq-hazcom.html

Hazard Communication Standard
OSHA Fact Sheet No. 93-26 (1993), 3 pages.
Highlights protections under OSHA's Hazard Communication standard.
http://www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=FACT_SHEETS&p_id=151

Hazard Communication Guidelines for Compliance
OSHA Publication 3111 (2000), 112 KB PDF, 33 pages.
This document aids employers in understanding the Hazard Communication standard and in implementing a hazard communication program.
http://www.osha.gov/Publications/osha3111.pdf

Chemical Hazard Communication
OSHA Publication 3084 (1998), 248 KB PDF, 31 pages.
This booklet answers several basic questions about chemical hazard communication.
http://www.osha.gov/Publications/osha3084.pdf

NIOSH Pocket Guide to Chemical Hazards
Handy source of general industrial hygiene information on several hundred chemicals/classes for workers, employers and occupational health professionals.
http://www.cdc.gov/niosh/npg/npg.html

Material Handling

Materials Handling and Storage
OSHA Publication 2236 (Revised 2002), 559 KB PDF, 40 pages.
A comprehensive guide to hazards and safe work practices in handling materials.
http://www.osha.gov/Publications/osha2236.pdf

Personal Protective Equipment

Personal Protective Equipment
OSHA Publication 3155 (2003), 305 KB PDF, 44 pages.
Discusses equipment most commonly used for protection for the head, including eyes and face and the torso, arms, hands, and feet. The use of equipment to protect against life-threatening hazards is also discussed.
http://www.osha.gov/Publications/OSHA3155/osha3155.html

Safety and Health Topics: Personal Protective Equipment
OSHA website index to hazard recognition, control and training related to personal protective equipment. http://www.osha.gov/SLTC/personalprotectiveequipment/index.html

Toxic Metals: Cadmium

Safety and Health Topics: Cadmium
OSHA website index to recognition, evaluation, control, compliance and training related to Cadmium.
http://www.osha.gov/SLTC/cadmium/index.html

Electronic Construction Resources

OSHA eTools and Expert Advisors can be found on OSHA's website: http://www.osha.gov

eTools

Construction: Preventing Fatalities. Construction can be a safe occupation when workers are aware of the hazards, and an effective safety and health program is used. This eTool will help workers identify and control the hazards that commonly cause the most serious construction injuries. A Spanish translation of this eTool is also available.

Scaffolding: Supported Scaffolds and Suspended Scaffolds. These eTools provide illustrated examples of safe scaffolding use. Hazards are identified as well as the controls that keep those hazards from becoming tragedies.

Solutions for Electrical Contractors. This eTool describes common hazards that electrical contractors may encounter and possible solutions for these hazards. The eTool was developed in cooperation with the Independent Electrical Contractors (IEC) as part of the OSHA-IEC Alliance.

Steel Erection. America's 56,000 steel erectors suffer 35 fatal accidents per year, a rate of one death per 1,600 workers. OSHA estimates that 30 of those deaths as well as nearly 1,150 annual lost-workday injuries can be averted by compliance with provisions of the Steel Erection standard, developed with industry and labor through negotiated rulemaking. To that end, this eTool has been created to educate employers and workers.

OSHA's Expert Advisors

The Asbestos Advisor: This computer program provides an introduction to the scope and logic of the regulations for general industry, construction and maritime.

Lead in Construction Advisor: This computer program provides an introduction to the scope and logic of the regulations regarding occupational exposure to lead and summary guidance to facilitate compliance.

Construction Industry Cooperative and State Programs

Voluntary Protection Programs
An OSHA Cooperative Program

Voluntary Protection Programs

OSHA recognizes Voluntary Protection Programs (VPP) worksites for their excellent safety and health management systems.

OSHA Construction

OSHA has announced an OSHA Construction program to address the unique needs of the industry. The goal of this program is to make VPP more accessible to construction employers, especially small construction employers and to maintain the high standards of VPP while expanding participation to broad construction industry categories such as short-term projects, mobile workforces, general contractors and subcontractors. Pilot programs in these categories have shown beneficial results for participants.

OSHA Challenge

OSHA has created the Challenge Pilot to provide greater opportunities to eligible employers interested in working with OSHA to create safer and healthier workplaces. The pilot is designed to reach and guide employers and companies in all major industry groups who are strongly committed to improving their safety and health management systems and interested in pursuing recognition in VPP. OSHA Challenge provides participants a guide or roadmap to improve performance and ultimately the opportunity to take part in the VPP Merit or Star programs.

alliance
An OSHA Cooperative Program

Alliance Program

Alliances enable organizations committed to workplace safety and health to collaborate with OSHA to prevent injuries and illnesses in the workplace.

OSHA has a number of national and regional or area office alliances that impact the construction industries. The details of these alliances can be found on www.osha.gov under Alliances.

PARTNERSHIP
An OSHA Cooperative Program

OSHA Strategic Partnership Program

Partnerships are voluntary, cooperative relationships between OSHA and groups of employers, employees and employee representatives (sometimes including other stakeholders and sometimes involving only one employer) that encourage, assist and recognize efforts to eliminate serious hazards and achieve a high level of worker safety and health. National construction partnerships include AMEC Construction, Associated Builders and Contractors (ABC) and the National Ready-Mixed Concrete Association. In addition to the national partnerships, OSHA has had nearly 170 regional strategic partnerships with the construction industry since the program's start in 1998.

State Programs

Twenty-six States and territories operate their own occupational safety and health programs under plans approved by Federal OSHA. Twenty-two of these programs cover both private sector and public (State and local government) employees; four cover public employees only. States may have somewhat different requirements and procedures for the construction industry, but they are required to be at least as effective as Federal OSHA. All State Plans offer a VPP program and have additional cooperative programs parallel to OSHA's Alliance and Strategic Partnership programs. A list of States with approved plans may be found at www.osha.gov

Consultation

Every state offers a free, on-site consultation program to help small employers find and fix hazards and establish effective safety and health management systems. Funded primarily by OSHA, consultation is provided at no cost to small employers and is delivered by state authorities through professional safety and health consultants. More information on OSHA's Consultation Program appears on the agency's website at www.osha.gov

Success Stories

Partnership Reduced Injuries during Art Museum Renovation

In 2002, OSHA and AMEC Construction developed a partnership to prevent injuries at the $425 million rebuilding/renovation construction project for New York City's renowned Museum of Modern Art (MoMA).

The partnership covered some 220 employees and 17 employers who worked to more than double MoMA's space and expand facilities for special exhibitions, public programs, educational outreach and scholarly research.

AMEC employees completed more than 800,000 hours in 2003 and racked up two impressive safety and health statistics: the number of Days Away Restricted and Transferred (DART) percentage was 90 percent below the national average for their standard industrial classification (SIC) code and the Total Case Incident Rate (TCIR)

was 92 percent below the national average for their SIC.

Best practices used included daily safety inspections conducted at the site and any hazards identified were corrected immediately. Inspection results were discussed at safety committee meetings. Each employee knew that a safety issue would be dealt with promptly when it came to management's attention. Additionally, an on-site incentive encouraged safe workplace practices.

The right combination of best safety management practices, partnering between OSHA and AMEC Construction, and a DART percentage 90 percent below the national average are fitting achievements for a new and better home for the world's leading collection of modern and contemporary art.

Fatalities Prevented, Injuries Minor, Workers' Comp Costs Slashed

Turner Construction and OSHA Teamed Up on Wisconsin Stadium Project

Teamwork at the Green Bay Packers' Lambeau Field is not just for professional football players. A partnership between Turner Construction and OSHA made teamwork in achieving health and safety a top priority for construction workers building and expanding the stadium.

In 2003, the $295 million renovation of the Lambeau Field stadium was completed, more than doubling the size of the previous stadium. Seating capacity was increased from 60,890 to over 72,000.

Partnering with OSHA paid off. There were fewer serious injuries for workers and a more than 20 percent cut in workers' compensation costs for the contractor.

The partnership had three goals:

- All contractors have an effective safety and health program;
- All hazards corrected daily after daily audits are conducted; and
- Increase the level of training for supervisors and employees.

The work was more hazardous than typical steel erections because stadiums are curved and angular in shape. Also, construction and demolition activities were taking place simultaneously, often within a few feet of each other.

Several potential serious accidents were avoided by requiring all contractors' safety and health programs to establish a requirement of 100 percent fall protection at or above six feet.

One worker on the project slipped off a steel beam located six stories above ground. Thanks to his use of full fall protection, serious injury -- or possible death -- was avoided. He was back at work shortly after his rescue. Less than two months later, a second worker slipped from a beam, but also escaped injury because of his fall protection equipment. Like his coworker, he returned to work the same day. An ironworker and a carpenter also fell and were saved by their harnesses.

A significant achievement included 4,300 workers completing OSHA's 10-hour construction training. An added benefit for the industry is that these employees are bringing their safety training to other sites where they are now working.

OSHA
Occupational Safety and Health Administration
U.S. Department of Labor
www.osha.gov

Employers are responsible for providing a safe and healthful workplace for their employees. OSHA's role is to assure the safety and health of America's workers by setting and enforcing standards; providing training, outreach and education; establishing partnerships; and encouraging continual improvement in workplace safety and health.

This informational booklet provides a general overview of a particular topic related to OSHA standards. It does not alter or determine compliance responsibilities in OSHA standards or the *Occupational Safety and Health Act of 1970*. Because interpretations and enforcement policy may change over time, you should consult current OSHA administrative interpretations and decisions by the Occupational Safety and Health Review Commission and the Courts for additional guidance on OSHA compliance requirements.

This information is available to sensory impaired individuals upon request. Voice phone: (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

OSHA®
Occupational Safety and Health Administration
www.osha.gov

Small Entity Compliance Guide for the Final Rule for Cranes and Derricks in Construction

OSHA 3433-10R 2014

www.osha.gov

Occupational Safety and Health Act of 1970

"To assure safe and healthful working conditions for working men and women; by authorizing enforcement of the standards developed under the Act; by assisting and encouraging the States in their efforts to assure safe and healthful working conditions; by providing for research, information, education, and training in the field of occupational safety and health."

This information will be made available to sensory-impaired individuals upon request. Voice phone: (202) 693-1999; teletypewriter (TTY) number: 1-877-889-5627.

Small Entity Compliance Guide for the Final Rule for Cranes and Derricks in Construction

U.S. Department of Labor

Occupational Safety and Health Administration

OSHA 3433-10R
2014

U.S. Department of Labor

Contents

Introduction 6

Employer Responsibilities 9

Section 1400 – Scope 14

Section 1401 – Definitions 17

Section 1402 – Ground Conditions 20

Sections 1403-1406 – Assembly and Disassembly 21

Sections 1407-1411 – Power Lines 25

Section 1412 – Inspections 34

Section 1413 – Wire Rope Inspection 42

Section 1414 – Wire Rope – Selection and Installation Criteria 44

Sections 1415 Safety Devices & 1416 Operational Aids 46

Section 1417 – Operation 48

Section 1418 – Authority to Stop Operation 51

Sections 1419-1422 – Signals 51

Section 1423 – Fall Protection 53

Section 1424 – Work Area Control 55

Section 1425 – Keeping Clear of the Load 56

Section 1426 – Free Fall and Controlled Load Lowering 57

Section 1427 – Operator Qualification and Certification* 59

Section 1428 – Signal Person Qualifications 61

Section 1429 – Qualifications of Maintenance & Repair Employees 62

Section 1430 – Training 62

Section 1431 – Hoisting Personnel 64

Section 1432 – Multiple-Crane/Derrick-Lifts 69

Section 1433 – Design, Construction and Testing 69

Section 1434 – Equipment Modifications 71

Section 1435 – Tower Cranes 72

Section 1436 – Derricks 75

Section 1437 – Floating Cranes/Derricks and Land Cranes/Derricks on Barges 79

Section 1438 – Overhead and Gantry Cranes 80

Section 1439 – Dedicated Pile Drivers 80

Section 1440 – Sideboom Cranes 81

Section 1441 – Equipment with a Rated Hoisting/Lifting Capacity of 2,000 Pounds or Less 81

Appendix A – Directory of States with Approved Occupational Safety and Health Programs 82

Workers' Rights 87

OSHA Assistance, Services and Programs 88

NIOSH Health Hazard Evaluation Program 91

OSHA Regional Offices 92

How to Contact OSHA 95

* *On September 26, 2014, OSHA published a final rule extending the deadline for crane operator certification by 3 years, to November 10, 2017.*

Introduction

This guide is intended to help small businesses comply with OSHA's standard for Cranes and Derricks in Construction. **It is designed to address the most common compliance issues that employers will face and to provide sufficient detail to serve as a useful compliance guide. It does not, however, describe all provisions of the standard or alter the compliance responsibilities set forth in the standard, which is published at 29 CFR 1926.1400 - 1442. The reader must refer to the standard itself, which is available on OSHA's website and in the Federal Register and will be published in the Code of Federal Regulations, to determine all of the steps that must be taken to comply with the standard.**

In addition to this guide, other information that will be helpful in complying with the standard can be found on OSHA's website.

If you are seeking advice about complying with the standard, OSHA's On-site Consultation Program offers free and confidential advice to small and medium-sized businesses in all states across the country, with priority given to high-hazard worksites. On-site Consultation services are separate from enforcement and do not result in penalties or citations. Consultants from state agencies and universities work with employers to identify workplace hazards, provide advice on compliance with OSHA standards, and help establish safety and health management systems. To find the OSHA On-site Consultation Program office nearest you, go to: https://www.osha.gov/dcsp/smallbusiness/consult_directory.html.

In 21 states and one territory, occupational safety and health standards are enforced by the state agency responsible for the OSHA-approved state program. These states are: Alaska, Arizona, California, Hawaii, Indiana, Iowa, Kentucky, Maryland, Michigan, Minnesota, Nevada, New Mexico, North Carolina, Oregon, Puerto Rico, South Carolina, Tennessee, Utah, Vermont, Virginia, Washington and Wyoming. New York, Connecticut, Illinois, New Jersey, and the Virgin Islands also operate OSHA-approved state programs limited in scope to state and local government employees.

States operating OSHA-approved state programs must adopt and enforce standards that are either identical to or at least as effective as federal standards. Therefore, these states must adopt a standard for cranes and derricks in construction that is at least as effective as OSHA's standard and must extend that protection to state and local government employees. If you are operating a small business in one of the above-listed states or territories, you must determine whether requirements in addition to those in the OSHA standard apply. For example, the OSHA standard requires that crane operators be qualified or certified by November 10, 2014, but states may require such qualification or certification by an earlier date. In addition, state or local licensing requirements may apply. (A list of phone numbers and addresses for the state programs is included in Appendix A).

Who must comply with the standard?

Employers who use cranes and derricks in construction work must comply with the standard. In addition, other employers on construction sites where cranes and derricks are used are responsible for violations that expose their employees to hazards and, therefore, need to know the requirements of the standard that may affect their employees. Crane lessors who provide operators and/or maintenance personnel with the equipment also have duties under the standard. See the section of this guide entitled "Employer Responsibilities" for additional information on the compliance responsibilities of different employers.

Who should read this guide?

Employers who have compliance responsibilities under the standard should read this guide. In addition, crane operators and other workers who work with or near cranes on construction sites can find information in this guide that will make them aware of the hazards that cranes present to them and their coworkers and the steps that employers must take to protect against those hazards.

How do I use this guide?

This guide is divided into chapters that correspond to the sections of the standard. The guide focuses on the standard's provisions that address the most serious hazards and the compliance issues that employers will face most frequently. Some issues that arise less frequently are addressed briefly or not at all. In some places, the guide refers the reader to sections of the standard for more detailed information about particular topics.

When this guide uses the word "you," it is referring to an employer who operates a crane on a construction site unless the context indicates otherwise. However, as noted above, other employers may also have responsibilities under the standard.

How does the new standard differ from the old standard it replaces?
Most requirements of the prior OSHA standard for cranes and derricks used in construction work (29 CFR 1926.550) incorporated requirements of certain pre-1970 national consensus standards. This standard sets forth most of its requirements in the text of the standard and incorporates national consensus standards by reference in only a few locations. In addition, this new standard includes a number of new provisions designed to improve safety. Several significant changes are:

- New requirements during assembly and disassembly will protect workers from being struck or crushed by unanticipated movement of crane components and will ensure that equipment is properly assembled.
- New requirements are included for maintaining sufficient clearance distances from power lines and protecting against electrocution hazards.
- New requirements for pre-erection inspection of tower cranes, use of synthetic slings during climbing of tower cranes and other assembly activities, and use of qualified riggers for those activities, will ensure the structural stability of such equipment.
- The new standard covers equipment (such as floating cranes) that was subject to very few requirements in the prior standard because the prior standard did not incorporate national consensus standards applicable to such equipment. It also covers equipment (such as dedicated pile drivers) that was not subject to the prior standard at all.

Employer Responsibilities

Employers who operate cranes on a construction site are responsible for complying with all aspects of the standard, but other employers whose personnel work at the site have responsibilities as well. These employer duties are consistent with OSHA's multi-employer policy, which recognizes that the Occupational Safety and Health Act imposes compliance duties on (1) employers who create or control hazards, (2) employers whose employees are exposed to hazards, and (3) employers with general supervisory authority over a worksite.

The following Questions and Answers explain the compliance duties of different employers under various common situations.

Question 1: I own and operate a crane on a construction site. The crane operator is my employee. What are my responsibilities under the standard?

Answer 1: You must comply with all requirements of the standard, as you control all hazards the crane may create.

Question 2: I operate a leased crane on a construction site. The crane's lessor has informed me that the crane meets OSHA's standard. Can I rely on the lessor's word and assume that the crane complies with the standard?

Answer 2: No. As the employer operating the crane you are responsible for complying with all requirements of the standard. Even if the lessor states that the crane meets the standard, you must take steps to verify that claim. One way to verify their claim is to ask the lessor for the most recent monthly and annual inspections reports, which will identify any problems found by the inspectors that either needed to be fixed or that need to be checked in future inspections. These documents must be made available to all persons who conduct inspections under the standard, including the shift inspections you must conduct while operating the crane. See Sections 1412(k) and 1413(e). If the lessor cannot produce the required inspection documents, you will need to conduct an annual inspection and document the results of that inspection before operating the crane. See Section 1412 for a description of the inspections required by the standard.

Question 3: I lease a crane to a construction contractor and provide an operator for the crane. While on the site, the operator is supervised exclusively by the lessee's foreman. Do I have any responsibilities under the standard?

Answer 3: Yes. You must comply with all requirements of the standard because your employee, the operator, would be exposed to any hazards resulting from the crane's operation. Moreover, you are responsible for any violations caused by the crane operator because you are the operator's employer and the lessee is relying on the operator's knowledge and skills to ensure that operations are conducted safely. See section 1427(a) (Operator qualification and certification).

Question 4: I lease a crane to a construction contractor. I do not provide an operator with the crane. However, when the lessee tells me that the crane requires maintenance or repair, I send my mechanic to do the necessary work. Do I have any responsibilities under the standard?

Answer 4: Yes. Because the mechanic is your employee, you must comply with section 1429 (Qualifications of maintenance and repair workers), and you are responsible for any hazards that result from the actions of your mechanic that expose other workers on the site to hazards. In addition, you are responsible for any violations to which your mechanic is exposed while he/she is working on the crane.

Question 5: I lease a crane to a construction contractor. I do not provide an operator for the crane, nor do I have anyone inspect or repair the crane while it is on the site. Do I have any responsibilities under the standard?

Answer 5: No. An employer who leases (or sells) a crane but does not send any employees to the worksite where the crane is used is not subject to the standard. However, as noted in Answer 2, the lessee is responsible for the condition of the crane and may ask you to produce written records of past crane inspections or to provide other information about the crane.

Question 6: I am a contractor on a construction site. Another contractor is using a crane on the site. None of my work involves the crane. Do I have any responsibilities under the standard?

Answer 6: Yes, because your employees may be exposed to hazards caused by the crane's operation. For example, if a crane collapses due to being overloaded, employees working elsewhere on the site can be killed or injured. And if, for example, a crane makes electrical contact with a power line, any employee touching or even near the crane can be electrocuted.

Even though you are not operating the crane, you must be aware of potential crane hazards and are responsible for protecting your employees against hazards you can reasonably foresee. You must take reasonable steps to protect your employees. For example, if you are concerned with a crane's stability due to potential overloading, unstable ground conditions, or high winds, you must satisfy yourself that the crane is stable before allowing your employees to work where they would be in danger if the crane collapses. One way is to ask the company operating the crane or the controlling contractor on the site whether all necessary precautions are being taken to ensure the crane's stability. Also, you have a duty to train your employees in the hazards associated with their work, including those that might arise from working near a crane.

Question 7: What training must I provide to my employees?

Answer 7: Training that must be provided under the standard to equipment operators, signal persons, competent and qualified persons, maintenance and repair workers, and workers who work near the equipment is referenced primarily in Section 1430. Additional training requirements are specified in other provisions of the standard. In addition, 1926.21(b)(2) requires employers to train construction workers how to recognize and avoid the hazards associated with their work and, depending on the circumstances, may require training in topics not listed in the cranes and derricks standard.

Question 8: I operate a lumberyard and deliver sheet goods (such as drywall or plywood) or packaged goods (such as roofing shingles, bags of cement, or rolls of roofing felt) to a construction site using a flatbed truck equipped with an articulating crane. At the site, I use the crane to place the material either onto the ground or onto the structure being erected. Must I comply with the standard?

Answer 8: If you only place materials on the ground without arranging the materials in a particular order for hoisting, you are not engaged in construction work and have no duties under the standard. If you place materials onto the structure, you are engaged in construction work, and the standard applies to your work. However, if you deliver only building supply sheet goods or building supply packaged materials onto the structure and your articulating/knuckleboom truck crane is equipped with a properly functioning automatic overload prevention device, you have no further duties under the standard. Otherwise, you must comply with the entire standard when using the crane to place material onto the structure.

Question 9: I deliver prefabricated roof trusses and wall panels to a construction site using a flatbed truck equipped with an articulating crane. At the site, I use the crane to place the material either onto the ground or onto the structure being erected. Must I comply with the standard?

Answer 9: You must comply with the standard if you unload the material onto the structure. You need not comply with the standard if you unload the material onto the ground without arranging the materials in a particular order for hoisting because that activity is not construction work.

Question 10: I am the general contractor on a home-building project. The framing subcontractor informs me that he will be bringing a crane onto the site to lift roof trusses onto the structure. Do I have any responsibilities under the standard?

Answer 10: You are responsible for seeing that the ground on which the crane will operate is sufficiently firm and level to enable the crane to operate safely. See Section 1402 (Ground conditions). In addition, you must inform the framing contractor of the location of hazards beneath the equipment set-up area (such as voids, tanks, utilities) if those hazards are identified in documents (such as site drawings, as-built drawings, or soil analyses) that are in your possession or the hazards are otherwise known to you. If there is more than one crane on the site and the working radii of the cranes overlap, you must establish a system to control their operations. See Section 1424(b). In addition to these specific duties under the standard, as the controlling contractor on the site you have the same responsibility under this standard as you have under other OSHA standards: you must exercise reasonable care to prevent and detect violations on the site. See OSHA Instruction CPL 2-0.124, "Multi-Employer Citation Policy," (Dec. 10, 1999), section X.E (available on OSHA's website).

Question 11: I notice that certain provisions of the standard direct my employees, such as my crane operator, to take certain steps. Do I have any responsibilities under such provisions?

Answer 11: Yes. Where provisions of this standard direct an operator, crewmember, or other employee to take certain actions, Section 1400(f) requires you to establish, effectively communicate to the relevant persons, and enforce work rules to ensure compliance with such provisions.

Section 1400 – Scope

COVERED AND EXCLUDED EQUIPMENT: The rule applies to power-operated equipment used in construction work that can hoist, lower and horizontally move a suspended load, unless such equipment is specifically excluded from coverage.

Section 1400 lists specific types of equipment that are covered and specific types that are excluded from coverage.

COVERED EQUIPMENT: The types of cranes and derricks that are most commonly used in construction are covered, including:

- Mobile cranes, including crawler mounted, wheel-mounted, rough terrain, all-terrain, commercial truck-mounted, and boom truck cranes.
- Tower cranes, including those with a fixed jib (i.e., "hammerhead boom") those with a luffing boom and self-erecting tower cranes.
- Articulating cranes, such as knuckle-boom cranes. (See below for rules that apply when such cranes are used to deliver material to a construction site).
- All derricks, except for gin poles used for the erection of communication towers. (Note that, despite their name, "digger derricks" are not "derricks" under the standard. As noted below, the standard applies to "digger derricks" unless they are used for certain work).

The rule also applies to the following more specialized types of equipment when used in construction:

- Floating cranes
- Cranes on barges
- Locomotive cranes
- Multi-purpose machines when configured to hoist and lower (by means of a winch or hook) and horizontally move a suspended load
- Industrial cranes (such as carry-deck cranes)
- Dedicated pile drivers
- Service/mechanic trucks with a hoisting device
- Monorail mounted cranes
- Pedestal cranes
- Portal cranes
- Overhead and gantry cranes (except that such cranes that are permanently installed in a facility are

subject to OSHA's General Industry standard, 29 CFR 1910.179, even when used for construction work.)

- Straddle cranes
- Sideboom cranes
- Digger derricks (except when used for augering holes for poles carrying electric and telecommunication lines, placing and removing the poles, and for handling associated materials to be installed on or removed from the poles).

ATTACHMENTS: Equipment that is covered under the standard continues to be covered when used with crane-attached or crane-suspended attachments. Such attachments include, but are not limited to: hooks, magnets, grapples, clamshell buckets, orange peel buckets, concrete buckets, drag lines, personnel platforms, augers or drills, and pile driving equipment.

EXCLUDED EQUIPMENT: The following types of equipment are specifically excluded from coverage:

- Equipment that would otherwise be covered while it has been converted or adapted for a non-hoisting/lifting use. Such conversions/adaptations include, but are not limited to, power shovels, excavators, and concrete pumps.
- Power shovels, excavators, wheel loaders, backhoes, loader backhoes, and track loaders. This machinery is also excluded when used with chains, slings, or other rigging to lift suspended loads.
- Automotive wreckers and tow trucks when used to clear wrecks and haul vehicles.
- Digger derricks when used for augering holes for poles carrying electric and telecommunication lines, placing and removing the poles, and for handling associated materials to be installed on or removed from the poles. Digger derricks used in such pole work must comply with either 29 CFR 1910.269 (electric lines) or 29 CFR 1910.268 (telecommunication lines).
- Machinery originally designed as vehicle-mounted aerial devices (for lifting personnel) and self-propelled elevating work platforms.
- Telescopic/hydraulic gantry systems.
- Stacker cranes.
- Powered industrial trucks (forklifts), except when configured to hoist and lower (by means of a winch or hook) and horizontally move a suspended load.

- Mechanic's truck with a hoisting device when used in activities related to equipment maintenance and repair.
- Machinery that hoists by using a come-a-long or chainfall.
- Dedicated drilling rigs.
- Gin poles when used for the erection of communication towers.
- Tree trimming and tree removal work.
- Anchor handling or dredge-related operations with a vessel or barge using an affixed A-frame.
- Roustabouts.
- Helicopter cranes.

SPECIAL RULES FOR ARTICULATING/KNUCKLE-BOOM CRANES USED TO DELIVER MATERIAL TO A CONSTRUCTION SITE:

It is common for material to be delivered to and unloaded on a construction site using a truck on which is mounted an articulating/knuckle-boom crane. Such equipment is covered by the standard when used in construction work.

When such equipment delivers materials by placing them on the ground without arranging them in a particular sequence for hoisting, the activity is not considered construction work and is not covered under the standard. This exclusion applies regardless of the type of material being delivered.

However, when the delivery equipment is used to transfer the materials onto a structure, the activity is considered construction work. Nevertheless, the activity is excluded from the standard if all of the following conditions are met:

- The materials are sheet goods (such as sheet rock, plywood, or sheets of roofing shingles) or packaged goods (such as roofing shingles, bags of cement, or rolls of roofing felt).
- The equipment uses a fork/cradle at the end of the boom to deliver the materials.
- The equipment is not used to hold, support, or stabilize the material to facilitate a construction activity, such as holding material in place while it is attached to the structure.
- The equipment is equipped with a properly functioning automatic overload prevention device.

This exception, as noted, is limited to delivery of sheet goods and packaged goods. It does not apply to delivery of prefabricated components or building sections, such as roof trusses and wall panels. It also does not apply to delivery of structural steel members or components of a systems-engineered metal building.

Section 1401 – Definitions

Section 1401 defines numerous terms that are used in the standard. The terms discussed below are of general interest and deserve particular attention. The definitions are in bold, and following each definition is an explanation of its significance.

A/D director (Assembly/Disassembly director) means an individual who meets this subpart's requirements for an A/D director, irrespective of the person's formal job title or whether the person is non-management or management personnel.

All assembly and disassembly operations must be carried out under the direction of an A/D director. The A/D director must be both a "competent person" and a "qualified person," or must be a "competent person" assisted by one or more "qualified persons." "Competent person" and "qualified person" are defined below.

Assembly/Disassembly means the assembly and/or disassembly of equipment covered under this standard. With regard to tower cranes, "erecting and climbing" replaces the term "assembly," and "dismantling" replaces the term "disassembly." Regardless of whether the crane is initially erected to its full height or is climbed in stages, the process of increasing the height of the crane is an erection process.

All assembly and disassembly operations must comply with either the procedures specified by the manufacturer or procedures developed by the employer that meet the criteria listed in Section 1406. Under either alternative, procedures must comply with all manufacturer prohibitions.

Competent person means one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them.

A competent person must conduct shift and monthly inspections of all equipment. The A/D director must meet the test for a competent person (as well as a qualified person – see below). In addition, duties under the sections of this standard governing Operations, Hoisting Personnel, Multiple Crane/ Derrick Lifts, Derricks, and Floating Cranes must be carried out by competent persons. In general, a qualified crane operator who has the authority to take corrective measures will be a competent person under this definition.

Controlling entity means an employer that is a prime contractor, general contractor, construction manager or any other legal entity which has the overall responsibility for the construction of the project – its planning, quality and completion.

The controlling entity is responsible for seeing that the ground conditions are adequate to support the equipment. The controlling entity must also inform the user and the operator of the equipment of the location of hazards beneath the equipment set-up area (such as voids, tanks, utilities) if those hazards are identified in documents (such as site drawings, as-built drawings, and soil analyses) in the possession of the controlling entity (whether at the site or off-site) or of any other hazards known to the controlling entity. See section 1402(c). The controlling entity must also establish a system to coordinate the operations of two cranes that operate within each other's working radius. See Section 1424(b).

Dedicated spotter (power lines): To be considered a dedicated spotter, the requirements of § 1926.1428 (Signal person qualifications) must be met and his/her sole responsibility is to watch the separation between the power line and the equipment, load line and load (including rigging and lifting accessories), and ensure through communication with the operator that the applicable minimum approach distance is not breached.

The use of a dedicated spotter is one of the safeguards used to prevent a crane, as well as its load and load line, from breaching the applicable minimum distance from a power line, and thereby prevent death by electrocution and electric shock and burn injuries. The minimum distances that must be maintained, and the safeguards that must be used, are addressed in sections 1407 – 1411.

Electrical contact occurs when a person, object, or equipment makes contact or comes in close proximity with an energized conductor or equipment that allows the passage of current.

Equipment (including the load and load line) coming into electrical contact with power lines is the leading cause of crane-related fatalities. Note that the equipment does not need to actually touch the power line to make electrical contact, as electricity can arc from a power line to nearby equipment. It is therefore critical to maintain a safe minimum distance and not merely prevent physical contact.

Fall protection equipment means guardrail systems, safety net systems, personal fall arrest systems, positioning device systems or fall restraint systems.

This standard contains fall protection requirements for cranes. The only provisions of OSHA's general fall protection requirements for construction (found in 29 CFR 1926 subpart M) that apply to cranes are specifically referenced in this standard. The listed types of fall protection equipment are further defined in the standard.

Qualified person means a person who, by possession of a recognized degree, certificate, or professional standing, or who by extensive knowledge, training and experience, successfully demonstrated the ability to solve/resolve problems relating to the subject matter, the work, or the project.

Numerous duties under the standard must be carried out by a person who meets this definition. These include conducting annual/comprehensive inspections of all equipment as well as inspections of modified equipment. The A/D director (see definition above) must be a qualified person as well as a competent person. A qualified person also is responsible for duties under various provisions of the standard, including those dealing with developing assembly/disassembly procedures, wire rope safety, fall protection, maintenance and repair, hoisting personnel, multiple crane/derrick lifts, equipment modifications, tower cranes, derricks, and floating cranes/derricks.

Rated capacity means the maximum working load permitted by the manufacturer under specified working conditions. Such working conditions typically include a specific combination of factors such as equipment configuration, radii, boom length, and other parameters of use.

Workers have been killed and injured when cranes have collapsed because their rated capacity was exceeded. Compliance with the rated capacity is therefore one of the most critical protective measures required by the standard.

Section 1402 – Ground Conditions

IMPORTANCE OF GROUND CONDITIONS: Adequate ground conditions are essential for safe crane operations because the crane's capacity and stability depend on such conditions being present. If, for example, the ground is muddy or otherwise unstable, a crane could overturn even if operated within the load limits specified by the manufacturer.

BASIC RULE: You must not assemble or use a crane unless ground conditions are firm, drained, and graded to a sufficient extent so that, in conjunction (if necessary) with the use of supporting materials (such as blocking, mats, cribbing, or marsh buggies (in marshes/wetlands)), the equipment manufacturer's specifications for adequate support and degree of level of the equipment are met. The requirement for the ground to be drained does not apply to marshes/wetlands.

RESPONSIBILITIES OF CONTROLLING ENTITY: A contractor operating a crane on a construction site may not have the ability or authority to provide for adequate ground conditions at the site. The standard therefore places the responsibility for ensuring that the ground conditions are adequate on the "controlling entity" at the site, that is the prime contractor, general contractor, construction manager, or other legal entity with overall responsibility for the project's planning, quality, and completion.

The controlling entity must also inform the user and operator of the equipment of hazards beneath the equipment set-up area (such as voids, tanks, utilities) if those hazards are identified in documents (such as site drawings, as-built drawings, and soil analyses) in the possession of the controlling entity (whether at the site or off-site) and of any other hazards known to the controlling entity.

If there is no controlling entity for the project, the responsibility for providing adequate ground conditions rests on the employer that has authority at the site to make or arrange for ground preparations.

RESPONSIBILITY OF COMPANY OPERATING CRANE: Although the controlling entity is responsible for providing adequate ground conditions, the company operating the crane will often be better able than the controlling entity to determine whether those conditions are adequate. If you are operating a crane and decide that ground conditions are inadequate, you must discuss the problem with the controlling entity and see that the problem is corrected before beginning or continuing operations.

Sections 1403-1406 – Assembly and Disassembly

Accidents during assembly and disassembly of lattice boom and tower cranes are one of the major causes of crane-related fatalities. These sections are designed to prevent such accidents by requiring safe assembly/disassembly procedures for lattice boom and tower cranes. Hydraulic-boom cranes are not generally assembled on site, but these sections contain some provisions, such as the requirement (section 1404(q)) for proper setting of outriggers and stabilizers, that apply to cranes with hydraulic booms.

REQUIRED PROCEDURES: When assembling or disassembling a crane, you must comply with either:

- Manufacturer procedures, or
- Your own employer procedures, which must be developed by a qualified person. Such procedures

must, at a minimum (1) prevent unintended dangerous movement or collapse of any part of the equipment; (2) provide adequate support and stability of all parts of the equipment; and (3) position employees involved in the assembly/disassembly operation so that their exposure to unintended movement or collapse of part or all of the equipment is minimized.

Regardless of which of these options you choose, you must follow any manufacturer prohibitions that apply to the assembly/disassembly operation.

THE A/D DIRECTOR: All assembly/disassembly operations must be directed by an individual who meets the criteria for both a competent person and a qualified person, or by a competent person who is assisted by one or more qualified persons. The A/D director must understand the applicable assembly/disassembly procedures. The A/D director must take the following precautions to protect against potential hazards associated with the operation, including:

- Site and ground conditions must be able to support the equipment during assembly/disassembly.
- Blocking material must be the correct size, amount, and condition. The blocking must be stacked so as to sustain the loads and maintain stability.
- When used to support lattice booms or components, blocking must be placed appropriately to protect the structural integrity of the equipment, and prevent dangerous movement and collapse.
- When using an assist crane, the loads that will be imposed on the assist crane at each phase of assembly/disassembly must be verified as being within its rated capacity.
- The point(s) of attachment of rigging to a boom (or boom sections, jib, or jib sections) must be suitable for preventing structural damage and facilitating safe handling of these components.
- The center of gravity of the load must be identified if necessary for the method used for maintaining stability. Where there is insufficient information to accurately identify the center of gravity, measures designed to prevent unintended dangerous movement resulting from an inaccurate identification of the center of gravity must be used.

- The boom sections, boom suspension systems (such as gantry A-frames and jib struts), and components must be rigged or supported to maintain stability upon the removal of the pins.
- Suspension ropes and pendants must not be allowed to catch on the boom or jib connection pins or cotter pins (including keepers and locking pins).
- Steps must be taken to prevent unintended movement from counterweights that are inadequately supported or are being hoisted.
- Each time reliance is to be placed on the boom hoist brake to prevent boom movement during assembly/disassembly, the brake must be tested prior to such reliance to determine if it is sufficient to prevent boom movement. If it is not sufficient, a boom hoist pawl, other locking device/back-up braking device, or another method of preventing dangerous movement of the boom (such as blocking or using an assist crane) from a boom hoist brake failure must be used.
- Backward stability must be assured before swinging the upperworks, travel, and when attaching or removing equipment components.
- The effect of wind speed and weather on the equipment must be taken into account.

THE CREW: Before the operation begins, the A/D director must ensure that the crew members understand all of the following:

- Their tasks.
- The hazards associated with their tasks.
- The hazardous positions/locations that they need to avoid.

Before a crew member goes to a location that is out of view of the operator and is either in, on, or under the equipment, or near the equipment (or load) where the crew member could be injured by movement of the equipment (or load), the crew member must inform the operator that he/she is going to that location. Whenever the operator knows that a crew member is in such a potentially dangerous position, the operator must not move any part of the equipment (or load) until the operator is informed in accord with a pre-arranged system of communication that the crew member is in a safe position.

THE RIGGER: When rigging is used for assembly/disassembly, the employer must ensure that the rigging work is done by a qualified rigger, i.e., a rigger who meets the definition of a qualified person.

WORKING UNDER THE BOOM, JIB OR OTHER COMPONENTS: When pins (or similar devices) are being removed, employees must not be under the boom, jib, or other components, unless site constraints require one or more employees to be in such a position. In such a case, the A/D director must implement procedures that minimize the risk of unintended dangerous movement and minimize the duration and extent of exposure under the boom.

SYNTHETIC SLINGS: When using synthetic slings during assembly or disassembly, you must follow the synthetic sling manufacturer's instructions, limitations, specifications and recommendations. Synthetic slings must be protected from abrasive, sharp or acute edges, and configurations that could cause a reduction of the sling's rated capacity, such as distortion or localized compression.

OUTRIGGERS AND STABILIZERS. When the load to be handled and the operating radius require the use of outriggers or stabilizers, or at any time when outriggers or stabilizers are used:

- The outriggers or stabilizers must be either fully extended or, if manufacturer procedures permit, deployed as specified in the load chart.
- The outriggers must be set to remove the equipment weight from the wheels, except for locomotive cranes. This provision does not apply to stabilizers.
- When outrigger floats are used, they must be attached to the outriggers. When stabilizer floats are used, they must be attached to the stabilizers.
- Each outrigger or stabilizer must be visible to the operator or to a signal person during extension and setting.
- Outrigger and stabilizer blocking must be the correct size, amount, and condition. The blocking must be placed only under the outrigger or stabilizer float/pad of the jack or, where the outrigger or stabilizer is designed without a jack, under the outer bearing surface of the extended outrigger or stabilizer beam.

DISMANTLING BOOMS AND JIBS: The following precautions must be taken to prevent dangerous movement of boom and jib sections that are being dismantled.

- None of the pins in the pendants are to be removed (partly or completely) when the pendants are in tension.
- None of the pins (top or bottom) on boom sections located between the pendant attachment points and the crane/derrick body are to be removed (partly or completely) when the pendants are in tension.
- None of the pins (top or bottom) on boom sections located between the uppermost boom section and the crane/derrick body are to be removed (partly or completely) when the boom is being supported by the uppermost boom section resting on the ground (or other support).
- None of the top pins on boom sections located on the cantilevered portion of the boom being removed (the portion being removed ahead of the pendant attachment points) are to be removed (partly or completely) until the cantilevered section to be removed is fully supported.

FALL PROTECTION: During assembly/disassembly work, fall protection is generally required when a worker is more than 15 feet above an unprotected side or edge. See section 1423.

Sections 1407-1411 – Power Lines

DANGER – HIGH VOLTAGE: Electrocutions caused by a crane, load, or load line contacting a power line have caused numerous fatalities. To prevent such accidents in the future, the standard contains detailed, systematic procedures that employers must follow when operating cranes near power lines. These procedures are designed to (1) prevent equipment from making electrical contact with power lines; and (2) protect workers in the event that such contact occurs.

NOTE: Special rules apply to work covered by 29 CFR, Subpart V, Power Transmission and Distribution. This Guide does not cover Subpart V work.

THE FIRST STEP – COULD THE CRANE GET CLOSER THAN 20 FEET TO A POWER LINE? Keeping a safe distance from power lines is the key to preventing power line accidents. Therefore, the first step you must take when planning to operate a crane on a site where a power line is present is to identify the crane's work zone and use that work zone to determine how close it could come to the power line. If you determine that no part of the crane, load, or load line could get closer than 20 feet to a power line, no further precautions are required. If the initial plan for the crane's use changes during the project, you must reevaluate whether the equipment could get closer than 20 feet to the power line. [**Note**: If the line's voltage is over 350,000 volts, a 50-foot, rather than 20-foot, minimum clearance must be maintained. This Guide assumes that the voltage is less than 350,000 volts and uses the 20-foot clearance distance.]

There are two ways to identify the work zone and use it to determine whether the equipment could get closer than 20 feet to the power line. First, if the equipment (crane, load, load line, or rigging) could not get closer than 20 feet to the line even if the crane is operated at its maximum working radius, the 20-foot requirement is satisfied. Alternatively, you may establish a work zone by establishing boundaries (using flags or a device such as a range limit device or range control warning device) that are more than 20 feet from the power line and prohibiting the operator from operating the equipment past those boundaries.

ALTERNATIVE TO 20-FOOT CLEARANCE (TABLE A): If you know the line's voltage, you may use the minimum clearance distance in Table A in lieu of 20 feet. Table A provides:

Table A - Minimum Clearance Distances	
Voltage (nominal, kV, alternating current)	Minimum clearance distance (feet)
up to 50	10
over 50 to 200	15
over 200 to 350	20
over 350 to 500	25
over 500 to 750	35
over 750 to 1,000	45
over 1,000	(as established by the utility owner/operator or registered professional engineer who is a qualified person with respect to electrical power transmission and distribution)
Note: The value that follows "to" is up to and includes that value. For example, over 50 to 200 means up to and including 200kV.	

One way to determine the line's voltage is to ask the line's owner or operator. The utility must respond to such a voltage inquiry within two working days.
If you use Table A to determine the minimum clearance distance, you must determine whether any part of the crane, load, or load line could get closer than the Table A distance to a power line if the equipment is operated up to its maximum working radius in the work zone.

If you determine that part of the crane, load, or load line could come closer to the power line than the required minimum clearance distance (either 20 feet or the Table A clearance), you must either **deenergize and ground** the line or take specified steps to **maintain the required minimum clearance distance.** These options will now be discussed.

DEENERGIZE AND GROUND: Deenergizing and visibly grounding the line will protect against electrocution and avoid the need for additional precautions. However, the employer must rely on the power line's owner or operator to take these steps, and utilities are generally unwilling to deenergize their lines because doing so will cut off service to their customers. As a result, this precaution will usually not be available.

You must assume that all power lines are energized unless the utility owner/operator confirms that the power line has been and continues to be deenergized and the line is visibly grounded at the worksite.

STEPS YOU MUST TAKE TO MAINTAIN THE REQUIRED MINIMUM CLEARANCE DISTANCE:

You must take all of the following steps.

- Conduct a planning meeting with the crane operator and the other workers who will be in the area of the equipment or load to review the location of the power line(s), and the steps that will be implemented to prevent encroachment/electrocution.
- If tag lines are used, they must be non-conductive.
- Erect and maintain an elevated warning line, barricade, or line of signs equipped with flags or similar high-visibility markings at the minimum clearance distance. If the operator cannot see the elevated warning line, a dedicated spotter must be used to signal the operator that the crane is passing the marked line.

In addition, you must use at least **one** of the following precautions:

- A dedicated spotter (a worker whose only duty is to observe the clearance between the equipment and the line) who is in continuous contact with the operator.
- A proximity alarm set to give the operator sufficient warning to prevent encroachment.
- A device that automatically warns the operator when to stop movement, such as a range control warning device. Such a device must be set to give the operator sufficient warning to prevent encroachment.
- A device that automatically limits the crane's range of movement, set to prevent encroachment.
- An insulating link/device installed between the end of the load line and the load.

If you use a dedicated spotter, the dedicated spotter must be able to judge the distance between the equipment and the line and inform the operator if the equipment is getting too close to the line. Therefore, the spotter must:

- Be equipped with a visual aid (such as a clearly visible line painted on the ground or a clearly visible line of stanchions) to assist in identifying the minimum clearance distance.
- Be positioned to effectively gauge the clearance distance.
- Where necessary, use equipment that enables the spotter to communicate directly with the operator.
- Give timely information to the operator so that the required clearance distance can be maintained.
- Be trained to be able to perform his/her duties effectively.

OPERATION BELOW POWER LINES GENERALLY PROHIBITED: No part of the equipment, load line, or load (including rigging and lifting accessories) is allowed below a power line unless:

- the employer has confirmed that the utility owner/operator has deenergized and visibly grounded the power line at the worksite, **or**
- the highest point of the equipment's boom, even if completely extended and vertical, will be more than the required minimum distance from the power line.

EMPLOYEE TRAINING: If the equipment contacts a power line, death or injury may be avoided if the workers in and on the crane know and understand the steps they can take to protect themselves. In general, the crane operator and any other person on the crane will be safe as long as they remain on the crane. The greatest danger is faced by a person who simultaneously touches both the crane and the ground, but a person who is near, but not touching, the crane can also suffer electric shock. To ensure that employees have the information they need to protect themselves, you must train each operator and crew member assigned to work with the equipment on how to avoid electrocution in the event the equipment contacts a power line. Such training must include:

- Information regarding the danger of electrocution if a person simultaneously touches the equipment and the ground.
- The importance to the operator's safety of remaining inside the cab except where there is an imminent danger of fire, explosion, or other emergency that necessitates leaving the cab.

- The safest means of evacuating from equipment that may be energized.
- The danger of the potentially energized zone around the equipment (step potential).
- The need for crew in the area to avoid approaching or touching the equipment and the load.
- Safe clearance distance from power lines.
- The limitations of an insulating link/device, proximity alarm, and range control (and similar) device, if used.
- How to properly ground equipment and the limitations of grounding.

ASSEMBLING A CRANE NEAR A POWER LINE: The precautions described above for crane operations must also be taken when assembling or disassembling a crane near a power line. Under no circumstances may a crane be assembled or disassembled beneath an energized power line.

PRECAUTIONS FOR MOVING EQUIPMENT: A crane traveling with a load must comply with the minimum clearance distance and associated precautions listed above. If the crane is traveling with no load, the following clearance distances must be maintained.

Table T – Minimum Clearance Distances While Traveling with No Load

Voltage (nominal, kV, alternating current)	While Traveling – Minimum clearance distance (feet)
up to 0.75	4
over .75 to 50	6
over 50 to 345	10
over 345 to 750	16
over 750 to 1,000	20
over 1,000	(as established by the utility owner/operator or registered professional engineer who is a qualified person with respect to electrical power transmission and distribution)

In determining whether the equipment will maintain the required clearance distance, you must take into account the effects of speed and terrain on the equipment's movement (including movement of the boom/mast). In addition, if any part of the equipment can get closer than 20 feet to the line, you must use a dedicated spotter to observe the clearance and signal the operator in order to keep the required minimum clearance.

LIMITED EXCEPTION TO MANDATORY MINIMUM CLEARANCE

In some circumstances, it is impossible to perform a required lift while staying the required minimum distance from a power line. The standard provides a limited exception for such circumstances that allows operations closer than the minimum distance. However, it requires additional precautions due to the extreme danger of operating so close to a power line.

Before using this exception, you must determine that specific work required to complete the project cannot be performed while maintaining the Table A clearance. In making this determination, you must consider whether an alternative method of performing the lift, such as repositioning the crane or the load, will enable you to maintain the required minimum distance. If you have decided that it is absolutely necessary to operate closer than the required minimum distance, you must consult the utility that owns or operates the line to determine whether it is feasible to deenergize and ground or relocate the line. Only if deenergizing/grounding or relocation is not feasible may you operate closer than the Table A distance to an energized line. In such a case, you must take the following precautions to protect workers:

FIRST: DETERMINE AN ABSOLUTE MINIMUM CLEARANCE. You must have the power line owner/operator or a registered professional engineer who is a qualified person with respect to electrical power transmission and distribution determine the minimum clearance distance that must be maintained to prevent electrical contact in light of the on-site conditions. The factors that must be considered in making this determination include, but are not limited to: conditions affecting atmospheric conductivity; time necessary to bring the equipment, load line, and load (including rigging and lifting accessories) to a complete stop; wind conditions; degree of sway in the power line; lighting conditions; and other conditions affecting the ability to prevent electrical contact.

SECOND: HOLD A PLANNING MEETING. You must hold a planning meeting with the utility owner/operator (or registered professional engineer who is a qualified person with respect to electrical power transmission and distribution) to determine the procedures that will be followed to prevent electrical contact and electrocution.

THIRD: USE PROTECTIVE PROCEDURES. The procedures required by the standard and any additional procedures developed at the planning meeting must be followed. The following procedures are required by the standard and **must be followed without exception**:

- If the power line is equipped with a device that automatically reenergizes the circuit in the event of a power line contact, before the work begins, the automatic reclosing feature of the circuit interrupting device must be made inoperative if the design of the device permits.
- A dedicated spotter who is in continuous contact with the operator must be used to ensure that the equipment does not breach the minimum clearance. The requirements for a dedicated spotter are discussed above.
- An elevated warning line, or barricade (not attached to the crane), in view of the operator (either directly or through video equipment), equipped with flags or similar high-visibility markings, must be erected.
- An insulating link/device must be installed at a point between the end of the load line (or below) and the load. (NOTE: certain safety procedures or devices may be substituted for a Nationally Recognized Testing Laboratory-approved insulating link during an interim time period. Refer to section 1926.1410(d)(4)(iv) and (v) of the standard for details)
- All employees who may come in contact with the equipment, the load line, or the load (except operators located on the equipment) must be insulated or guarded from the equipment, the load line, and the load by wearing insulating gloves rated for the voltage involved or using another effective means of insulating them from the equipment.

- Nonconductive rigging must be used.
- If the equipment is equipped with a device that automatically limits range of movement, it must be used and set to prevent any part of the equipment, load line, or load (including rigging and lifting accessories) from breaching the minimum approach distance.
- Any tag line that is used must be of the nonconductive type.
- Barricades forming a perimeter at least 10 feet away from the equipment must be erected to prevent unauthorized personnel from entering the work area. In areas where obstacles prevent the barricade from being at least 10 feet away, the barricade must be as far from the equipment as feasible.
- Workers other than the operator must be prohibited from touching the load line above the insulating link/device and crane. The operator is excluded from this requirement because, while on the equipment, the operator is, in effect, touching the load line above the insulating link/device. However, if the operator is remotely operating the equipment from the ground, he/she must use either wireless controls that isolate the operator from the equipment or insulating mats that insulate the operator from the ground.
- Only personnel essential to the operation are permitted in the area of the crane and load.
- The equipment must be properly grounded.
- Insulating line hose or cover-up must be installed by the utility owner/operator except where such devices are unavailable for the line voltages involved.
- Each operator and crew member assigned to work with the equipment must be trained in the topics listed earlier in this section.

FOURTH: APPOINT A PROJECT DIRECTOR.
You, along with the utility owner/operator (or registered professional engineer) and all other employers involved in the work, must identify one person who will direct the implementation of the procedures. That person must have the authority to stop work at any time to ensure safety.

FIFTH: RECONSIDER YOUR PLAN IF A PROBLEM ARISES. The danger of operating a crane close to a power line cannot be overemphasized. Procedures that may appear adequate at the beginning of a job may not be adequate in practice. For example, if electricity arcs from the line to the equipment, whatever precautions are being taken are not sufficient. Therefore, if there is any indication that the procedures being followed are inadequate to protect workers, you must safely stop operations and either develop new, more protective procedures or have the utility owner/operator deenergize and visibly ground or relocate the power line before resuming work.

Section 1412 – Inspections (with section 1435(f) (Tower crane inspections) and section 1436(p) (Derricks inspections))

To ensure that equipment is in a safe condition, the standard requires a variety of inspections. The following inspections are required of all equipment:

- Shift inspections
- Monthly inspections
- Annual inspections
- Shift, monthly, and annual wire rope inspections (if the equipment uses wire rope)

In addition, the following special inspections are required in particular circumstances:

- Post-assembly inspections
- Pre- and post-erection inspections of tower cranes (section 1435(f))
- Equipment used in severe service
- Equipment not in regular use
- Inspections of certain modified equipment
- Inspections of certain repaired/adjusted equipment

As described below, certain inspections must be conducted by a competent person and others by a qualified person. See Section 1401 (Definitions) for an explanation of these terms.

SHIFT INSPECTIONS: A competent person must visually inspect the equipment each shift the equipment is used. Taking apart equipment components and booming down is not required as part of this inspection unless the results of the visual inspection or trial operation indicate that further investigation necessitating taking apart equipment components or booming down is needed. At a minimum the inspection must include all of the following:

- Control mechanisms for maladjustments interfering with proper operation.
- Control and drive mechanisms for apparent excessive wear of components and contamination by lubricants, water or other foreign matter.
- Air, hydraulic, and other pressurized lines for deterioration or leakage, particularly those which flex in normal operation.
- Hydraulic system for proper fluid level.
- Hooks and latches for deformation, cracks, excessive wear, or damage such as from chemicals or heat.
- Wire rope reeving for compliance with the manufacturer's specifications.
- Wire rope (see section 1413 for the rules for wire rope inspections).
- Electrical apparatus for malfunctioning, signs of apparent excessive deterioration, or dirt or moisture accumulation.
- Tires (when in use) for proper inflation and condition.
- Ground conditions around the equipment for proper support, including ground settling under and around outriggers/stabilizers and supporting foundations, ground water accumulation, or similar conditions.
- The equipment for level position within the tolerances specified by the equipment manufacturer's recommendations, both before each shift and after each move and setup.
- Operator cab windows for significant cracks, breaks, or other deficiencies that would hamper the operator's view.
- Rails, rail stops, rail clamps and supporting surfaces when the equipment travels on rails.
- Safety devices and operational aids for proper operation.

- For derricks, guys for proper tension (section 1436(p)).
- Deficiencies identified during the most recent annual inspection that the inspector determined must be monitored in the monthly inspections.

If the inspection shows that a safety device (see section 1415 for a list of required safety devices) is not working properly, the equipment must not be used. If it shows that an operational aid (see section 1416 for a list of required operational aids) is not working properly, the equipment may be used for a limited period of time (7 or 30 calendar days depending on the type of operational aid) as long as specified temporary alternative precautions are taken. For the other items covered by the inspection, if the inspector finds any deficiency in an item, he/she must determine if the deficiency is serious enough to be a safety hazard. If so, the equipment must not be used until the deficiency is corrected. Shift inspections need not be documented.

MONTHLY INSPECTIONS: The monthly inspection is the same as a shift inspection for most equipment. For tower cranes, the following additional items must be included (section 1435(f)(4)):

- Tower (mast) bolts and other structural bolts (for loose or dislodged condition) from the base of the tower crane up or, if the crane is tied to or braced by the structure, those above the uppermost brace support.
- The uppermost tie-in, braces, floor supports and floor wedges where the tower crane is supported by the structure, for loose or dislodged components.

Documentation of monthly inspection: The following information must be documented and maintained for a minimum of three months by the employer that conducts the inspection:

- The items checked and the results of the inspection.
- The name and signature of the person who conducted the inspection and the date.

ANNUAL/COMPREHENSIVE INSPECTIONS: The annual inspection must be conducted by a qualified person and is far more thorough than a shift or monthly inspection. In addition to those items that must be checked during a shift inspection, the annual inspection must include:

- Equipment structure (including the boom and, if equipped, the jib) as follows:
- Structural members: deformed, cracked, or significantly corroded.
- Bolts, rivets and other fasteners: loose, failed, or significantly corroded.
- Welds for cracks.
- Sheaves and drums for cracks or significant wear.
- Parts such as pins, bearings, shafts, gears, rollers and locking devices for distortion, cracks, or significant wear.
- Brake and clutch system parts, linings, pawls, and ratchets for excessive wear.
- Safety devices and operational aids for proper operation (including significant inaccuracies).
- Gasoline, diesel, electric, or other power plants for safety-related problems (such as leaking exhaust and emergency shutdown feature) and conditions, and proper operation.
- Chains and chain drive sprockets for excessive wear of sprockets and excessive chain stretch.
- Travel steering, brakes, and locking devices, for proper operation.
- Tires for damage or excessive wear.
- Hydraulic, pneumatic and other pressurized hoses, fittings, and tubing, as follows:
  - Flexible hose or its junction with the fittings for indications of leaks.
  - Threaded or clamped joints for leaks.
  - Outer covering of the hose for blistering, abnormal deformation, or other signs of failure/impending failure.
  - Outer surface of a hose, rigid tube, or fitting for indications of excessive abrasion or scrubbing.
- Hydraulic and pneumatic pumps and motors, as follows:
  - Performance indicators: unusual noises or vibration, low operating speed, excessive heating of the fluid, low pressure.
  - Loose bolts or fasteners.
  - Shaft seals and joints between pump sections for leaks.

- Hydraulic and pneumatic valves, as follows:
  - Spools: sticking, improper return to neutral, and leaks.
  - Leaks.
  - Valve housing cracks.
  - Relief valves: failure to reach correct pressure (if there is a manufacturer procedure for checking pressure, it must be followed).
- Hydraulic and pneumatic cylinders, as follows:
  - Drifting caused by fluid leaking across the piston.
  - Rod seals and welded joints for leaks.
  - Cylinder rods for scores, nicks, or dents.
  - Case (barrel) for significant dents.
  - Rod eyes and connecting joints: loose or deformed.
- Outrigger or stabilizer pads/floats for excessive wear or cracks.
- Slider pads for excessive wear or cracks.
- Electrical components and wiring for cracked or split insulation and loose or corroded terminations.
- Warning labels and decals originally supplied with the equipment by the manufacturer or otherwise required under this standard: missing or unreadable.
- Originally equipped operator seat (or equivalent): missing.
- Operator seat: unserviceable.
- Originally equipped steps, ladders, handrails, or guards: missing.
- Steps, ladders, handrails, or guards: in unusable/unsafe condition.
- For tower cranes, all turntable and tower bolts must be inspected for proper condition and torque (section 1435(f)).
- For derricks, gudgeon pins for cracks, wear, and distortion, and foundation supports for continued ability to sustain the imposed loads (section 1436(p)).

If necessary, disassembly is required to complete the annual inspection. Also, the inspection must include functional testing to determine that the equipment as configured in the inspection is functioning properly.

Corrective action: If the qualified person who conducts the inspection identifies any deficiency in any of the items inspected and determines that the deficiency constitutes a safety hazard, the equipment must be taken out of service until the deficiency is corrected. (See the discussion above under shift inspections for the corrective action required if an operational aid is not working properly). If the qualified person determines that, though not presently a safety hazard, the deficiency needs to be monitored, the employer must ensure that the deficiency is checked in the monthly inspections.

Documentation of annual/comprehensive inspection. The following information must be documented, maintained, and retained for a minimum of 12 months, by the employer that conducts the inspection:

- The items checked and the results of the inspection.
- The name and signature of the person who conducted the inspection and the date.

POST-ASSEMBLY INSPECTIONS: Before the equipment can be used, it must be inspected by a qualified person to ensure that it is configured in accord with manufacturer equipment criteria. This qualified person may be the A/D director. Where manufacturer equipment criteria are unavailable, a qualified person must:

- Determine if a registered professional engineer (RPE) familiar with the type of equipment involved is needed to develop criteria for the equipment configuration. If an RPE is not needed, the employer must ensure that the criteria are developed by the qualified person. If an RPE is needed, the employer must ensure that they are developed by an RPE.
- Determine if the equipment meets these criteria before the equipment is used.

PRE- AND POST-ERECTION INSPECTION OF TOWER CRANES (section 1435(f)): Tower crane components must be inspected by a qualified person before being erected for damage or excessive wear. The qualified person must pay particular attention to components that will be difficult to inspect thoroughly during shift inspections.

If the qualified person determines that a component is damaged or worn to the extent that it would create a safety hazard if used on the crane, that component must not be erected on the crane unless it is repaired and, upon reinspection by the qualified person, found to no longer create a safety hazard. If the qualified person determines that, though not presently a safety hazard, the component needs to be monitored, the employer must ensure that the component is checked in the monthly inspections. Any such determination must be documented, and the documentation must be available to any individual who conducts a monthly inspection.

In addition to the other requirements listed above for post-assembly inspections, the following requirements must be met:

- A load test using certified weights, or scaled weights using a certified scale with a current certificate of calibration, must be conducted after each erection.
- The load test must be conducted in accord with the manufacturer's instructions when available. Where these instructions are unavailable, the test must be conducted in accord with written load test procedures developed by a registered professional engineer familiar with the type of equipment involved.

SEVERE SERVICE INSPECTIONS: Where the severity of use/conditions is such that there is a reasonable probability of damage or excessive wear (such as loading that may have exceeded rated capacity, shock loading that may have exceeded rated capacity, or prolonged exposure to a corrosive atmosphere), the employer must stop using the equipment and a qualified person must:

- Inspect the equipment for structural damage to determine if the equipment can continue to be used safely.
- In light of the use/conditions determine whether any items/conditions that must be inspected during an annual inspection need to be inspected; if so, the qualified person must inspect those items/conditions.

INSPECTION OF EQUIPMENT NOT IN REGULAR USE: Equipment that has been idle for 3 months or more must be inspected by a qualified person in accord with the requirements for monthly inspections before being used.

INSPECTION OF MODIFIED EQUIPMENT: Equipment that has had modifications or additions which affect the safe operation of the equipment (such as modifications or additions involving a safety device or operational aid, critical part of a control system, power plant, braking system, load-sustaining structural components, load hook, or in-use operating mechanism) or capacity must be inspected by a qualified person after such modifications/additions have been completed, prior to initial use. Note that, under section 1434, any such modification/addition must be approved by either the manufacturer or a registered professional engineer. The inspection must assure that the modifications or additions have been made in accord with that approval and must include functional testing of the equipment.

INSPECTION OF REPAIRED/ADJUSTED EQUIPMENT: Equipment that has had a repair or adjustment that relates to safe operation (such as a repair or adjustment to a safety device or operator aid, or to a critical part of a control system, power plant, braking system, load-sustaining structural components, load hook, or in-use operating mechanism) must be inspected by a qualified person after such a repair or adjustment has been completed, prior to initial use. The qualified person must determine if the repair/adjustment meets manufacturer equipment criteria (where applicable and available). Where manufacturer equipment criteria are unavailable or inapplicable, the qualified person must determine if a registered professional engineer (RPE) is needed to develop criteria for the repair/adjustment. If an RPE is not needed, the employer must ensure that the criteria are developed by the qualified person. If an RPE is needed, the employer must ensure that the criteria are developed by the RPE. The inspection must determine if the repair/adjustment meets the criteria developed by the RPE or qualified person and must include functional testing.

Section 1413 – Wire Rope Inspection

Wire rope must be inspected as part of the shift, monthly, and annual inspections required by section 1412. The shift and monthly inspections must evaluate all rope that is visible during the shift in which the inspection is conducted. The annual inspection must include the entire length of the rope. The shift and monthly inspections must pay particular attention to the following:

- Rotation resistant wire rope in use.
- Wire rope being used for boom hoists and luffing hoists, particularly at reverse bends.
- Wire rope at flange points, crossover points, and repetitive pickup points on drums.
- Wire rope at or near terminal ends.
- Wire rope in contact with saddles, equalizer sheaves, or other sheaves where rope travel is limited.

In addition to these items, the annual inspection must include:

- Those sections that are normally hidden during shift and monthly inspections.
- Wire rope subject to reverse bends.
- Wire rope passing over sheaves.

You must take certain action if an inspection reveals a defect in the rope. Some defects require either that the rope be removed from service or the damaged section be severed. For others, the inspector must evaluate whether the defect constitutes a safety hazard, with the corrective action depending on the outcome of the evaluation. Note that, if a wire rope must be repaired or replaced, either the equipment (as a whole) or the hoist with that wire rope must be tagged-out during the repair/replacement process.

SEVERING WIRE ROPE: Where severing the rope is permitted, the section that is damaged must be discarded. Two undamaged sections may not be spliced to make a longer rope. If the undamaged part that remains is too short for the drum to have two full wraps of rope when the load and/or boom is in its lowest position, the rope cannot be used and must be replaced.

ELECTRICAL CONTACT WITH POWER LINE: Wire rope that has made electrical contact with a power line (either by the rope, the equipment, or the load contacting the line) must be immediately removed from service even if no damage is visible. The rope may have suffered internal damage that cannot be repaired.

DEFECTS THAT REQUIRE REMOVAL FROM SERVICE OR SEVERING: The following defects require that the rope either be removed from service or the defective part severed.

- Visible broken wires, as follows:
  - In running wire ropes: six randomly distributed broken wires in one rope lay, or three broken wires in one strand in one rope lay, where a rope lay is the length along the rope in which one strand makes a complete revolution around the rope.
  - In rotation resistant ropes: two randomly distributed broken wires in six rope diameters, or four randomly distributed broken wires in 30 rope diameters.
  - In pendants or standing wire ropes: more than two broken wires in one rope lay located in rope beyond end connections, or more than one broken wire in a rope lay located at an end connection.
- A diameter reduction of more than 5% from nominal diameter.
- In rotation resistant wire rope, core protrusion or other distortion indicating core failure.
- A broken strand.

Exception: If the wire rope manufacturer has approved different criteria for visible broken wires or diameter reduction, you may follow those criteria instead of those above.

DEFECTS THAT REQUIRE EVALUATION: The following defects must be evaluated by the inspector to determine whether they constitute a safety hazard:

- Significant distortion of the wire rope structure such as kinking, crushing, unstranding, birdcaging, signs of core failure, or steel core protrusion between the outer strands.
- Significant corrosion.

- Electric arc damage (from a source other than power lines) or heat damage.
- Improperly applied end connections.
- Significantly corroded, cracked, bent, or worn end connections (such as from severe service).

If these defects are found to be hazardous: The rope must be removed from service or the defective part severed.

If they are not found to be an immediate hazard: You may continue to use the rope. However, if such a defect is identified during an annual inspection, you must check it during each monthly inspection. Note that this may require a more complete monthly inspection than would otherwise be required because the annual inspection must cover the entire rope and may reveal a defect in a part of the rope that would not normally be visible during a shift or monthly inspection.

Section 1414 – Wire Rope – Selection and Installation Criteria

This section requires that wire rope be used in accord with the recommendations of the wire rope manufacturer, the equipment manufacturer, or a qualified person. It establishes a classification system for rotation resistant rope and specifies design factors for the different classes of such rope.

ROPE CLASSIFICATION: Wire rope is classified as either "standard rope" or "rotation resistant rope." Rotation resistant rope, in turn, can be constructed in various ways, and the standard lists three different "Types" that vary in their construction.

For all three types, rotation resistant rope's internal design resists twisting better than standard rope. Rotation resistant rope therefore enables better control of the load because it tends to keep the load from rotating while it is being hoisted or suspended. However, the design of rotation resistant rope makes it more susceptible to internal damage than standard rope and such internal damage can be hard to detect. Because of the chance of hidden damage, this section restricts the use of rotation resistant rope for boom hoist reeving and duty cycle/repetitive lifts.

Boom hoist reeving: Rotation resistant rope may only be used for boom hoist reeving when load hoists are used as boom hoists for attachments such as luffing attachments or boom and mast attachment systems. When you use rotation resistant rope for such a purpose, you must comply with six conditions specified in section 1414(e)(4)(ii).

Duty cycle/repetitive lifts: You must meet certain criteria when using rotation resistant rope for duty cycle and repetitive lifts. These are defined as follows:

> **Duty Cycle:** A type of crane service in which bulk material is transferred from one point to another by rapidly lifting, swinging, booming, and placing the material. Typical types of duty cycle service are dragline, clamshell, grapple, and magnet. This type of service is differentiated from standard crane "lift service" in that cycle times are very short and continuous, often less than 1 minute per load, and loads are lifted and placed in general areas rather than precise positions to permit such rapid cycles.
>
> **Repetitive lifts:** A continuous operation with loads that may vary in size and weight.

The requirements for using rotation resistant rope for duty cycle and repetitive lifts vary with the type of rotation resistant rope being used and the operating design factor of the rope. If you are using rotation resistant rope for one of these purposes, check the standard for the criteria that apply to the type of rope you are using.

Section 1414 also contains the following requirements:

- Wire rope clips used in conjunction with wedge sockets must be attached to the unloaded dead end of the rope only, except that the use of devices specifically designed for dead-ending rope in a wedge socket is permitted.
- Socketing must be done in the manner specified by the manufacturer of the wire rope or fitting.
- Prior to cutting a wire rope, seizings must be placed on each side of the point to be cut. The length and number of seizings must be in accord with the wire rope manufacturer's instructions.

Sections 1415 Safety Devices & 1416 Operational Aids

These sections require that cranes/derricks be equipped with certain types of safety equipment. Some types are called safety devices, while others are called operational aids. Safety devices must be in proper working order for the equipment to be permitted to operate. If an operational aid is not working properly, the equipment may still be operated for a limited time as long as certain alternative precautions are taken.

Note that section 1412 requires that safety devices and operational aids must be checked for proper operation during all shift inspections.

Safety devices and operational aids must not be used as a substitute for the exercise of professional judgment by the operator.

SAFETY DEVICES: The following safety devices are required on all equipment unless otherwise specified:

- **Crane level indicator** (except on portal cranes, derricks, floating cranes/derricks and land cranes/derricks on barges, pontoons, vessels or other means of flotation).
- **Boom stops** (except for derricks and hydraulic booms).
- **Jib stops** (if a jib is attached), except for derricks.
- **Locks** on foot pedal brakes.
- **Integral holding device/check valve** on hydraulic outrigger jacks and hydraulic stabilizer jacks.
- **Rail clamps and rail stops** for equipment on rails (except portal cranes).
- **Horn** (either built into the equipment or on the equipment and immediately available to the operator).

OPERATIONAL AIDS: These are divided into two categories that differ in the amount of time the equipment may operate before they are repaired. **While an operational aid is not working properly, the temporary alternative measures specified in the standard must be taken.** Category I aids must be repaired within 7 calendar days after a deficiency occurs, while equipment may operate for 30 calendar days before a Category II aid is repaired. In both cases, additional time is permitted if a necessary part is ordered in a timely manner but is not received within the 7- or 30-day period.

Certain operational aids are only required on equipment manufactured after a specified date. In some cases, these are past dates that reflect when these devices began to be installed on equipment. In other cases, they are future dates that are intended to give manufacturers time to install the devices on new equipment.

CATEGORY I OPERATIONAL AIDS:

- **Boom hoist limiting device** (required on equipment manufactured after December 16, 1969).
- **Luffing jib limiting device.**
- **Automatic anti two-blocking device** (required on telescopic boom cranes manufactured after February 28, 1992; lattice boom cranes manufactured after November 8, 2011; derricks manufactured after November 8, 2011; articulating cranes equipped with a load hoist manufactured after December 31, 1999; digger derricks manufactured after November 8, 2011).
- **Automatic or warning-type anti two-blocking device** (required on lattice boom cranes manufactured after February 28, 1992 and before November 8, 2011).

Note: Two-block protection is not required for lattice boom equipment used for dragline, clamshell (grapple), magnet, drop ball, container handling, concrete bucket, marine operations that do not involve hoisting personnel, and pile driving work.

CATEGORY II OPERATIONAL AIDS:

- **Boom angle or radius indicator** (required on all equipment, except digger derricks manufactured before November 9, 2010).
- **Jib angle indicator if the equipment has a luffing jib.**
- **Boom length indicator if the equipment has a telescopic boom** (unless the rated capacity is independent of the boom length).
- **Load weighing and similar devices** (required on equipment (other than derricks, articulating cranes,

and digger derricks manufactured before November 8, 2011) manufactured after March 29, 2003 with a rated capacity over 6,000 pounds).

- **Automatic overload prevention device, load weighing device, load moment** (or rated capacity) indicator, or load moment (rated capacity) limiter (required on articulating cranes manufactured after November 8, 2011).
- **Outrigger/stabilizer position (horizontal beam extension) sensor/monitor if the equipment has outriggers or stabilizers** (required on equipment manufactured after November 8, 2011).
- **Hoist drum rotation indicator if the equipment has a hoist drum not visible from the operator's station** (required on equipment manufactured after November 8, 2011).

NOTE: Articulating cranes need not be equipped with boom angle or radius indicators, jib angle indicators, or boom length indicators.

Section 1417 – Operation

This section contains a number of requirements that are designed to prevent dangerous conditions during crane operations.

COMPLIANCE WITH RATED CAPACITY: One of the most serious hazards that cranes present is collapse of the equipment caused by exceeding the crane's rated capacity. The term "rated capacity" is defined in section 1401, and that definition reads:

> ***Rated capacity*** **means the maximum working load permitted by the manufacturer under specified working conditions. Such working conditions typically include a specific combination of factors such as equipment configuration, radii, boom length, and other parameters of use.**

The combination of factors that enter into rated capacity is set forth in a load chart that must be on the equipment. In general, the load chart states the weight of the load that the crane can lift at different boom radii. The longer the radius at which the lift occurs, the smaller amount of weight the crane can lift.

You must not operate a crane in excess of its rated capacity. Some crane users believe they can safely exceed the rated capacity because the manufacturer includes a safety factor in the load chart. However, any safety factor included by the manufacturer is not intended to be treated as excess capacity. It is included because a variety of variable worksite conditions, such as swinging of the load caused by wind or other factors, can reduce the capacity of the crane from that which exists under ideal conditions.

To comply with the rated capacity, the weight of the load must be known. Before beginning a lift, you must determine the load weight by a reliable means.

OTHER MANUFACTURER PROCEDURES: In addition to complying with the rated capacity, you must comply with all other manufacturer procedures applicable to the operation of the equipment. If the manufacturer's procedures are unavailable, you must comply with procedures that you develop. Procedures for the operational controls must be developed by a qualified person. Procedures related to the capacity of the equipment must be developed and signed by a registered professional engineer familiar with the equipment.

All procedures applicable to the operation of the equipment, including rated capacities (load charts), recommended operating speeds, special hazard warnings, instructions, and operator's manual, must be readily available in the cab at all times for use by the operator.

OPERATOR ATTENTION: The operator must not engage in any practice or activity that diverts his/her attention while actually engaged in operating the equipment, such as the use of a cell phone (except when used for signal communications).

OPERATOR USUALLY MUST REMAIN AT CONTROLS WHILE THE LOAD IS SUSPENDED: An exception is provided for working gear (such as slings, spreader bars, ladders, and welding machines) when the weight of the working gear is negligible compared to the capacity of the equipment and the working gear is not over an entrance or exit. Another exception applies when the load is to be held suspended for a period of time exceeding that of normal lifting operations. See section 1417(e) for the conditions that must be met for this exception to apply.

TAGGING OUT OF SERVICE EQUIPMENT AND FUNCTIONS. When the equipment is out of service, a tag must be placed in the cab stating that the equipment is out of service and is not to be used. Where a function is out of service, a tag must be placed in a conspicuous position stating that the function is out of service and is not to be used. The equipment or function may not be used until the tag is removed by an authorized person.

PRECAUTIONS DURING STARTUP: Before starting the engine, the operator must verify that all controls are in the proper starting position and that all personnel are in the clear.

BAD WEATHER PRECAUTIONS: When a local storm warning has been issued, the competent person must determine whether it is necessary to implement manufacturer recommendations for securing the equipment. The competent person must adjust the equipment and/or operations to address the effect of wind, ice, and snow on equipment stability and rated capacity.

SIDELOADING PROHIBITED: The equipment must not be used to drag or pull loads sideways.

BRAKE TEST: The operator must test the brakes each time a load that is 90% or more of the maximum line pull is handled by lifting the load a few inches and applying the brakes. In duty cycle and repetitive lifts where each lift is 90% or more of the maximum line pull, this requirement applies to the first lift but not to successive lifts.

PROTECTION AGAINST ROPE DETACHMENT: To prevent rope from becoming detached from a drum, neither the load nor the boom must be lowered below the point where less than two full wraps of rope remain on their respective drums.

TRAVELING WITH A LOAD: Traveling with a load is prohibited if the practice is prohibited by the manufacturer. Where it is not prohibited, you must take precautions to prevent hazardous movement of the load and avoid excessive movement of the load that could overload the crane.

Section 1418 – Authority to Stop Operation

This section provides that, whenever there is a concern about safety, the operator must have the authority to stop and refuse to handle loads until a qualified person has determined that safety has been assured

Sections 1419-1422 – Signals

A crane operator often needs a second set of eyes, in the form of a signal person, to be able to operate safely. These sections state when a signal person must be provided and the types of signals that are allowed. The qualifications the signal person must possess are specified in section 1428 (Signal person qualifications).

WHEN A SIGNAL PERSON IS NEEDED: In each of the following situations, a signal person must be provided:

- When the point of operation, meaning the path the load travels or the area where the load is placed, is not in full view of the operator.
- When the equipment is traveling and the operator's view in the direction of travel is obstructed.
- When, due to site-specific safety concerns, either the operator or the person handling the load determines that it is necessary.

During operations requiring signals, the ability to transmit signals between the operator and signal person must be maintained. If that ability is interrupted at any time, the operator must safely stop operations until signal transmission is reestablished and a proper signal is given and understood.

Only one person may give signals to a crane/derrick at a time, except that any person may give an emergency stop signal.

TYPES OF SIGNALS: Hand, voice, audible, or new signals are allowed. The type of signals used and means of transmitting the signals to the operator (such as direct line of sight, video, radio, etc.), must be appropriate for the site conditions. All directions given to the operator by the signal person must be given from the operator's perspective.

HAND SIGNALS: When using hand signals, the Standard Method must be used. ***Exception:*** Where an operation or use of an attachment is not covered in the Standard Method or the use of the Standard Method is otherwise infeasible, non-standard hand signals may be used. When using non-standard hand signals, the signal person, operator, and lift director (where there is one) must contact each other prior to the operation and agree on the non-standard hand signals that will be used. Hand signal charts must be either posted on the equipment or conspicuously posted in the vicinity of the hoisting operation.

VOICE SIGNALS: These are signals given by oral communication, with or without amplification or electronic transmission. If this type of signal is used, the operator, signal person, and lift director (if there is one) must, before beginning operations, contact each other and agree on the voice signals that will be used. In most cases where voice signals are given, some type of electronic transmission and reception will be used. When this is the case:

- The device(s) used to transmit signals must be tested on site before beginning operations to ensure that the signal transmission is effective, clear, and reliable.
- Signal transmission must be through a dedicated channel, except:
  - Multiple cranes/derricks and one or more signal persons may share a dedicated channel for the purpose of coordinating operations.
  - Where a crane is being operated on or adjacent to railroad tracks, and the actions of the crane operator need to be coordinated with the movement of other equipment or trains on the same or adjacent tracks.

- The operator's reception of signals must be by a hands-free system.

AUDIBLE SIGNALS: These are signals made by a distinct sound or series of sounds, such as sounds made by a bell, horn, or whistle. As with other types of signals, the signal person and operator must clearly understand the meaning of the signals being used.
NEW SIGNALS: The standard allows room for development of new signal technology by permitting signals other than hand, voice, or audible signals to be used where the employer demonstrates that:

- The new signals provide at least equally effective communication as voice, audible, or Standard Method hand signals, or
- The new signals comply with a national consensus standard that provides at least equally effective communication as voice, audible, or Standard Method hand signals.

Section 1423 – Fall Protection

Falls from dangerous heights can occur when employees work on boom sections during assembly/disassembly, when employees are gaining access to and from their workstations, or at other times when employees are working at elevations, as on tower crane walkways. The provisions of this section are designed to protect employees who work on elevated parts of equipment from falling.

OSHA's general fall protection standard for construction work, 29 CFR 1926 subpart M, only applies to work on cranes when this section explicitly refers to a provision in that subpart.

BOOM WALKWAYS: When lattice boom cranes are assembled and disassembled, it is sometimes necessary for employees to walk and work on the boom sections to install and remove pins or for other purposes. To provide them with a safer surface on which to walk and work, certain booms manufactured after November 8, 2011 must have built-in walkways. The booms that must be equipped with walkways are those more than six feet from cord centerline to cord centerline. The walkways must be at least 12 inches wide and need not be protected by guardrails, railings, or other permanent fall protection attachments.

STEPS, HANDHOLDS, LADDERS, GRABRAILS, GUARDRAILS AND RAILINGS: If the equipment was originally equipped with these devices, you must maintain them in good condition. However, the standard does not require existing equipment to be retrofitted with these devices.

Equipment manufactured after November 8, 2011 must be equipped to provide safe access and egress between the ground and the operator workstation(s), including the forward and rear positions, by the provision of these types of devices. Walking/stepping surfaces, except for crawler treads, must have slip-resistant features/properties (such as diamond plate metal, strategically placed grip tape, expanded metal, or slip-resistant paint).

FALL PROTECTION DURING NON-ASSEMBLY/ DISASSEMBLY WORK: As the employer, you must provide and ensure the use of fall protection equipment for employees who are on a walking/ working surface with an unprotected side or edge more than 6 feet above a lower level as follows:

- When moving point-to-point:
  - On non-lattice booms (whether horizontal or not horizontal).
  - On lattice booms that are not horizontal.
  - On horizontal lattice booms where the fall distance is 15 feet or more.
- While at a workstation on any part of the equipment (including any type of boom), except when the employee is at or near draw-works (when the equipment is running), in the cab, or on the deck.

FALL PROTECTION DURING ASSEMBLY/ DISASSEMBLY WORK: You must provide and ensure the use of fall protection equipment for employees who are on a walking/working surface with an unprotected side or edge more than 15 feet above a lower level, except when the employee is at or near draw-works when the equipment is running in the cab, or on the deck.

ANCHORAGE: Fall protection must be anchored to an apparently substantial part of the equipment that would meet the criteria in 29 CFR 1926 subpart M. A personal fall arrest system may be anchored to the crane/derrick's hook (or other part of the load line) where all of the following requirements are met:

- A qualified person has determined that the set-up and rated capacity of the crane/derrick (including the hook, load line, and rigging) meets or exceeds the requirements in 29 CFR 1926 subpart M.
- The equipment operator must be at the work site and informed that the equipment is being used for this purpose.
- No load is suspended from the load line when the personal fall arrest system is anchored to the crane/derrick's hook (or any other part of the load line).

Section 1424 – Work Area Control

This section is designed to protect employees who work near a crane from being struck or crushed by the crane's rotating superstructure. To prevent employees from entering an area where they could be struck/crushed, you must:

- Train each employee assigned to work on or near the equipment in how to recognize struck-by and pinch/crush hazard areas posed by the rotating superstructure.
- Erect and maintain control lines, warning lines, railings, or similar barriers to mark the boundaries of the hazard areas. ***Exception:*** When you can demonstrate that it is neither feasible to erect such barriers on the ground nor on the equipment, the hazard areas must be clearly marked by a combination of warning signs (such as "Danger – Swing/Crush Zone") and high visibility markings on the equipment that identify the hazard areas. In addition, you must train each employee to understand what these markings signify.

Before an employee goes to a location in the hazard area that is out of view of the operator, the employee (or someone instructed by the employee) ensures that the operator is informed that he/she is going to that location. Where the operator knows that an employee went to such a location, the operator must not rotate the superstructure until the operator is informed in accord with a pre-arranged system of communication that the employee is in a safe position.

Section 1425 – Keeping Clear of the Load

This section seeks to protect employees against being struck by a moving or falling load.

SAFE HOISTING ROUTES: Where available, hoisting routes that minimize the exposure of employees to hoisted loads must be used, to the extent consistent with public safety.

STATIONARY SUSPENDED LOADS: While the operator is not moving a suspended load, no employee may be within the fall zone, except for employees:

- Engaged in hooking, unhooking, or guiding the load;
- Engaged in the initial attachment of the load to a component or structure; or
- Operating a concrete hopper or concrete bucket.

HOOKING, UNHOOKING, OR GUIDING THE LOAD: When employees in the fall zone are engaged in hooking, unhooking, or guiding the load, or are connecting a load to a component or structure, all of the following criteria must be met:

- The materials being hoisted must be rigged to prevent unintentional displacement.
- Hooks with self-closing latches or their equivalent must be used. ***Exception:*** "J" hooks may be used for setting wooden trusses so that a worker need not go onto the truss to open the hook.
- The materials must be rigged by a qualified rigger.

RECEIVING A LOAD: Only employees needed to receive a load are permitted to be within the fall zone when a load is being landed.

TILT-UP OR TILT-DOWN OPERATION: During a tilt-up or tilt-down operation:

- No employee may be directly under the load.
- Only employees essential to the operation are permitted in the fall zone (but not directly under the load). Such employees include those who must be in the fall zone to guide the load, monitor the load's movement, or attach and/or detach the load.

Section 1426 – Free Fall and Controlled Load Lowering

FREE FALL GENERALLY PROHIBITED: Some older cranes are designed with a "live boom," where the rate of lowering the boom can only be controlled by a brake. Failure of the brake can lead to free fall of the boom and a risk of death or serious injury to workers near the crane. This standard prohibits the use of equipment with a live boom unless:

- The equipment was manufactured before October 31, 1984, or
- The equipment is a floating crane/derrick or a land crane/derrick on a vessel/flotation device.

FREE FALL SPECIFICALLY PROHIBITED: Even in the two situations where the equipment may have a live boom, the equipment may not be used in the following circumstances:

- An employee is in the fall zone of the boom or load.
- An employee is being hoisted.
- The load or boom is directly over a power line, or over any part of the area extending the Table A of § 1926.1408 clearance distance to each side of the power line; or any part of the area extending the Table A clearance distance to each side of the power line is within the radius of vertical travel of the boom or the load.
- The load is over a shaft, except where there are no employees in the shaft.
- The load is over a cofferdam, except where there are no employees in the fall zone of the boom or the load.
- Lifting operations are taking place in a refinery or tank farm.

BACKUP PROTECTION: In the situations listed above where the use of equipment with a live boom is prohibited, the boom hoist must have a secondary mechanism or device designed to prevent the boom from falling in the event the primary system used to hold or regulate the boom hoist fails, as follows:

- Friction drums must have:
  - A friction clutch and, in addition, a braking device, to allow for controlled boom lowering.
  - A secondary braking or locking device, which is manually or automatically engaged, to backup the primary brake while the boom is held (such as a secondary friction brake or a ratchet and pawl device).
- Hydraulic drums must have an integrally mounted holding device or internal static brake to prevent boom hoist movement in the event of hydraulic failure.
- Neither clutches nor hydraulic motors may be considered brake or locking devices for purposes of this subpart.
- Hydraulic boom cylinders must have an integrally mounted holding device.

PREVENTING UNCONTROLLED RETRACTION: Hydraulic telescoping booms must have an integrally mounted holding device to prevent the boom from retracting in the event of hydraulic failure.

LOAD LINE FREE FALL PROHIBITED. In each of the following circumstances, controlled load lowering is required and free fall of the load line hoist is prohibited:

- An employee is directly under the load.
- An employee is being hoisted.
- The load is directly over a power line, or over any part of the area extending the Table A of § 1926.1408 clearance distance to each side of the power line; or any part of the area extending the Table A of § 1926.1408 clearance distance to each side of the power line is within the radius of vertical travel of the load.
- The load is over a shaft.
- The load is over a cofferdam, except where there are no employees in the fall zone of the load.

Section 1427 – Operator Qualification and Certification

IMPORTANT: On September 26, 2014, OSHA published a final rule that extends the deadline for crane operator certification in the cranes standard at 29 CFR 1926.1427 for 3 years, to November 10, 2017 (published in the Federal Register, available at www.regulations.gov). The proposed changes also extend the employer's duty to ensure that operators are competent to operate the crane safely for the same three year period. During this extension, OSHA will consider addressing operator qualification through additional rulemaking. OSHA will provide updated information about the crane operator certification and qualification requirements as it becomes available at www.osha.gov/cranes-derricks.

Question 1: What must employers do before the operator certification requirements go into effect to ensure the competency of their operators?

Answer 1: Employers must ensure that equipment operators are competent through training and experience to operate the equipment safely (see 29 CFR 1926.1427(k)(2)). If an employee assigned to operate a crane does not have the required knowledge or ability to operate the equipment safely, the employer must train that employee before allowing him or her to operate the equipment and must evaluate the operator to confirm that he/she understands the information provided in the training (see 29 CFR 1926.1427(f) training requirements).

Question 2: Does OSHA require operators to be certified under existing state, county, or city licensing programs?

Answer 2: The answer depends on whether the licensing criteria meets the minimum requirements ("federal floor") in 29 CFR 1926.1427(e)(2) and (j). If a state or local jurisdiction has a licensing program that meets the federal floor, OSHA requires the employer to ensure that all operators operating within that jurisdiction are licensed by that state or local jurisdiction, unless they are qualified by the U.S. Military (see §1926.1427(a)(1)). This requirement went into effect in November 2010. Note, however, that the crane standard's operator certification requirements do not supersede state or local licensing laws. If the licensing program does not meet the federal floor, OSHA does not require operators to be licensed in accordance with that program, although the operator may still be subject to action by the state or local authority for failure to comply with its requirements.

Question 3: Who will determine if a state or local operator certification process meets the "Federal floor" requirements in new 29 CFR 1926.1427?

Answer 3: Initially, states or local governments are responsible for determining if a state or local operator certification program meets the requirements of 29 CFR 1926.1427(e)(2)(i-ii) (see §1926.1427(e)(2)(iii)). OSHA does not require compliance with a state or local licensing requirement unless the state or local authority that oversees the licensing department/office assesses that program and determines that it meets the minimum requirements in §1926.1427(e)(2)(i) and (ii), including satisfying the substantive testing criteria of §1926.1427(j) through written and practical tests and providing testing procedures for re-licensing. OSHA does not intend to require compliance with a state or local licensing requirement absent a public statement by the authority with oversight responsibility for the licensing office that the licensing program meets OSHA's minimum requirements and the reason for that determination. However, OSHA has the final authority in determining that the program meets minimum OSHA requirements.

Question 4: Is the option for qualification by the U.S. Military available to employees of private contractors working under contract to the Department of Defense?

Answer 4: No. This option is only available to civilian and uniformed employees of the Department of Defense. When the operator certification requirements are in effect, private contractors must use one of the other options for operator certification/qualification available under 29 CFR 1926.1427.

Section 1428 – Signal Person Qualifications

Each signal person must meet the following qualification requirements:

- Know and understand the type of signals used. If hand signals are used, the signal person must know and understand the Standard Method for hand signals.
- Be competent in the application of the type of signals used.
- Have a basic understanding of equipment operation and limitations, including the crane dynamics involved in swinging and stopping loads and boom deflection from hoisting loads.
- Know and understand the relevant requirements of the sections of the standard dealing with signals.
- Demonstrate that he/she meets these requirements through an oral or written test, and through a practical test.

The employer of the signal person must ensure that the signal person meets these Qualification Requirements through one of the following qualification options:

Option (1) – Third party qualified evaluator. The signal person has documentation from a third party qualified evaluator (see section 1401 for definition of "Qualified Evaluator (third party)") showing that the signal person meets the qualification requirements.

Option (2) – Employer's qualified evaluator. The employer's qualified evaluator (see section 1401 for definition of "Qualified Evaluator (not a third party)") and determines that the individual meets the qualification requirements.

The employer must make the documentation for whichever option is used available at the site while the signal person is employed by the employer. Such documentation is considered "available" when it is physically present on the site or retrievable via an on-site computer. The documentation must specify each type of signaling (e.g., hand signals, radio signals, etc.) for which the signal person meets the requirements of paragraph (c) of this section.

If subsequent actions by the signal person indicate that the individual does not meet the qualification requirements, the employer must not allow the individual to continue working as a signal person until retraining is provided and a reassessment is made under one of the two options that confirms that the individual meets the qualification requirements.

Section 1429 – Qualifications of Maintenance & Repair Employees

Improper crane maintenance and repair can lead to dangerous equipment failure. To ensure that maintenance and repair employees are qualified to perform their assigned tasks, this section requires maintenance and repair personnel to meet the definition of a qualified person with respect to the equipment and maintenance/repair tasks they perform. The definition of "qualified person" is found in section 1401.

Some maintenance and repair tasks may require the maintenance and repair personnel to operate the equipment to diagnose a problem or check its operation. Such personnel need not be qualified or certified under section 1427 to operate the equipment as long as the following requirements are met:

- The operation is limited to those functions necessary to perform maintenance, inspect the equipment, or verify its performance, and
- The personnel either:
  - Operate the equipment under the direct supervision of an operator who meets the qualification/certification requirements of section 1427, or
  - Are familiar with the operation, limitations, characteristics, and hazards associated with the type of equipment.

Section 1430 – Training

Other sections of this standard require training in specific topics. This section lists the training requirements found in other sections and includes additional training requirements not found elsewhere.

TRAINING REQUIREMENTS SPECIFIED ELSEWHERE:

- ***Overhead powerlines.*** (Sections 1408(g) and 1410(m))
- ***Signal persons.*** (Section 1428(c))
- ***Operators.*** (See section 1427 for the training required for operators during the four-year transitional period for operator qualification/certification, for operators of equipment that does not require qualification/certification, and for operators-in-training).

ADDITIONAL TRAINING REQUIREMENTS:

- ***Operators.*** You must train each equipment operator in the manufacturer's emergency procedures for halting unintended equipment movement and in the following practice: whenever moving a boom off a support, first raise the boom a short distance (sufficient to take the load of the boom) to determine if the boom hoist brake needs to be adjusted or repaired.
- ***Competent persons and qualified persons.*** You must train each competent person and each qualified person in the requirements of this standard that apply to them.
- ***Crush/pinch points.*** You must train each employee who works with the equipment to keep clear of holes, crush/pinch points, and the hazards addressed in section 1424 (Work area control).
- ***Tag-out.*** You must train each operator and each additional employee authorized to start/energize equipment or operate equipment controls (such as maintenance and repair employees) in the tag-out and start-up procedures in sections 1417(f) and (g).

TRAINING ADMINISTRATION: You have the following responsibilities with respect to each employee who must be trained under this standard:

- Evaluate each employee to confirm that the employee understands the information provided in the training.
- Provide refresher training in relevant topics for each employee when, based on the conduct of the employee or an evaluation of the employee's knowledge, there is an indication that retraining is necessary.
- Provide the training at no cost to the employee.

Section 1431 – Hoisting Personnel

HOISTING PERSONNEL IS GENERALLY PROHIBITED: Cranes and derricks may not be used to hoist employees except where the employer demonstrates that the erection, use, and dismantling of conventional means of reaching the work area, such as a personnel hoist, ladder, stairway, aerial lift, elevating work platform, or scaffold, would be more hazardous, or is not possible because of the project's structural design or worksite conditions.

This section contains stringent criteria to assure the safety of personnel who must be hoisted by a crane or derrick. These criteria are fundamentally the same as those in the prior standard.

USE OF PERSONNEL PLATFORM: A personnel platform must be used when hoisting employees except when hoisting them:

- Into and out of drill shafts that are 8 feet in diameter or smaller.
- In pile driving operations.
- Solely for transfer to or from a marine worksite in a marine-hoisted personnel transfer device.
- In storage tank (steel or concrete), shaft, and chimney operations.

Where these exceptions apply, the employee may be hoisted in either a personnel platform or a boatswain's chair. See the standard for rules applicable to these special types of lifts.

PERSONNEL PLATFORM CRITERIA: The personnel platform must conform to the following:

- A qualified person familiar with structural design must design the personnel platform and attachment/suspension system used for hoisting personnel.
- The system used to connect the personnel platform to the equipment must allow the platform to remain within 10 degrees of level, regardless of boom angle.

- The suspension system must be designed to minimize tipping of the platform due to movement of employees occupying the platform.
- The personnel platform itself (excluding the guardrail system and personal fall arrest system anchorages) must be able to support, without failure, its own weight and at least five times the maximum intended load.
- All welding of the personnel platform and its components must be performed by a certified welder familiar with the weld grades, types and material specified in the platform design.
- The personnel platform must be equipped with a guardrail system which meets OSHA criteria and must be enclosed at least from the toeboard to mid-rail with either solid construction material or expanded metal having openings no greater than ½ inch. Points to which personal fall arrest systems are attached must meet OSHA anchorage requirements.
- A grab rail must be installed inside the entire perimeter of the personnel platform except for access gates/doors.
- If installed, access gates/doors of all types (including swinging, sliding, folding, or other types) must:
    - Not swing outward. However, if due to the size of the personnel platform, such as a 1-person platform, it is infeasible for the door to swing inward and allow safe entry for the platform occupant, then the access gate/door may swing outward.
    - Be equipped with a device that prevents accidental opening.
- Headroom must be sufficient to allow employees to stand upright in the platform.
- In addition to the use of hard hats, employees must be protected by overhead protection on the personnel platform when employees are exposed to falling objects. The platform overhead protection must not obscure the view of the operator or platform occupants (such as wire mesh that has up to ½ inch openings) unless full protection is necessary.
- All edges exposed to employee contact must be smooth enough to prevent injury.

- The weight of the platform and its rated capacity must be conspicuously posted on the platform with a plate or other permanent marking.
- The personnel platform must not be loaded in excess of its rated capacity.
- Personnel platforms must be used only for employees, their tools, and the materials necessary to do their work.
- Materials and tools must be secured to prevent displacement and evenly distributed within the platform.
- The number of employees occupying the personnel platform must not exceed the maximum number the platform was designed to hold or the number required to perform the work, whichever is less.

HOISTING EQUIPMENT: The hoisting equipment must meet the following criteria when hoisting personnel:

- The equipment must be uniformly level, within one percent of level grade, and located on footing that a qualified person has determined to be sufficiently firm and stable.
- Equipment with outriggers or stabilizers must have them all extended and locked. The amount of extension must be the same for all outriggers and stabilizers and in accord with manufacturer procedures and load charts.
- The total load (including the hook, load line and rigging) must not exceed 50 percent of the rated capacity for the radius and configuration of the equipment, except during proof testing.
- When the occupied personnel platform is in a stationary working position, the load and boom hoist brakes, swing brakes, and operator actuated secondary braking and locking features (such as pawls or dogs) or automatic secondary brakes must be engaged.
- The equipment must be equipped with the safety devices specified in section 1431(d)(5).
- Attachments and rigging hardware must meet the criteria specified in section 1431(g).

TRIAL LIFT AND INSPECTION: A trial lift with the unoccupied personnel platform loaded at least to the anticipated liftweight must be made from ground level, or any other location where employees will enter the platform, to each location at which the platform is to be hoisted and positioned. Where there is more than one location to be reached from a single set-up position, either individual trial lifts for each location, or a single trial lift, in which the platform is moved sequentially to each location, must be performed; the method selected must be the same as the method that will be used to hoist the personnel. Immediately after the trial lift, a competent person must visually inspect the equipment, base support or ground, and personnel platform, to determine whether the trial lift has exposed any defect or problem or produced any adverse effect. Any condition found during the trial lift and subsequent inspection that fails to meet a requirement of this standard or otherwise creates a safety hazard must be corrected before hoisting personnel.

PROOF TESTING: Prior to hoisting employees on the personnel platform, and after any repair or modification, the platform and rigging must be proof tested to 125 percent of the platform's rated capacity. The proof test may be done concurrently with the trial lift. Personnel hoisting must not be conducted until a competent person determines that the platform and rigging have successfully passed the proof test.

WORK PRACTICES: The following practices must be used:

- Hoisting of the personnel platform must be performed in a slow, controlled, cautious manner, with no sudden movements of the equipment or the platform.
- Platform occupants must keep all parts of the body inside the platform during raising, lowering, and horizontal movement, and must not stand, sit on, or work from the top or intermediate rail or toe-board, or use any other means/device to raise their working height.
- Before employees exit or enter a hoisted personnel platform that is not landed, the platform must be secured to the structure where the work is to be performed, unless the employer can demonstrate that securing the platform to the structure would create a greater hazard.
- If the platform is tied to the structure, the operator must not move the platform until the operator receives confirmation that it is freely suspended.

- Tag lines must be used when necessary to control the platform.
- Where the platform is not equipped with controls, the equipment operator must remain at the equipment controls, on site, and in view of the equipment, at all times while the platform is occupied.
- Where the platform is equipped with controls, all of the following must be met at all times while the platform is occupied:
  - The occupant using the controls in the platform must be a qualified person with respect to their use, including the safe limitations of the equipment and hazards associated with its operation.
  - The equipment operator must be at a set of equipment controls that include boom and swing functions of the equipment, and must be on site and in view of the equipment.
  - The platform operating manual must be in the platform or on the equipment.
- When wind speed (sustained or gusts) exceeds 20 mph at the personnel platform, or other potentially dangerous weather conditions are present, a qualified person must determine if, in light of the wind conditions, it is not safe to lift personnel. If it is not, the lifting operation must not begin (or, if already in progress, must be terminated).
- Employees being hoisted must remain in direct communication with the signal person (where used) or the operator.
- Except over water, employees occupying the personnel platform must be provided and use a personal fall arrest system attached to a structural member within the personnel platform. (The fall arrest system must meet the requirements in § 1926.502). When working over or near water, the requirements of § 1926.106 apply.
- No lifts may be made on any other of the equipment's load lines while personnel are being hoisted, except in pile driving operations.
- Hoisting of employees while the equipment (other than derricks) is traveling is prohibited except in certain circumstances. Derricks are prohibited from traveling while personnel are hoisted.

PRE-LIFT MEETING: A pre-lift meeting must be held before the trial lift to review the applicable requirements of this section and the procedures that will be followed. The meeting must be attended by the equipment operator, signal person (if used for the lift), employees to be hoisted, and the person responsible for the task to be performed.

HOISTING PERSONNEL NEAR POWER LINES: Hoisting personnel within 20 feet of a power line that is up to 350 kV, and hoisting personnel within 50 feet of a power line that is over 350 kV, is prohibited (except for power transmission and distribution work).

Section 1432 – Multiple-Crane/ Derrick Lifts

Lifts in which more than one crane or derrick is used require careful planning and precise coordination. It is particularly important to determine how the weight of the load will be distributed among the multiple pieces of equipment during all phases of the operation to ensure that all are operated within their rated capacities. Accordingly, when more than one crane/derrick is used to support the load, a plan must be developed and implemented. The plan must be developed by a qualified person and be designed to ensure that all requirements of this standard are met. Where the qualified person determines that engineering expertise is needed for the planning, the employer must ensure that it is provided.

The multiple-crane/derrick lift must be directed by a lift director who meets the criteria for both a competent person and a qualified person, or by a competent person who is assisted by one or more qualified persons. The lift director must review the plan in a meeting with all workers who will be involved with the operation.

Section 1433 – Design, Construction and Testing

For equipment to be used safely, it must be built with appropriate safety features and maintained in a safe condition. Although manufacturers are not directly subject to this standard, crane users rely on manufacturers to see that the equipment is built and tested so that it is safe when it leaves the manufacturer. Therefore, with the exceptions discussed below, the crane user's obligations under this section are met where the employer can refer to documentation from the manufacturer showing that the equipment has been designed, constructed and tested in accord with this section and the equipment has not changed since it was manufactured (except in accord with Section 1434 – Equipment Modifications).

You **cannot** rely on manufacturer documentation to comply with the following requirements:

RATED CAPACITY AND RELATED INFORMATION: The following information must be available in the cab:

- A complete range of the manufacturer's equipment rated capacities.
- A work area chart for which capacities are listed in the load chart. (The work area figure and load chart must clearly indicate the areas where no load is to be handled).
- Recommended reeving for the hoist lines.
- Recommended parts of hoist reeving, size, and type of wire rope for various equipment loads.
- Recommended boom hoist reeving diagram, where applicable; size, type and length of wire rope.
- Tire pressure (where applicable).
- Caution or warnings relative to limitations on equipment and operating procedures, including an indication of the least stable direction.
- Position of the gantry and requirements for intermediate boom suspension (where applicable).
- Instructions for boom erection and conditions under which the boom, or boom and jib combinations, may be raised or lowered.
- Whether the hoist holding mechanism is automatically or manually controlled, whether free fall is available, or any combination of these.
- The maximum telescopic travel length of each boom telescopic section.
- Whether sections are telescoped manually or with power.
- The sequence and procedure for extending and retracting the telescopic boom section.

- Maximum loads permitted during the boom extending operation, and any limiting conditions or cautions.
- Hydraulic relief valve settings specified by the manufacturer.

MISCELLANEOUS REQUIREMENTS:

- Load hooks (including latched and unlatched types), ball assemblies, and load blocks must be of sufficient weight to overhaul the line from the highest hook position for boom or boom and jib lengths and the number of parts of the line in use.
- Hook and ball assemblies and load blocks must be marked with their rated capacity and weight.
- Hooks must be equipped with latches, except where a qualified person has determined that it is safer to hoist and place the load without latches (or with the latches removed/tied-back), and routes for the loads are pre-planned to ensure that no employee is required to work in the fall zone except for employees necessary for the hooking or unhooking of the load.
- Posted warnings required by this standard as well as those originally supplied with the equipment by the manufacturer must be maintained in legible condition.
- An accessible fire extinguisher must be on the equipment.

Section 1434 – Equipment Modifications

This section applies to modifications that affect the capacity or safe operation of the equipment. Its provisions safeguard against unsafe equipment modifications and provide that the modifications are reflected in the equipment's instructions and specifications so that the modified equipment can be used safely.

MANUFACTURER REVIEW AND APPROVAL:
The equipment's manufacturer is uniquely qualified to evaluate any proposed modifications to the equipment. If the manufacturer is available and is willing to evaluate the proposed modifications, any modifications or additions that affect the capacity or safe operation of the equipment are only permitted where:

- The manufacturer approves the modifications/additions in writing, and
- The load charts, procedures, instruction manuals, and instruction plates/tags/decals are modified as necessary to accord with the modification/addition.

MANUFACTURER REVIEW UNAVAILABLE:
In the event the manufacturer is unavailable, is unwilling to review the proposed modification/addition or to reject it in writing, fails to initiate the review or acknowledge the request within 30 days, or fails to complete the review within 120 days, the modification/addition may be made if a registered professional engineer who is a qualified person with respect to the equipment involved:

- Approves the modification/addition and specifies the equipment configurations to which that approval applies, and
- Modifies load charts, procedures, instruction manuals, and instruction plates/tags/decals as necessary to accord with the modification/addition.

Under this option as well as that involving manufacturer approval, the original safety factor of the equipment may not be reduced.

Section 1435 – Tower Cranes

Tower cranes present unique issues that are addressed in this section. In general, all provisions of the standard apply to tower cranes unless this section specifies different or additional requirements.

ADDITIONAL REQUIREMENTS FOR ERECTING, CLIMBING, AND DISMANTLING: To reflect industry terminology, "erecting, climbing, and dismantling" are used instead of "assembly/disassembly" when referring to tower cranes. The following requirements apply in addition to those specified in sections 1403-1406:

- Tower crane foundations and structural supports (including both the portions of the structure used for support and the means of attachment) must be designed by the manufacturer or a registered professional engineer.

- The Assembly/Disassembly (A/D) director must determine that tower crane foundations and structural supports are installed in accord with their design.
- The A/D Director must address the backward stability of self-erecting cranes or cranes on traveling or static undercarriages.
- Wind must not exceed the speed recommended by the manufacturer or, where the manufacturer does not specify this information, the speed determined by a qualified person.
- Towers must be erected plumb to the manufacturer's tolerance and verified by a qualified person. Where the manufacturer does not specify plumb tolerance, the crane tower must be plumb to a tolerance of at least 1:500 (approximately 1 inch in 40 feet).
- On jobsites where more than one fixed jib (hammerhead) tower crane is installed, the cranes must be located such that no crane can come in contact with the structure of another crane. Cranes are permitted to pass over one another.
- Prior to, and during, all climbing procedures (including inside climbing and top climbing), the employer must comply with all manufacturer prohibitions and have a registered professional engineer verify that the host structure is strong enough to sustain the forces imposed through the braces, brace anchorages, and supporting floors.
- Equipment must not be erected, dismantled or operated without the amount and position of counterweight and/or ballast in place as specified by the manufacturer or a registered professional engineer familiar with the equipment. The maximum counterweight and/or ballast specified by the manufacturer or registered professional engineer must not be exceeded.
- The size and location of signs installed on tower cranes must be in accord with manufacturer specifications. Where these are unavailable, a registered professional engineer familiar with the type of equipment involved must approve in writing the size and location of any signs.

PARTICULAR CAUTION REQUIRED WHEN USING SYNTHETIC SLINGS: This requirement appears in section 1404(r) but bears repeating here: when using synthetic slings during erecting, climbing, and dismantling, you must follow the synthetic sling manufacturer's instructions, limitations, specifications and recommendations. Synthetic slings must be protected from abrasive, sharp or acute edges, and configurations that could cause a reduction of the sling's rated capacity, such as distortion or localized compression.

SAFETY DEVICES: Different safety devices than those specified in section 1415 are required on tower cranes. Those required on tower cranes are:

- **Boom stops** on luffing boom type tower cranes.
- **Jib stops** on luffing boom type tower cranes if equipped with a jib attachment.
- **Travel rail end stops** at both ends of travel rail.
- **Travel rail clamps** on all travel bogies.
- **Integrally mounted check valves** on all load-supporting hydraulic cylinders.
- **Hydraulic system pressure limiting device.**
- The following **brakes**, which must automatically set in the event of pressure loss or power failure, are required:
    - A **hoist brake** on all hoists.
    - **Swing brake.**
    - **Trolley brake.**
    - **Rail travel brake.**
- **Deadman control** or forced neutral return control (hand) levers.
- **Emergency stop switch** at the operator's station.
- **Trolley end stops** must be provided at both ends of travel of the trolley.

Proper operation of these safety devices is required before operations can begin.

OPERATIONAL AIDS: Different operational aids than those specified in section 1416 are required for tower cranes. Those required on tower cranes are:

- **Trolley travel limiting device** at both trolley end stops.
- **Boom hoist limiting device** that limits the range of the boom at the minimum and maximum radius.
- **Anti two-blocking device.**

- **Hoist drum lower limiting device** on tower cranes manufactured after November 8, 2011.
- **Load moment limiting device.**
- **Hoist line pull limiting device.**
- **Rail travel limiting device.**
- **Boom hoist drum positive locking device and control.**
- **Boom angle or hook radius indicator** readable from the operator's station. (Required on all luffing boom tower cranes and on hammerhead tower cranes manufactured after November 8, 2011).
- **Trolley travel deceleration device.**
- **Boom hoist deceleration device.**
- **Load hoist deceleration device.**
- **Wind speed indicator.**
- **Load indicating device** on tower cranes manufactured after November 8, 2011.

As with operational aids on other equipment, tower cranes may be operated for limited amounts of time with malfunctioning aids as long as the temporary alternative measures specified in the standard are taken.

INSPECTIONS: Additional inspection requirements for tower cranes are discussed under section 1412 (Inspections).

Section 1436 – Derricks

OPERATOR QUALIFICATIONS: Derrick operators need not meet the operator qualification/certification requirement of section 1427. However, you must train each derrick operator on how to operate the equipment safely.

LOAD CHARTS: For permanently installed derricks with fixed lengths of boom, guy, and mast, a load chart must be posted where it is visible to personnel responsible for the operation of the equipment. For derricks that are not permanently installed, the load chart must be readily available at the job site to personnel responsible for operating the equipment. Load charts must contain at least the following information:

- Rated capacity at corresponding ranges of boom angle or operating radii.

- Specific lengths of components to which the rated capacities apply.
- Required parts for hoist reeving.
- Size and construction of rope must be included on the load chart or in the operating manual.

CONSTRUCTION: Derricks must be constructed to meet all stresses imposed on members and components when installed and operated in accord with the manufacturer's/ builder's procedures and within its rated capacity. Load anchoring data developed by the manufacturer or a qualified person must be used.

Specific additional construction requirements are specified for:

- Guy derricks
- Stiffleg derricks
- Gin pole derricks
- Chicago boom derricks

SWINGERS AND HOISTS: The boom, swinger mechanisms, and hoists must be suitable for the derrick work intended and must be anchored to prevent displacement from the imposed loads.

Hoists must meet the following requirements:

- Base mounted drum hoists must meet certain specified requirements of ASME B30.7-2001 ("Base-Mounted Drum Hoists").
- New hoists must be load tested to a minimum of 110% of rated capacity, but not more than 125% of rated capacity, unless otherwise recommended by the manufacturer. This requirement is met where the manufacturer has conducted the testing.
- Hoists that have had repairs, modifications, or additions affecting their capacity or safe operation must be evaluated by a qualified person to determine if a load test is necessary. If it is, load testing must be conducted in the manner specified in the standard.

OPERATIONAL AIDS: The operational aids requirements listed in section 1416 apply to derricks except (1) a boom hoist limiting device (required by section 1416 for other equipment) is not required for derricks, and (2) alternative requirements to those in section 1416 are specified for the following two operational aids:

Boom angle or radius indicator: Such a device is not required, but if the derrick is not equipped with a functioning one, the employer must ensure that either:

- The boom hoist cable is marked with caution and stop marks. The stop marks must correspond to maximum and minimum allowable boom angles. The caution and stop marks must be in view of the operator or a spotter who is in direct communication with the operator; or
- An electronic or other device that signals the operator in time to prevent the boom from moving past its maximum and minimum angles, or automatically prevents such movement, is used.

Load weight/capacity device. Derricks manufactured after November 8, 2011 with a maximum rated capacity over 6,000 pounds must have at least one of the following: load weighing device, load moment indicator, rated capacity indicator, or rated capacity limiter.

POST-ASSEMBLY APPROVAL AND TESTING: The following requirements apply to new or reinstalled derricks:

- ***Anchorages.*** Anchorages, including the structure to which the derrick is attached (if applicable), must be approved by a qualified person.
- ***Functional test.*** Prior to initial use, new or reinstalled derricks must be tested by a competent person with no hook load to verify proper operation. This test must include:
  - Lifting and lowering the hook(s) through the full range of hook travel.
  - Raising and lowering the boom through the full range of boom travel.
  - Swinging in each direction through the full range of swing.
  - Actuating the anti two-block and boom hoist limit devices (if provided).
  - Actuating locking, limiting, and indicating devices (if provided).

- ***Load test.*** Prior to initial use, new or reinstalled derricks must pass a load test conducted by a competent person. Test loads must be at least 100% and no more than 110% of the rated capacity, unless otherwise recommended by the manufacturer or qualified person, but in no event must the test load be less than the maximum anticipated load. The test must consist of:
  - Hoisting the test load a few inches and holding to verify that the load is supported by the derrick and held by the hoist brake(s).
  - Swinging the derrick, if applicable, the full range of its swing, at the maximum allowable working radius for the test load.
  - Booming the derrick up and down within the allowable working radius for the test load.
  - Lowering, stopping, and holding the load with the brake(s).
- ***Test documentation.*** The functional and load tests must be documented. The document must contain the date, test results, and name of the tester. The document must be retained until the derrick is retested or dismantled, whichever occurs first. All such documents must be available during the applicable document retention period to all persons who conduct required inspections (see section 1412).

LOAD TESTING REPAIRED OR MODIFIED DERRICKS: Derricks that have had repairs, modifications, or additions affecting the derrick's capacity or safe operation must be evaluated by a qualified person to determine if a load test is necessary. If it is, load testing must be conducted and documented.

POWER FAILURE PROCEDURES: If power fails during operations, the derrick operator must safely stop operations. This must include setting all brakes or locking devices and moving all clutch and other power controls to the off position.

JUMPING: The process of jumping a derrick must be supervised by the Assembly/Disassembly (A/D) director.

Section 1437 – Floating Cranes/ Derricks and Land Cranes/Derricks on Barges

This section contains requirements for floating cranes and derricks that supplement the other requirements of the standard. Because this equipment is highly specialized and is not used by most construction employers, this Guide will only address a few of the areas where additional or different requirements are specified for this type of equipment.

INSPECTIONS: Additional items must be inspected during the shift, monthly, and annual inspections. In addition, every four years, a marine engineer, marine architect, licensed surveyor, or other qualified person who has expertise with respect to vessels/flotation devices must survey the internal portion of the barge, pontoons, vessel, or other means of flotation.

SAFETY DEVICES: The following additional safety devices are required: barge, pontoon, vessel, or other means of flotation list and trim device; positive equipment house lock; wind speed and direction indicator (if a competent person determines that wind is a factor that needs to be considered).

WORKING WITH A DIVER: When a crane/derrick is used to lift a diver or divers into and out of the water, it must not be used for any other purpose until all the divers are back on board.

LAND CRANES/DERRICKS ON FLOTATION DEVICES: The rated capacity must be reduced to take into account the additional sources of instability (list, trim, wave action, and wind) resulting from operating on water. Alternative means of physical attachment and an exception to the requirement for physical attachment are specified.

EQUIPMENT DESIGNED FOR USE ON FLOTATION DEVICES: Requirements for maximum list, trim, and wind speed are specified. Additional rules to ensure the structural integrity and stability of the equipment apply to employer-made (as opposed to manufacturer-made) equipment.

Section 1438 – Overhead & Gantry Cranes

Most overhead and gantry cranes are used in general industry rather than construction work. In some cases, overhead and gantry cranes that are usually used in general industry may engage in construction work when they are used to renovate the facility in which they are installed. To prevent the same crane from being subject to general industry and construction standards at different times, this section provides that OSHA's General Industry standard (29 CFR 1910.179) applies to an overhead or gantry crane that is **permanently installed in a facility**.

For overhead and gantry cranes that are **not permanently installed in a facility**, this section lists the provisions of this standard that apply. These are:

- Sections 1400 through 1414.
- Sections 1417 through 1425.
- Section 1426(d).
- Sections 1427 through 1434.
- Sections 1437, 1439, and 1441.

In addition, certain provisions of 29 CFR 1910.179 and certain provisions of ASME B30.2-2005 (Overhead and Gantry Cranes) apply to overhead and gantry cranes not permanently installed in a facility. These provisions are listed in section 1438.

Section 1439 – Dedicated Pile Drivers

Most provisions of this standard apply to dedicated pile drivers. The only exceptions are:

- The requirement in section 1416 for an anti two-blocking device.
- Certain requirements of section 1433 that apply to design, construction, and testing of mobile cranes.
- The requirement in section 1416 for load weighing and similar devices applies only to dedicated pile drivers manufactured after November 8, 2011.

Section 1440 – Sideboom Cranes

Most provisions of this standard apply to sideboom cranes. The exceptions are:

- Section 1402 (Ground conditions),
- Section 1415 (Safety devices),
- Section 1416 (Operational aids), and
- Section 1427 (Operator qualification and certification).

In addition, instead of the provision on boom free fall found in section 1426, sideboom cranes in which the boom is designed to free fall (live boom) are permitted only if manufactured prior to November 8, 2010. This section also specifies that sideboom cranes mounted on wheel or crawler tractors must meet certain listed requirements of ASME B30.14-2004 ("Side Boom Tractors").

Section 1441 – Equipment with a Rated Hoisting/Lifting Capacity of 2,000 Pounds or Less

Although equipment with a capacity of 2,000 pounds or less does not require all of the precautions required for heavier equipment, its operation still presents significant hazards that can cause death or injury. For example, operation near energized power lines requires the same precautions as heavier equipment because the potential for electrocution is the same.

This section lists the provisions of the standard that apply to equipment with a capacity of 2,000 pounds or less and those for which modified requirements apply. The most significant differences are:

- The requirement for operator qualification/certification in section 1427 does not apply. Instead, the employer must train each operator on the safe operation of the equipment before the operator may operate the equipment.
- The requirements for shift, monthly, and annual inspections in section 1412 do not apply. However, post-assembly inspections and the wire rope inspections required by section 1413 must be conducted.

- More limited assembly/disassembly requirements apply.
- The safety devices and operational aids listed in sections 1415 – 1416 need not be used, except for two-block protection. However, safety devices and operational aids that are part of the original equipment must be maintained in accord with manufacturer procedures.
- Signal persons must be adequately trained but need not meet the qualification requirements of section 1428.
- Equipment covered by this section must not be used to hoist personnel.

Appendix A – Directory of States with Approved Occupational Safety and Health Programs

Alaska

Alaska Occupational Safety and Health
3301 Eagle Street, Room 305
Anchorage, AK 99503
Phone (800) 656-4972 or (907) 465-2700
Fax (907) 269-4950

Arizona

Arizona Division of Occupational
Safety and Health (ADOSH)
800 W Washington Street
Phoenix AZ 85007
Phone (602) 542-5795
Toll-Free (855) 268-5251
Fax (602) 542-1614

California

Division of Occupational Safety and Health (DOSH)
1515 Clay Street, 17th Floor
Oakland, CA 94612
Phone (510) 622-8965
Fax (510) 286-7037

Connecticut

Connecticut Occupational Safety and
Health Division (CONN-OSHA)
38 Wolcott Hill Rd
Wethersfield, CT 06109
Phone (860) 263-6900
Fax (860) 263-694

Hawaii
Hawaii Occupational Safety and
Health Division (HIOSH)
830 Punchbowl Street, Suite 321
Honolulu, HI 96813
Phone (808) 586-8841
Fax (808) 586-9116

Illinois
Illinois Department of Labor
Safety Inspection and Education Division
900 South Spring Street
Springfield, IL 62704
Phone (217) 782-9386
Fax (217) 785-8776

Indiana
Indiana Occupational Safety and
Health Administration (IOSHA)
402 West Washington Street, Room W195
Indianapolis, IN 46204
Phone (317) 232-2693
Fax (317) 233-3790

Iowa
Iowa Occupational Safety and Health Administration
1000 E Grand Avenue
Des Moines, IA 50319-0209
Phone (515) 242-5870
Fax (515) 281-7995

Kentucky
Kentucky Occupational Safety and Health
1047 U.S. Highway 127 South, Suite 4
Frankfort, KY 40601
Phone (502) 564-3070
Fax (502) 696-1902

Maryland
Maryland Occupational Safety and Health (MOSH)
10946 Golden West Drive, Suite 160
Hunt Valley, MD 21031
Phone (410) 527-4499
Fax (410) 527-4481

Michigan
Michigan Occupational Safety &
Health Administration (MIOSHA)
P.O. Box 30643
7150 Harris Drive
Lansing, MI 48909-8143
Phone (517) 322-1814
Fax (517) 322-1775

Minnesota
Minnesota Occupational Safety and
Health Administration
443 Lafayette Road N.
St. Paul, MN 55155
Phone (651) 284-5050
Toll-Free (877) 470-6742
Fax (651) 284-5741

Nevada
Nevada Occupational Safety and
Health Administration
1301 N. Green Valley Parkway, Suite 200
Henderson, NV 89074
Phone (702) 486-9000
Fax (702) 486-9172

New Jersey
New Jersey Public Employee Occupational
Safety and Health (PEOSH) Office
One John Fitch Plaza-State Office Building Campus
P.O. Box 110
Trenton, NJ 08625-0110
Phone (609) 633-3896
Fax (609) 292-3749

New Mexico
New Mexico Occupational Health & Safety Bureau
525 Camino de los Marquez, Suite 3
Santa Fe, NM 87502
Phone (505) 476-8700
Fax (505) 476-8734

New York
Public Employees Safety and Health (PESH) Bureau
Governor W. Averell Harriman State Building Campus
Building 12, Room 158
Albany, NY 12240
Phone (518) 457-1263
Fax (518) 457-5545

North Carolina
North Carolina Department of Labor
Occupational Safety and Health Division
1101 Mail Service Center
Raleigh, NC 27699-1101
Phone (919) 807-2900

Oregon
Oregon Occupational Safety and Health Division
(Oregon OSHA)
Salem Central Office
P.O. Box 14480
350 Winter Street, NE, Rm. 430
Salem, OR 97309-0405
Phone (503) 378-3272 (800) 922-2689
Fax (503) 947-7461

Puerto Rico
Puerto Rico Occupational Safety and
Health Administration (PR OSHA)
Prudencio Rivera Martinez Building, 20th Floor
#505 Muñoz Rivera Avenue, 20th floor
Hato Rey, PR 00918
Phone (787) 754-2172
Fax (787) 767-6051

South Carolina
South Carolina Department of Labor,
Licensing & Regulation Division of
Occupational Safety and Health
P.O. Box 11329
Columbia, SC 29211-1329
Phone (803) 896-7665
Fax (803) 896-7670

Tennessee
Tennessee Occupational and Safety and
Health Administration (TOSHA)
220 French Landing Drive
Nashville, TN 37243-1002
Phone (615)741-2793
Fax (615) 741-3325

Utah
Utah Occupational Safety and Health Administration
(Utah OSHA)
160 East 300 South
P.O. Box 146600
Salt Lake City, UT 84114-6650
Phone (801) 530-6800
Fax (801) 530-6044

Vermont
Vermont Occupational Safety and
Health Administration (VOSHA)
5 Green Mountain Drive
P.O. Box 488
Montpelier, VT 05601-0488
Phone (800) 287-2765

Virgin Islands
Virgin Islands Division of Occupational Safety and
Health (VIDOSH) 4401 Sion Farm
Christiansted, St. Croix, VI 00820
Phone (340) 773-1994 or (340) 773-1440
Fax (340) 773-0094

Virginia
Virginia Occupational Safety and Health (VOSH)
10515 Battleview Parkway
Manassas, VA 20109
Phone (703) 392-0900
Fax (703 392-0308

Washington
Division of Occupational Safety and Health (DOSH)
7273 Linderson Way SW
Tumwater, WA 98501-5414
Phone (360) 902-5580
Fax (360) 902-5619

Wyoming
Wyoming Department of Workforce Services,
Wyoming Safety (OSHA) Herschler Building
1510 East Pershing Boulevard, West Wing
Cheyenne, WY 82002
Phone (307) 777-7786
Fax (307) 777-3646

Workers' Rights

Under OSHA law, workers are entitled to working conditions that do not pose a risk of serious harm. To help assure a safe and healthful workplace, the law provides workers with the right to:

- File a confidential complaint with OSHA to have their workplace inspected.
- Receive information and training about hazards, methods to prevent harm, and the OSHA standards that apply to their workplace. The training must be done in a language and vocabulary workers can understand.
- Receive copies of records of work-related injuries and illnesses that occur in their workplace.
- Receive copies of the results from tests and monitoring done to find and measure hazards in their workplace.
- Receive copies of their workplace medical records.
- Participate in an OSHA inspection and speak in private with the inspector.
- File a complaint with OSHA if they have been retaliated against by their employer as the result of requesting an inspection or using any of their other rights under the OSH Act.
- File a complaint if punished or retaliated against for acting as a "whistleblower" under the 21 additional federal laws for which OSHA has jurisdiction.

For more information, visit OSHA's Workers' Rights page at www.osha.gov/workers.html.

OSHA Assistance, Services and Programs

OSHA has a great deal of information to assist employers in complying with their responsibilities under OSHA law. Several OSHA programs and services can help employers identify and correct job hazards, as well as improve their injury and illness prevention program.

Establishing an Injury and Illness Prevention Program

The key to a safe and healthful work environment is a comprehensive injury and illness prevention program.

Injury and illness prevention programs are systems that can substantially reduce the number and severity of workplace injuries and illnesses, while reducing costs to employers. Thousands of employers across the United States already manage safety using injury and illness prevention programs, and OSHA believes that all employers can and should do the same. Thirty-four states have requirements or voluntary guidelines for workplace injury and illness prevention programs. Most successful injury and illness prevention programs are based on a common set of key elements. These include management leadership, worker participation, hazard identification, hazard prevention and control, education and training, and program evaluation and improvement. Visit OSHA's illness and injury prevention program web page at www.osha.gov/dsg/topics/safetyhealth for more information.

Compliance Assistance Specialists

OSHA has compliance assistance specialists throughout the nation located in most OSHA offices. Compliance assistance specialists can provide information to employers and workers about OSHA standards, short educational programs on specific hazards or OSHA rights and responsibilities, and information on additional compliance assistance resources. For more details, visit www.osha.gov/dcsp/compliance_assistance/cas.html or call 1-800-321-OSHA (6742) to contact your local OSHA office.

Free On-site Safety and Health Consultation Services for Small Business

OSHA's On-site Consultation Program offers free and confidential advice to small and medium-sized businesses in all states across the country, with priority given to high-hazard worksites. Each year, responding to requests from small employers looking to create or improve their safety and health management programs, OSHA's On-site Consultation Program conducts over 29,000 visits to small business worksites covering over 1.5 million workers across the nation.

On-site consultation services are separate from enforcement and do not result in penalties or citations. Consultants from state agencies or universities work with employers to identify workplace hazards, provide advice on compliance with OSHA standards, and assist in establishing safety and health management programs.

For more information, to find the local On-site Consultation office in your state, or to request a brochure on Consultation Services, visit www.osha.gov/consultation, or call 1-800-321-OSHA (6742).

Under the consultation program, certain exemplary employers may request participation in OSHA's **Safety and Health Achievement Recognition Program (SHARP)**. Eligibility for participation includes, but is not limited to, receiving a full-service, comprehensive consultation visit, correcting all identified hazards and developing an effective safety and health management program. Worksites that receive SHARP recognition are exempt from programmed inspections during the period that the SHARP certification is valid.

Cooperative Programs

OSHA offers cooperative programs under which businesses, labor groups and other organizations can work cooperatively with OSHA. To find out more about any of the following programs, visit www.osha.gov/dcsp/compliance_assistance/index_programs.html.

Strategic Partnerships and Alliances

The OSHA Strategic Partnerships (OSP) provide the opportunity for OSHA to partner with employers, workers, professional or trade associations, labor organizations, and/or other interested stakeholders. OSHA Partnerships are formalized through unique agreements designed to encourage, assist, and recognize partner efforts to eliminate serious hazards and achieve model workplace safety and health practices. Through the Alliance Program, OSHA works with groups committed to worker safety and health to prevent workplace fatalities, injuries and illnesses by developing compliance assistance tools and resources to share with workers and employers, and educate workers and employers about their rights and responsibilities.

Voluntary Protection Programs (VPP)

The VPP recognize employers and workers in private industry and federal agencies who have implemented effective safety and health management programs and maintain injury and illness rates below the national average for their respective industries. In VPP, management, labor, and OSHA work cooperatively and proactively to prevent fatalities, injuries, and illnesses through a system focused on: hazard prevention and control, worksite analysis, training, and management commitment and worker involvement.

Occupational Safety and Health Training

The OSHA Training Institute in Arlington Heights, Illinois, provides basic and advanced training and education in safety and health for federal and state compliance officers, state consultants, other federal agency personnel and private sector employers, workers, and their representatives. In addition, 27 OSHA Training Institute Education Centers at 42 locations throughout the United States deliver courses on OSHA standards and occupational safety and health issues to thousands of students a year.

For more information on training, contact the OSHA Directorate of Training and Education, 2020 Arlington Heights Road, Arlington Heights, IL 60005; call 1-847-297-4810; or visit www.osha.gov/otiec.

OSHA Educational Materials

OSHA has many types of educational materials in English, Spanish, Vietnamese and other languages available in print or online. These include:

- Brochures/booklets that cover a wide variety of job hazards and other topics;
- Fact Sheets, which contain basic background information on safety and health hazards;
- Guidance documents that provide detailed examinations of specific safety and health issues;
- Online Safety and Health Topics pages;
- Posters;
- Small, laminated QuickCards™ that provide brief safety and health information; and
- *QuickTakes*, OSHA's free, twice-monthly online newsletter with the latest news about OSHA initiatives and products to assist employers and workers in finding and preventing workplace hazards. To sign up for *QuickTakes* visit www.osha.gov/quicktakes.

To view materials available online or for a listing of free publications, visit www.osha.gov/publications. You can also call 1-800-321-OSHA (6742) to order publications.

OSHA's web site also has a variety of eTools. These include utilities such as expert advisors, electronic compliance assistance, videos and other information for employers and workers. To learn more about OSHA's safety and health tools online, visit www.osha.gov.

NIOSH Health Hazard Evaluation Program

Getting Help with Health Hazards

The National Institute for Occupational Safety and Health (NIOSH) is a federal agency that conducts scientific and medical research on workers' safety and health. At no cost to employers or workers, NIOSH can help identify health hazards and recommend ways to reduce or eliminate those hazards in the workplace through its Health Hazard Evaluation (HHE) Program.

Workers, union representatives and employers can request a NIOSH HHE. An HHE is often requested when there is a higher than expected rate of a disease or injury in a group of workers. These situations may be the result of an unknown cause, a new hazard, or a mixture of sources. To request a NIOSH Health Hazard Evaluation go to www.cdc.gov/niosh/hhe/request.html. To find out more about the Health Hazard Evaluation Program:

- Call (513) 841-4382, or to talk to a staff member in Spanish, call (513) 841-4439; or
- Send an email to HHERequestHelp@cdc.gov.

OSHA Regional Offices

Region I
Boston Regional Office
(CT*, ME, MA, NH, RI, VT*)
JFK Federal Building, Room E340
Boston, MA 02203
(617) 565-9860 (617) 565-9827 FAX

Region II
New York Regional Office
(NJ*, NY*, PR*, VI*)
201 Varick Street, Room 670
New York, NY 10014
(212) 337-2378 (212) 337-2371 FAX

Region III
Philadelphia Regional Office
(DE, DC, MD*, PA, VA*, WV)
The Curtis Center
170 S. Independence Mall West
Suite 740 West
Philadelphia, PA 19106-3309
(215) 861-4900 (215) 861-4904 FAX

Region IV
Atlanta Regional Office
(AL, FL, GA, KY*, MS, NC*, SC*, TN*)
61 Forsyth Street, SW, Room 6T50
Atlanta, GA 30303
(678) 237-0400 (678) 237-0447 FAX

Region V
Chicago Regional Office
(IL*, IN*, MI*, MN*, OH, WI)
230 South Dearborn Street
Room 3244
Chicago, IL 60604
(312) 353-2220 (312) 353-7774 FAX

Region VI
Dallas Regional Office
(AR, LA, NM*, OK, TX)
525 Griffin Street, Room 602
Dallas, TX 75202
(972) 850-4145 (972) 850-4149 FAX
(972) 850-4150 FSO FAX

Region VII
Kansas City Regional Office
(IA*, KS, MO, NE)
Two Pershing Square Building
2300 Main Street, Suite 1010
Kansas City, MO 64108-2416
(816) 283-8745 (816) 283-0547 FAX

Region VIII
Denver Regional Office
(CO, MT, ND, SD, UT*, WY*)
Cesar Chavez Memorial Building
1244 Speer Boulevard, Suite 551
Denver, CO 80204
(720) 264-6550 (720) 264-6585 Fax

Region IX
San Francisco Regional Office
(AZ*, CA*, HI*, NV*, and American Samoa, Guam and the Northern Mariana Islands)
90 7th Street, Suite 18100
San Francisco, CA 94103
(415) 625-2547 (415) 625-2534 FAX

Region X
Seattle Regional Office
(AK*, ID, OR*, WA*)
300 Fifth Avenue, Suite 1280
Seattle, WA 98104
(206) 757-6700 (206) 757-6705 FAX

* These states and territories operate their own OSHA-approved job safety and health plans and cover state and local government employees as well as private sector employees. The Connecticut, Illinois, New Jersey, New York and Virgin Islands programs cover public employees only. (Private sector workers in these states are covered by Federal OSHA). States with approved programs must have standards that are identical to, or at least as effective as, the Federal OSHA standards.

Note: To get contact information for OSHA area offices, OSHA-approved state plans and OSHA consultation projects, please visit us online at www.osha.gov or call us at 1-800-321-OSHA (6742).

How to Contact OSHA

For questions or to get information or advice, to report an emergency, report a fatality or catastrophe, order publications, sign up for OSHA's e-newsletter *QuickTakes*, or to file a confidential complaint, contact your nearest OSHA office, visit www.osha.gov or call OSHA at 1-800-321-OSHA (6742), TTY 1-877-889-5627.

For assistance, contact us.
We are OSHA. We can help.

OSHA®
www.osha.gov

U.S. Department of Labor

For more information:

Occupational Safety and Health Administration

www.osha.gov (800) 321-OSHA (6742)

OSHA® FactSheet

Subpart CC – Cranes and Derricks in Construction: Wire Rope – Inspection

This fact sheet describes the inspection requirements of subpart CC – Cranes and Derricks in Construction, as specified in 29 CFR 1926.1413. These provisions are effective November 8, 2010. This document is intended to assist wire rope inspectors and supervisors.

Inspection Trigger	Inspection Details	Performed by	Documentation
Each shift	See list below, visual inspection must begin prior to each shift in which the equipment is used.	Competent Person	Not required
Monthly	See details below.	Competent Person	Required. Must be signed by the person who conducted the inspection and retained for a minimum of 3 months.
Annual	See details below.	Qualified Person	Required. Must be signed by the person who conducted the inspection and retained for a minimum of 12 months.

- The annual/comprehensive and monthly inspections must be documented according to 1926.1412(f)(7) and 1916.1412(e)(3), respectively.
- Rope lubricants of the type that hinder inspection must not be used.
- All documents produced under this section must be available, during the applicable document retention period, to all persons who conduct inspections under this section.

Shift Inspection

Shift inspections are visual inspections that a competent person must begin prior to each shift during which the equipment is used. Shift inspections do not require untwisting (opening) of wire ropes or booming down. The inspection must consist of observation of wire ropes (running and standing) that are likely to be in use during the shift for apparent deficiencies, including the following:

Apparent Deficiencies – Category I	Removal from Service Criteria
• Significant distortion of the wire rope structure such as kinking, crushing, unstranding, birdcaging, signs of core failure, or steel core protrusion between the outer strands. • Significant corrosion. • Electric arc damage (from a source other than power lines) or heat damage. • Improperly applied end connections. • Significantly corroded, cracked, bent, or worn end connections (such as from severe service).	If a Category I deficiency is identified, the competent person must immediately determine whether it constitutes a safety hazard. If the deficiency is determined to be a safety hazard, all operations involving use of the wire rope in question must be prohibited until: • The wire rope is replaced. (See 1926.1417), or • If the deficiency is localized, the problem is corrected by severing the wire rope in two; the undamaged portion may continue to be used. Joining lengths of wire rope by splicing is prohibited. If a rope is shortened under this paragraph, the employer must ensure that the drum will still have two wraps of wire when the load and/or boom is in its lowest position.

Apparent Deficiencies – Category II	Removal from Service Criteria
• Visible broken wires: ∘ In running wire ropes: six randomly distributed broken wires in one rope lay or three broken wires in one strand in one rope lay, where a rope lay is the length along the rope in which one strand makes a complete revolution around the rope. ∘ In rotation-resistant ropes: two randomly distributed broken wires in six rope diameters or four randomly distributed broken wires in 30 rope diameters. ∘ In pendants or standing wire ropes: more than two broken wires in one rope lay located in rope beyond end connections and/or more than one broken wire in a rope lay located at an end connection. • A diameter reduction of more than 5% from nominal diameter.	If a Category II deficiency is identified, operations involving use of the wire rope in question must be prohibited until: • Employer complies with the wire rope manufacturer's established criterion for removal from service, or with a different criterion that the wire rope manufacturer has approved in writing for that specific wire rope. (See 1926.1417). • The wire rope is replaced. (See 1926.1417), or • If the deficiency is localized, the problem is corrected by severing the wire rope in two; the undamaged portion may continue to be used. Joining lengths of wire rope by splicing is prohibited. If a rope is shortened under this paragraph, the employer must ensure that the drum will still have two wraps of wire when the load and/or boom is in its lowest position.

Apparent Deficiencies – Category III	Removal from Service Criteria
• In rotation-resistant wire rope, core protrusion or other distortion indicating core failure. • Prior electrical contact with a power line. • A broken strand.	If a Category III deficiency is identified, operations involving use of the wire rope in question must be prohibited until: • The wire rope is replaced. (See 1926.1417), or • If the deficiency (other than power line contact) is localized, the problem is corrected by severing the wire rope in two; the undamaged portion may continue to be used. Joining lengths of wire rope by splicing is prohibited. Repair of wire rope that contacted an energized power line is also prohibited. If a rope is shortened under this paragraph, the employer must ensure that the drum will still have two wraps of wire when the load and/or boom is in its lowest position.

Where a wire rope is required to be removed from service under this section, either the equipment (as a whole), or the hoist with that wire rope must be tagged-out, in accord with 1926.1417(f)(1), until the wire rope is repaired or replaced.

Critical Review Items

Particular attention must be given to all of the following:

- Rotation-resistant wire rope in use.
- Wire rope being used for boom hoists and luffing hoists, particularly at reverse bends.
- Wire rope at flange points, crossover points, and repetitive pickup points on drums.
- Wire rope at or near terminal ends.
- Wire rope in contact with saddles, equalizer sheaves or other sheaves where rope travel is limited.

Monthly Inspection

Each month an inspection must be conducted as stated under "Shift Inspection" above.

In addition to the criteria for shift inspection, monthly inspections require that:

- The inspection must include any deficiencies that the qualified person who conducts the annual inspection determines under 1926.1413(c)(3)(ii) must be monitored.
- Wire ropes on equipment must not be used until an inspection under this paragraph demonstrates that no corrective action under 1926.1413(a)(4) is required.
- The inspection must be documented according to 1926.1412(e)(3) (monthly inspection documentation).

Annual/Comprehensive Inspection

At least every 12 months, wire ropes in use on equipment must be inspected by a qualified person as stated under "Shift Inspection" above.

In addition to the criteria for shift inspection, annual inspections require that –

- The inspection must be complete and thorough, covering the surface of the entire length of the wire ropes, with particular attention given to all of the following:
  - Critical review items from 1926.1413(a)(3)–(see "Critical Review Items" above).
  - Those sections that are normally hidden during shift and monthly inspections.
  - Wire rope subject to reverse bends.
  - Wire rope passing over sheaves.

Exception

In the event an annual inspection under 1926.1413(c)(2) is not feasible due to existing set-up and configuration of the equipment (such as where an assist crane is needed) or due to site conditions (such as a dense urban setting), such inspections must be conducted as soon as it becomes feasible, but no longer than an additional 6 months for running ropes and, for standing ropes, at the time of disassembly.

- If a deficiency is determined to constitute a safety hazard, operations involving use of the wire rope in question must be prohibited until:
  - The wire rope is replaced (see 1926.1417), or
  - If the deficiency is localized, the problem is corrected by severing the wire rope in two; the undamaged portion may continue to be used. Joining wire rope by splicing is prohibited. If a rope is shortened under this paragraph, the employer must ensure that the drum will still have two wraps of wire when the load and/or boom is in its lowest position.
- If a deficiency is identified and the qualified person determines that, though not presently a safety hazard, the deficiency needs to be monitored, the employer must ensure that the deficiency is checked in the monthly inspections.

Additionally

- The inspection must be documented according to 1926.1412(f)(7).
- Rope lubricants of the type that hinder inspection must not be used.
- All documents produced under this section must be available, during the applicable document retention period, to all persons who conduct inspections under this section.

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

For assistance, contact us. We can help. It's confidential.

OSHA® Occupational Safety and Health Administration

U.S. Department of Labor
www.osha.gov (800) 321-OSHA (6742)

DOC FS-3635 01/2013

OSHA® FactSheet

Reducing Falls in Construction: Safe Use of Extension Ladders

Workers who use extension ladders risk permanent injury or death from falls and electrocutions. These hazards can be eliminated or substantially reduced by following good safety practices. This fact sheet examines some of the hazards workers may encounter while working on extension ladders and explains what employers and workers can do to reduce injuries. OSHA's requirements for extension ladders are in Subpart X—Stairways and Ladders of OSHA's Construction standards.

What is an Extension Ladder?

Also known as "portable ladders," extension ladders usually have two sections that operate in brackets or guides allowing for adjustable lengths. (See Figure 1, below.) Because extension ladders are not self-supporting they require a stable structure that can withstand the intended load.

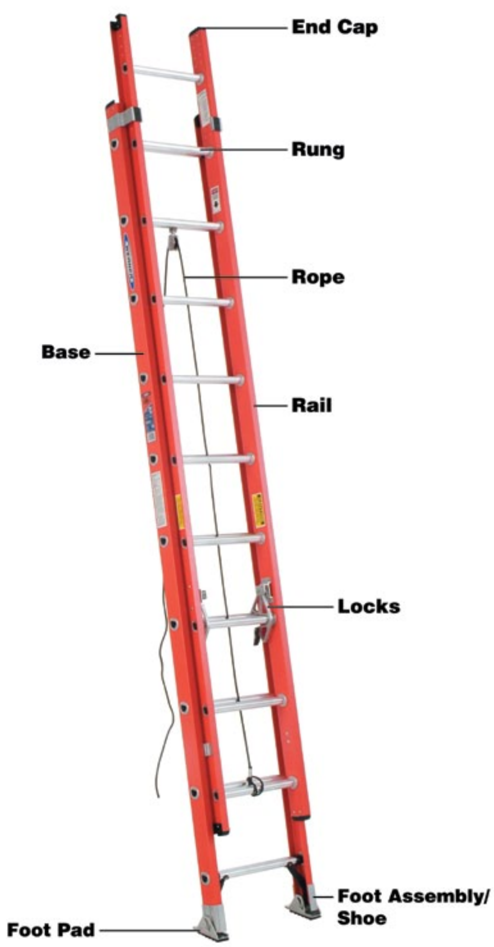


Figure 1: Extension Ladder

PLAN Ahead to Get the Job Done Safely.

- Use a ladder that can sustain at least four times the maximum intended load, except that each extra-heavy duty type 1A metal or plastic ladder shall sustain at least 3.3 times the maximum intended load. Also acceptable are ladders that meet the requirements set forth in Appendix A of Subpart X. Follow the manufacturer's instructions and labels on the ladder. To determine the correct ladder, consider your weight plus the weight of your load. Do not exceed the load rating and always include the weight of all tools, materials and equipment.
- A competent person must visually inspect all extension ladders before use for any defects such as: missing rungs, bolts, cleats, screws and loose components. Where a ladder has these or other defects, it must be immediately marked as defective or tagged with "Do Not Use" or similar language.
- Allow sufficient room to step off the ladder safely. Keep the area around the bottom and the top of the ladder clear of equipment, materials and tools. If access is obstructed, secure the top of the ladder to a rigid support that will not deflect, and add a grasping device to allow workers safe access.
- Set the ladder at the proper angle. When a ladder is leaned against a wall, the bottom of the ladder should be one-quarter of the ladder's working length away from the wall. For access to an elevated work surface, extend the top of the ladder three feet above that surface or secure the ladder at its top.
- Before starting work, survey the area for potential hazards, such as energized overhead power lines. Ladders shall have

nonconductive side rails if they are used where the worker or the ladder could contact exposed energized electrical equipment. Keep all ladders and other tools at least 10 feet away from any power lines.
- Set the base of the ladder so that the bottom sits securely and so both side rails are evenly supported. The ladder rails should be square to the structure against which it is leaning with both footpads placed securely on a stable and level surface.
- Secure the ladder's dogs or pawls before climbing.
- When using a ladder in a high-activity area, secure it to prevent movement and use a barrier to redirect workers and equipment. If the ladder is placed in front of a door, always block off the door.

Figure 2: Ladder extending three feet above the landing area.

PROVIDE the Right Extension Ladder for the Job with the Proper Load Capacity.

Select a ladder based on the expected load capacity (duty rating), the type of work to be done and the correct height. There are five categories of ladder duty ratings.

Type	Duty Rating	Use	Load
IAA*	Special Duty	Rugged	375 lbs.
IA	Extra Duty	Industrial	300 lbs.
I	Heavy Duty	Industrial	250 lbs.
II	Medium Duty	Commercial	225 lbs.
III	Light Duty	Household	200 lbs.

Source for Types IA, I, II, III: Subpart X—Stairways and Ladders, Appendix A (American National Standards Institute (ANSI)) 14.1, 14.2, 14.5 (1982)) of OSHA's Construction standards. Source for Type IAA: ANSI 14.1, 14.2, 14.5 (2009), which are non-mandatory guidelines.

TRAIN Workers to Use Extension Ladders Safely.

Employers must train each worker to recognize and minimize ladder-related hazards.

PLAN.
PROVIDE.
TRAIN.
Three simple steps to prevent falls.

Safe Ladder Use—DO:

- Maintain a 3-point contact (two hands and a foot, or two feet and a hand) when climbing/descending a ladder.
- Face the ladder when climbing up or descending.
- Keep the body inside the side rails.
- Use extra care when getting on or off the ladder at the top or bottom. Avoid tipping the ladder over sideways or causing the ladder base to slide out.
- Carry tools in a tool belt or raise tools up using a hand line. Never carry tools in your hands while climbing up/down a ladder.
- Extend the top of the ladder three feet above the landing. (See Figure 2.)
- Keep ladders free of any slippery materials.

Safe Ladder Use—DO NOT:

- Place a ladder on boxes, barrels, or unstable bases.
- Use a ladder on soft ground or unstable footing.
- Exceed the ladder's maximum load rating.
- Tie two ladders together to make them longer.
- Ignore nearby overhead power lines.
- Move or shift a ladder with a person or equipment on the ladder.
- Lean out beyond the ladder's side rails.
- Use an extension ladder horizontally like a platform.

OSHA standard: **29 CFR 1926 Subpart X**—Stairways and Ladders

American National Standards Institute standard: **ANSI A14.1, A14.2, A14.5—Ladder Safety Requirements** *(Not an OSHA standard, included to be used as guidance to meet OSHA's requirements)*

Employers using extension ladders must follow the ladder requirements set forth in 29 CFR 1926 Subpart X. Per Appendix A to Subpart X of Part 1926—Ladders, ladders designed in accordance with the following ANSI standards will be considered in accordance with 29 CFR 1926.1053(a)(1): ANSI A14.1-1982—American National Standard for Ladders—Portable Wood—Safety Requirements, ANSI A14.2-1982—American National Standard for Ladders—Portable Metal—Safety Requirements, and ANSI A14.5-1982—American National Standard for Ladders—Portable Reinforced Plastic—Safety Requirements.

State plan guidance: States with OSHA-approved state plans may have additional requirements for avoiding falls from ladders. For more information on these requirements, please visit: www.osha.gov/dcsp/osp/statesstandards.html.

Most OSHA offices have compliance assistance specialists to help employers and workers comply with OSHA standards. For details call 1-800-321-OSHA (6742) or visit: www.osha.gov/htm/RAmap.html.

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

For assistance, contact us. We can help. It's confidential.

Occupational Safety and Health Administration

U.S. Department of Labor
www.osha.gov (800) 321-OSHA (6742)

DOC FS-3660 05/2013

OSHA® FactSheet

Reducing Falls in Construction: Safe Use of Job-made Wooden Ladders

Workers who use job-made wooden ladders risk permanent injury or death from falls and electrocutions. These hazards can be eliminated or substantially reduced by following good safety practices. This fact sheet lists some of the hazards workers may encounter while working on job-made wooden ladders and explains what employers and workers can do to reduce injuries. OSHA's requirements for job-made ladders are in Subpart X—Stairways and Ladders of OSHA's Construction standards.

What is a Job-made Wooden Ladder?

A job-made wooden ladder is a ladder constructed at the construction site. It is not commercially-manufactured. A job-made wooden ladder provides access to and from a work area. It is not intended to serve as a work platform. These ladders are temporary, and are used only until a particular phase of work is completed or until permanent stairways or fixed ladders are installed. A 24-ft. job-made ladder built to the American National Standards Institute (ANSI) A14.4-2009 non-mandatory guidelines is shown below.

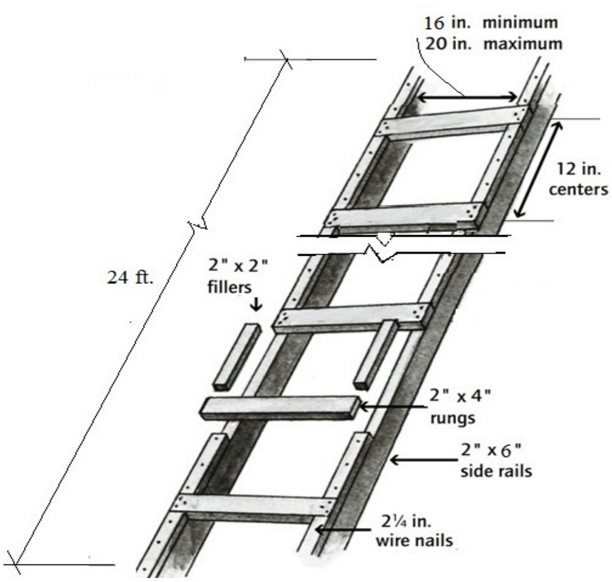


Figure 1: Single-Cleat Ladder

Training Requirements

Employers must provide a training program for employees using ladders and stairways. The training must enable each worker to recognize ladder-related hazards and to use ladders properly to minimize hazards.

Constructing a Safe Job-made Wooden Ladder

Side rails:

- Use construction-grade lumber for all components.
- Side rails of single-cleat ladders up to 24 ft. (7.3 m) long should be made with at least 2 in. (3.8 cm) x 6 in. (14 cm) nominal stock lumber.
- Side rails should be continuous, unless splices are the same strength as a continuous rail of equal length.
- The width of single-rung ladders should be at least 16 in. (41 cm), but not more than 20 in. (51 cm) between rails measured inside to inside.
- Rails should extend above the top landing between 36 in. (91.5 cm) and 42 in. (1.1 m) to provide a handhold for mounting and dismounting, and cleats must be eliminated above the landing level.
- Side rails of ladders which could contact energized electrical equipment should be made using nonconductive material. Keep ladders free of any slippery materials.
- Only put ladders on a stable and level surface that is not slippery.

Cleats:

- Cleats should be equally spaced 12 inches on center from the top of one cleat to the top of the next cleat.
- Cleats should be fastened to each rail with three 12d common wire nails which are nailed directly onto the smaller surfaces of the side rails.
- Making cuts in the side rails to receive the cleats is not advisable.
- Cleats should be at least 1 in. (2.5 cm) x 4 in. (8.9 cm) for ladders 16 ft. (41 cm) to 24 ft. (7.3 m) in length.

Filler Blocks:

- Filler should be 2 in. (3.8 cm) x 2 in. (3.8 cm) wood strips.
- Insert filler between cleats.
- Nail filler at the bottom of each side rail first. Nail the ends of a cleat to each side rail with three 12d common nails. One nail is placed 1-1/2 inch in from each end of the filler block.
- Nail the next two fillers and cleat, and then repeat. The ladder is complete when filler is nailed at the top of each rail.
- Make all side rails, rungs and fillers before the ladder is assembled.

Inspecting Ladders

- A competent person must visually inspect job-made ladders for defects on a periodic basis and after any occurrence that could affect their safe use.
- Defects to look for include: structural damage, broken/split side rails (front and back), missing cleats/steps, and parts/labels painted over.
- Ladders should be free of oil, grease and other slipping hazards.

PLAN.
PROVIDE.
TRAIN.

Three simple steps to prevent falls.

Safe Ladder Use—DO:

To prevent workers from being injured from falls from ladders, employers are encouraged to adopt the following practices:

- Secure the ladder's base so that it does not move.
- Smooth the wood surface of the ladder to reduce injuries to workers from punctures or lacerations and to prevent snagging of clothing.
- Use job-made wooden ladders with spliced side rails at an angle so that the horizontal distance from the top support to the foot of the ladder is one-eighth the working length of the ladder.
- Ensure that job-made wooden ladders can support at least four times the maximum intended load.
- Only use ladders for the purpose for which they were designed.
- Only put ladders on stable and level surfaces unless secured to prevent accidental movement.
- Ensure that the worker faces the ladder when climbing up and down.
- Maintain a 3-point contact (two hands and a foot, or two feet and a hand) when climbing a ladder.
- Keep ladders free of any slippery materials.
- Maintain good housekeeping in the areas around the top and bottom of ladders.

Safe Ladder Use—DO NOT:

- Paint a ladder with nontransparent coatings.
- Carry any object or load that could cause the worker to lose balance and fall.
- Subject a job-made wooden ladder to excessive loads or impact tests.

OSHA standard: 29 CFR 1926 Subpart X—Stairways and Ladders

American National Standards Institute standard: ANSI A14.4-1979, ANSI A14.4-2009

Employers constructing job-made ladders must follow the ladder requirements set forth in 29 C.F.R. 1926 Subpart X. They are encouraged to consult the non-mandatory guidelines set forth in ANSI A.14.4-1979—Safety Requirements for Job-Made Ladders (referenced in Appendix A to Subpart X of Part 1926—Ladders) and ANSI A.14.4-2009—Safety Requirements for Job-Made Wooden Ladders.

State plan guidance: States with OSHA-approved state plans may have additional requirements for avoiding falls from ladders. For more information on these requirements, please visit: www.osha.gov/dcsp/osp/statesstandards.html.

Most OSHA offices have compliance assistance specialists to help employers and workers comply with OSHA standards. For details call 1-800-321-OSHA (6742) or visit: www.osha.gov/htm/RAmap.html.

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

For assistance, contact us. We can help. It's confidential.

OSHA® Occupational Safety and Health Administration

U.S. Department of Labor
www.osha.gov (800) 321-OSHA (6742)

DOC FS-3661 05/2013

OSHA FactSheet

Reducing Falls in Construction: Safe Use of Stepladders

Workers who use ladders in construction risk permanent injury or death from falls and electrocutions. These hazards can be eliminated or substantially reduced by following good safety practices. This fact sheet examines some of the hazards workers may encounter while working on stepladders and explains what employers and workers can do to reduce injuries. OSHA's requirements for stepladders are in Subpart X—Stairways and Ladders of OSHA's Construction standards.

What is a Stepladder?

A **stepladder** is a portable, self-supporting, A-frame ladder. It has two front side rails and two rear side rails. Generally, there are steps mounted between the front side rails and bracing between the rear side rails. (See Figure 1, below.)

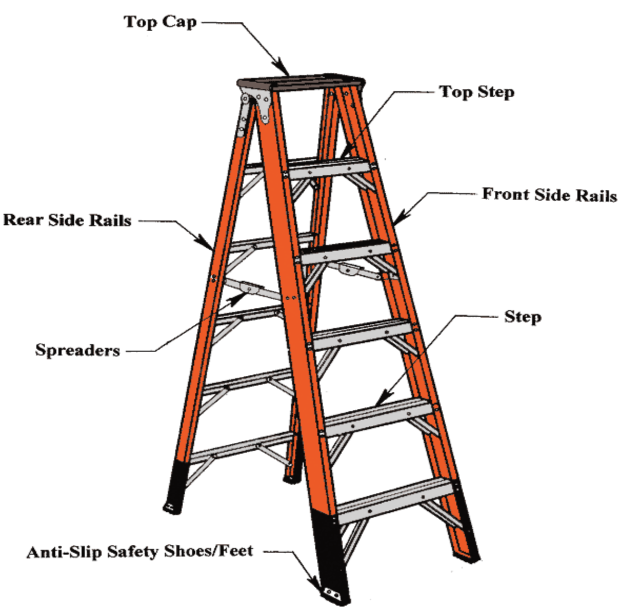


Figure 1: Stepladder

PLAN Ahead to Get the Job Done Safely.

A competent person must visually inspect stepladders for visible defects on a periodic basis and after any occurrence that could affect their safe use. Defects include, but are not limited to:

- Structural damage, split/bent side rails, broken or missing rungs/steps/cleats and missing or damaged safety devices.
- Grease, dirt or other contaminants that could cause slips or falls.
- Paint or stickers (except warning or safety labels) that could hide possible defects.

PROVIDE the Right Stepladder for the Job with the Proper Load Capacity.

- Use a ladder that can sustain at least four times the maximum intended load, except that each extra-heavy duty type 1A metal or plastic ladder shall sustain at least 3.3 times the maximum intended load. Also acceptable are ladders that meet the requirements set forth in Appendix A of Subpart X. Follow the manufacturer's instructions and labels on the ladder. To determine the correct ladder, consider your weight plus the weight of your load. Do not exceed the load rating and always include the weight of all tools, materials and equipment.

Type	Duty Rating	Use	Load
1AA	Special Duty	Rugged	375 lbs.
1A	Extra Heavy Duty	Industrial	300 lbs.
1	Heavy Duty	Industrial	250 lbs.
II	Medium Duty	Commercial	225 lbs.
III	Light Duty	Household	200 lbs.

Source for Types IA, I, II, III: Subpart X—Stairways and Ladders, Appendix A (American National Standards Institute (ANSI) 14.1, 14.2, 14.5 (1982)) of OSHA's Construction standards. Source for Type IAA: ANSI 14.1, 14.2, 14.5 (2009), which are non-mandatory guidelines.

TRAIN Workers to Use Stepladders Safely.

Employers must train each worker to recognize and minimize ladder-related hazards.

PLAN. PROVIDE. TRAIN.
Three simple steps to prevent falls.

Common Stepladder Hazards

- Damaged stepladder
- Ladders on slippery or unstable surface
- Unlocked ladder spreaders
- Standing on the top step or top cap
- Loading ladder beyond rated load
- Ladders in high-traffic location
- Reaching outside ladder side rails
- Ladders in close proximity to electrical wiring/equipment

Safe Stepladder Use—DO:

Read and follow all the manufacturer's instructions and labels on the ladder.

- Look for overhead power lines before handling or climbing a ladder.
- Maintain a 3-point contact (two hands and a foot, or two feet and a hand) when climbing/descending a ladder.
- Stay near the middle of the ladder and face the ladder while climbing up/down.
- Use a barricade to keep traffic away from the ladder.
- Keep ladders free of any slippery materials.
- Only put ladders on a stable and level surface that is not slippery.

Safe Stepladder Use—DO NOT:

- Use ladders for a purpose other than that for which they were designed. For example, do not use a folded stepladder as a single ladder.
- Use a stepladder with spreaders unlocked.
- Use the top step or cap as a step.
- Place a ladder on boxes, barrels or other unstable bases.
- Move or shift a ladder with a person or equipment on the ladder.
- Use cross bracing on the rear of stepladders for climbing.
- Paint a ladder with opaque coatings.
- Use a damaged ladder.
- Leave tools/materials/equipment on stepladder.
- Use a stepladder horizontally like a platform.
- Use a metal stepladder near power lines or electrical equipment.

How to Contact OSHA

Under the Occupational Safety and Health Act of 1970, employers are responsible for providing safe and healthful workplaces for their employees. OSHA's role is to help ensure these conditions for America's workers by setting and enforcing standards, and providing training, education, and assistance. For more information, visit www.osha.gov or call OSHA at 1-800-321-OSHA (6742), TTY 1-877-889-5627.

Additional Resources

OSHA standard: 29 CFR 1926 Subpart X—Stairways and Ladders

American National Standards Institute standard:
ANSI A14.1, A14.2, A14.5—Ladder Safety Requirements *(Not an OSHA standard, included to be used as guidance to meet OSHA's requirements)*

Employers using stepladders must follow the ladder requirements set forth in 29 CFR 1926 Subpart X. Per Appendix A to Subpart X of Part 1926—Ladders, ladders designed in accordance with the following ANSI standards will be considered in accordance with 29 CFR 1926.1053(a)(1): ANSI A14.1-1982—American National Standard for Ladders-Portable Wood-Safety Requirements, ANSI A14.2-1982—American National Standard for Ladders—Portable Metal—Safety Requirements, and ANSI A14.5-1982—American National Standard for Ladders—Portable Reinforced Plastic—Safety Requirements.

State plan guidance: States with OSHA-approved state plans may have additional requirements for avoiding falls from ladders. For more information on these requirements, please visit: www.osha.gov/dcsp/osp/statesstandards.html.

Most OSHA offices have compliance assistance specialists to help employers and workers comply with OSHA standards. For details call 1-800-321-OSHA (6742) or visit: www.osha.gov/contactus/bystate.

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

U.S. Department of Labor

OSHA® Occupational Safety and Health Administration

DOC FS-3662 05/2013

CONTROL SILICA DUST
Breathe Easier

OSHA's Respirable Crystalline Silica Standard for Construction

Workers who are exposed to respirable crystalline silica dust are at increased risk of developing serious silica-related diseases. OSHA's standard requires employers to take steps to protect workers from exposure to respirable crystalline silica.

What is Respirable Crystalline Silica?

Crystalline silica is a common mineral that is found in construction materials such as sand, stone, concrete, brick, and mortar. When workers cut, grind, drill, or crush materials that contain crystalline silica, very small dust particles are created. These tiny particles (known as "respirable" particles) can travel deep into workers' lungs and cause silicosis, an incurable and sometimes deadly lung disease. Respirable crystalline silica also causes lung cancer, other potentially debilitating respiratory diseases such as chronic obstructive pulmonary disease, and kidney disease. In most cases, these diseases occur after years of exposure to respirable crystalline silica.

How are Construction Workers Exposed to Respirable Crystalline Silica?

Exposure to respirable crystalline silica can occur during common construction tasks, such as using masonry saws, grinders, drills, jackhammers and handheld powered chipping tools; operating vehicle-mounted drilling rigs; milling; operating crushing machines; using heavy equipment for demolition or certain other tasks; and during abrasive blasting and tunneling operations. About two million construction workers are exposed to respirable crystalline silica in over 600,000 workplaces.

What Does the Standard Require?

The standard (29 CFR 1926.1153) requires employers to limit worker exposures to respirable crystalline silica and to take other steps to protect workers. Employers can either use a control method laid out in **Table 1** of the construction standard, or they can measure workers' exposure to silica and independently decide which dust controls work best to limit exposures in their workplaces to the permissible exposure limit (PEL).

What is Table 1?

Table 1 matches 18 common construction tasks with effective dust control methods, such as using water to keep dust from getting into the air or using a vacuum dust collection system to capture dust. In some operations, respirators may also be needed. Employers who follow Table 1 correctly are not required to measure workers' exposure to silica from those tasks and are not subject to the PEL.

Table 1 Example: Handheld Power Saws

If workers are sawing silica-containing materials, they can use a saw with a built-in system that applies water to the saw blade. The water limits the amount of respirable crystalline silica that gets into the air.

Table 1: Specified Exposure Control Methods When Working With Materials Containing Crystalline Silica

Equipment/ Task	Engineering and Work Practice Control Methods	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 hrs/ shift	> 4 hrs/ shift
Handheld power saws (any blade diameter)	Use saw equipped with integrated water delivery system that continuously feeds water to the blade. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.		
	• When used outdoors.	None	APF 10
	• When used indoors or in an enclosed area.	APF 10	APF 10

Excerpt from Table 1 in 29 CFR 1926.1153

In this example, if a worker uses the saw outdoors for four hours or less per day, no respirator would be needed. If a worker uses the saw for more than four hours per day or any time indoors, he or she would need to use a respirator with an assigned protection factor (APF) of at least 10, such as a NIOSH-certified filtering facepiece respirator that covers the nose and mouth (sometimes referred to as a dust mask). See the respiratory protection standard (29 CFR 1910.134) for information on APFs.

Alternative Exposure Control Methods

Employers who do not fully implement the control methods on Table 1 must:

- **Determine the amount of silica that workers are exposed to** if it is, or may reasonably be expected to be, at or above the **action level of 25 µg/m³** (micrograms of silica per cubic meter of air), averaged over an 8-hour day;
- Protect workers from respirable crystalline silica exposures above the **PEL of 50 µg/m³**, averaged over an 8-hour day;
- Use **dust controls** and safer work methods to protect workers from silica exposures above the PEL; and
- Provide **respirators** to workers when dust controls and safer work methods cannot limit exposures to the PEL.

What Else Does the Standard Require?

Regardless of which exposure control method is used, all construction employers covered by the standard are required to:

- Establish and implement a **written exposure control plan** that identifies tasks that involve exposure and methods used to protect workers, including procedures to restrict access to work areas where high exposures may occur;
- Designate a **competent person** to implement the written exposure control plan;
- Restrict **housekeeping** practices that expose workers to silica, such as use of compressed air without a ventilation system to capture the dust and dry sweeping, where effective, safe alternatives are available;
- Offer **medical exams**—including chest X-rays and lung function tests—every three years for workers who are required by the standard to wear a respirator for 30 or more days per year;
- **Train workers** on the health effects of silica exposure, workplace tasks that can expose them to silica, and ways to limit exposure; and
- **Keep records** of workers' silica exposure and medical exams.

Applying water to the blade of a handheld power saw reduces the amount of dust created when cutting.

Additional Information

Additional information on OSHA's silica standard can be found at www.osha.gov/silica.

OSHA can provide compliance assistance through a variety of programs, including technical assistance about effective safety and health programs, workplace consultations, and training and education.

OSHA's On-Site Consultation Program offers free, confidential occupational safety and health services to small and medium-sized businesses in all states and several territories across the country, with priority given to high-hazard worksites. On-Site consultation services are separate from enforcement and do not result in penalties or citations. Consultants from state agencies or universities work with employers to identify workplace hazards, provide advice on compliance with OSHA standards, and assist in establishing and improving safety and health management systems. To locate the OSHA On-Site Consultation Program nearest you, call 1-800-321-OSHA or visit www.osha.gov/consultation.

How to Contact OSHA

Under the Occupational Safety and Health Act of 1970, employers are responsible for providing safe and healthful workplaces for their employees. OSHA's role is to ensure these conditions for America's working men and women by setting and enforcing standards, and providing training, education and assistance. For more information, visit www.osha.gov or call OSHA at 1-800-321-OSHA (6742), TTY 1-877-889-5627.

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

U.S. Department of Labor

OSHA® **Occupational Safety and Health Administration**

DSG FS-3681 12/2017

OSHA®
Occupational
Safety and Health
Administration
www.osha.gov

Protecting Roofing Workers

OSHA 3755-05 2015

OSHA®
www.osha.gov

Occupational Safety and Health Act of 1970

"To assure safe and healthful working conditions for working men and women; by authorizing enforcement of the standards developed under the Act; by assisting and encouraging the States in their efforts to assure safe and healthful working conditions; by providing for research, information, education, and training in the field of occupational safety and health..."

Cover photo courtesy of the National Roofing Contractors Association.

Protecting Roofing Workers

U.S. Department of Labor
Occupational Safety and Health Administration

OSHA 3755-05 2015

U.S. Department of Labor

Disclaimer

This guidance document is not a standard or regulation and it creates no new legal obligations. The document is advisory in nature, informational in content, and is intended to assist employers in providing a safe and healthful workplace. The *Occupational Safety and Health Act* requires employers to comply with safety and health standards promulgated by OSHA or by a state with an OSHA-approved state plan. In addition, the Act's Section 5(a)(1), the General Duty Clause, requires employers to provide their workers with a workplace free from recognized hazards likely to cause death or serious physical harm. Employers can be cited for violating the General Duty Clause if there is a recognized hazard and they do not take reasonable steps to prevent or abate the hazard. However, failure to implement any specific recommendations contained within this document is not, in itself, a violation of the General Duty Clause. Citations can only be based on standards, regulations, and the General Duty Clause.

Table of Contents

Purpose and Scope of this Guide 7

Plan, Provide, Train 8

Getting Started with Roofing Safety 9

Fall Protection Requirements 10

Fall Protection Training 10

The Requirement to Provide Fall Protection 11

Using a Personal Fall Arrest System (PFAS) 11

How to Set Up a Personal Fall Arrest System 12

Rescue of Workers 15

Using a Fall Restraint System 15

Using a Guardrail System 16

Warning Lines and Safety Monitors 16

Covers 17

All Ladders 18

Worker Position on a Ladder 19

Extension Ladders 19

Stepladders 19

Scaffolding 20

Access 20

Platform 21

Guardrails 21

Falling Object Protection 22

Training 23

Lifts 23

Aerial Lifts 23

All-Terrain Forklifts 24

Safe Debris Disposal 24

Electrical Safety 25

Integrity of Older Buildings 25

Roofing Operations 25
Built-up Roofing. 25
Torch Applied Roofing 27
Single-ply Roofing. 27
Roofing Tool Safety 28
Personal Protective Equipment 28
Protecting Workers Who Work with Hazardous Substances 30
Hazard Communication 30
Specific Health Hazards 30
Coordinating with Other Contractors. 31
Housekeeping 31
Emergency Action Plan (EAP). 32
Emergency Services 32
First Aid and Medical Emergencies 32
General Duty to Protect Workers from Other Hazards 33
Heat Illnesses. 33
Cold Stress 34
Other Weather Conditions 34
Workers' Rights 35
OSHA Assistance, Services and Programs 35
NIOSH Health Hazard Evaluation Program 39
OSHA Regional Offices 40
How to Contact OSHA. 43

Purpose and Scope of this Guide

Falls are the leading cause of death in the construction industry, accounting for over 3,500 fatalities between 2003 and 2013. Falls from roofs accounted for nearly 1,200, or 34%, of the fall deaths during that period. Roofers encounter many hazards on the job, including hazards associated with working at heights and from ladders, power tools, electricity, noise, hazardous substances, and extreme temperatures. Unless these hazards are controlled by the employer, roofers risk serious injury, illness and death.

To protect workers on roofing jobs, employers must identify the hazards present and take steps to address them. This guide covers safe practices to prevent falls, other physical injuries, hazardous substance exposures, and injuries and illnesses related to environmental conditions.

Below is a table of frequently cited OSHA standards for roofing contractors during FY 2013.

OSHA Standards Frequently Cited During FY 2013 Inspections of Roofing Contractors (NAICS 238160)

Rank by Number of Citations Issued	Categories	Standard
1	Duty to have fall protection	1926.501
2	Ladder safety	1926.1053
3	Fall protection training requirements	1926.503
4	Eye and face protection	1926.102
5	General scaffold requirements	1926.451
6	General safety and health provisions	1926.20
7	Head protection	1926.100
8	Fall protection systems criteria and practices	1926.502

OSHA Standards Frequently Cited During FY 2013 Inspections of Roofing Contractors (NAICS 238160)		
Rank by Number of Citations Issued	**Categories**	**Standard**
9	Ladder training requirements	1926.1060
10	Hazard Communication	1926.59 which refers to 1910.1200

Source: NAICS 238160 – Roofing Contractors, October 2012 through September 2013.

Plan, Provide, Train

Falls can be prevented and lives can be saved through three simple steps: "Plan, Provide and Train." See OSHA's Fall Prevention Campaign web page for resources to help prevent falls (www.osha.gov/stopfalls).

Here are some basic ideas for developing fall protection strategies for roofing operations.

- Employers need to "PLAN" ahead to get the job done safely — Employers need to develop a plan and ensure the proper equipment, material and appropriately trained workers are available.
  - Know the pitch of the roof and follow the appropriate standard.
    - Low slope roof – 4:12 slope or less – 29 CFR 1926.501(b)(10).
    - Steep roof – above 4:12 slope – 29 CFR 1926.501(b)(11).
- Employers must "PROVIDE" the right equipment — Employers must provide fall protection and the right equipment for the job, including the right kinds of ladders, scaffolds, and safety gear.
- Employers must "TRAIN" workers to use the equipment safely — Employers must train workers in hazard recognition and in

the care and safe use of ladders, scaffolds, fall protection systems, and other equipment they will be using on the job.

- Understand the requirements of OSHA's Fall Protection standards at 29 CFR 1926, Subpart M, to protect workers exposed to falls six feet or more above a lower level.
- Implement safe work practices to reduce the possibility of falls.
- Supervise workers to ensure fall protection equipment is used and maintained correctly.
- Lead by example. Employers, project managers, and supervisors should follow the rules they are responsible for enforcing.

Need help? Don't wait. Call your nearest local OSHA area Compliance Assistance Specialist (www.osha.gov/dcsp/compliance_assistance/cas.html) or Consultation Program office (www.osha.gov/consultation).

Getting Started with Roofing Safety

All employers in the construction industry must have a safety program. Contractors and employers who perform construction work must comply with standards in 29 CFR 1926, Subpart C, General Safety and Health Provisions, as well as other applicable

Photo courtesy of ACTA Safety & Peterson Dean Roofing standards. The standards outline employers' responsibilities for initiating and maintaining a safety program that provides for frequent and regular inspections of job sites, materials, and equipment (29 CFR 1926.20(b)(2)) and for ensuring that workers are trained to recognize and avoid unsafe conditions (29 CFR 1926.21(b)(2)). Employers must provide training in a language and in a manner that workers can understand.

Fall Protection Requirements

Falls are the leading cause of work-related injuries and deaths among roofers. Working six feet or more above lower levels put roofers at risk for serious injury or death if they should fall. A lack of fall protection, damaged fall protection equipment, or improper setup will increase their risk of falling from height.

Fall Protection Training

Employers must provide fall protection training for all workers who may be exposed to fall hazards. The training must be conducted by a competent person and include information on how to recognize fall hazards and on what procedures to follow to minimize them (29 CFR 1926.503(a)). Training must address how to inspect, erect/disassemble, and maintain the fall protection equipment involved in the work (29 CFR 1926.503(a)(2)(ii)).

Retraining is required when previous training becomes obsolete due to changes in work conditions or fall protection systems or equipment. Retraining is also required when worker performance indicates a need for it (29 CFR 1926.503(c)).

Employers must certify that workers have been trained by documenting it in accord with 29 CFR 1926.503(b) – Certification of Training.

For additional information on what must be included in fall protection training, see 29 CFR 1926.503 – Training Requirements.

The Requirement to Provide Fall Protection

Using a Personal Fall Arrest System (PFAS)

Employers generally must provide fall protection if workers are exposed to a fall of 6 feet or more to a lower level. One form of fall protection is a personal fall arrest system (PFAS). When used properly, these systems will arrest a fall and prevent the worker from contacting a lower level. A PFAS consists of an anchor, a harness, and a lifeline or lanyard (usually with a deceleration device).

A PFAS must be used properly to be effective. Adjust the harness to fit snugly. The D-ring attachment for the harness should be centered between the worker's shoulder blades and the leg straps should be adjusted until they are snug.

Fall arrest systems must be designed and set up to prevent a worker from free falling more than 6 feet or contacting a lower level (e.g., the floor or the ground) (29 CFR 1926.502(d)(16)(iii)).

Body belts are not acceptable in a PFAS because they can cause serious injury during a fall (29 CFR 1926.502(d)).

The anchorage for a fall arrest system must be capable of supporting 5,000 pounds per worker attached or be designed, installed, and used under the supervision of a qualified person, as part of a complete personal fall arrest system that maintains a safety factor of at least two (29 CFR 1926.502(d)(15)). During roofing work, it is important not to attach anchors to sheathing, single trusses, or most guardrails. These are typically not strong enough to meet OSHA's standard. Instead of attaching anchors to sheathing alone, attach an anchor to a structural member by driving the fasteners through the sheathing and into the rafter or truss member below. It is important to follow the manufacturer's instructions when installing anchorage.

Employers must ensure that fall arrest equipment subjected to the forces of a fall are taken out of service until it has been inspected by a competent person and determined to be undamaged and suitable for reuse (29 CFR 1926.502(d)(19)).

How to Set Up a Personal Fall Arrest System

The length of the lifeline or lanyard, the position of the anchor, and the distance to the lower level are all important. Employers need to select equipment that permits workers to operate efficiently while limiting the distance they could fall.

Employers must properly calculate the fall clearance distance to ensure that a worker will not contact the lower level in the event of a fall (29 CFR 1926.502(d)(16)(iii)). And employers also need to evaluate the potential for a pendulum effect, which could swing a fallen worker into a nearby object. Swing-fall hazards can cause serious injuries, but they can be minimized by installing the anchorage point above the work area (i.e., up the roof slope from the worker) and setting up a maximum work range from the anchor point according to the manufacturer's instructions.

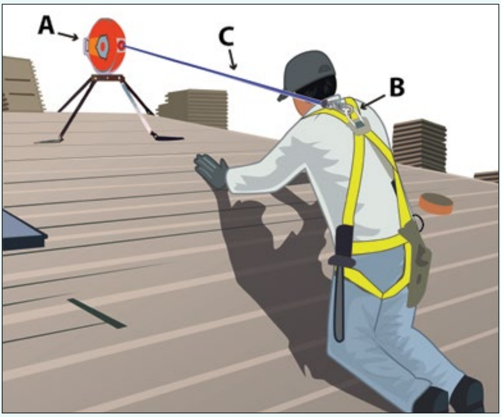
A **personal fall arrest system** is designed to safely stop a fall before the worker strikes a lower level. It has three major components:

A. An **anchorage** to which the lanyard's snap hook is attached.

B. A full-body **harness** worn by the worker.

C. A connector, such as a **lanyard** or **lifeline,** linking the harness to the anchorage.

Personal fall arrest systems typically use a shock-absorbing lanyard, a self-retracting lifeline, or a deceleration device.

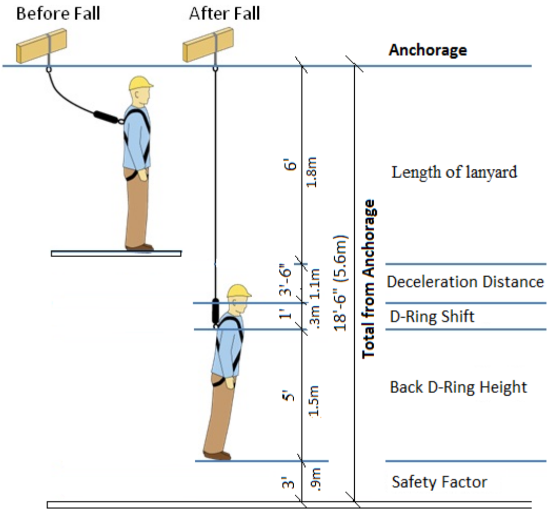


The ***total fall distance*** is the minimum vertical distance between the worker and a lower level that is necessary to ensure that the worker avoids contact with the lower level during a fall. It is important that employers calculate this distance before work begins to ensure that the proper fall protection equipment is selected for the location. To determine the total fall distance, several factors must be taken into consideration:

- **Free fall distance**: The distance the worker falls before the PFAS begins to slow the fall. This distance must be 6 feet or less for a PFAS (29 CFR 1926.502(d)(16)(iii)).

- **Deceleration distance**: The distance the lanyard stretches in order to arrest the fall. OSHA requires that this distance be no greater than 3.5 feet (29 CFR 1926.502(d)(16)(iv)), but it may be less for some PFAS equipment.
- **D-ring shift**: How far the D-ring shifts and the harness stretches when it supports the full weight of a fallen worker, including the weight of tool belts and other attached equipment or tools. Employers typically assume this shift is 1 foot, but it can vary, depending on the equipment design and the manufacturer.
- **Back D-ring height**: The height of the D-ring, measured as the distance between the D-ring and the sole of the worker's footwear. Employers often use a standard distance of 5 feet for this height, assuming a worker who is 6 feet tall. The D-ring height needs to be adjusted for very tall workers, and for shorter workers as well.
- **Safety margin**: An additional distance (typically a minimum of 2 feet) to ensure that there is enough clearance between the worker and the lower level after a fall.

The total fall clearance distance can be calculated by adding all of these values together.



Rescue of Workers

Employers need a plan for rescuing workers in the event of a fall whenever personal fall arrest systems are used. A personal fall arrest system can save a life; however, a medical emergency, such as suspension trauma, can develop if the fallen worker is not rescued quickly. A fallen worker may not be able to reach a safe work surface without assistance. The availability of rescue personnel, ladders or other rescue equipment should be evaluated prior to starting the job. Employers need to ensure supervisors and workers are trained on how to get the fallen worker to safety. Rescues must be done promptly (29 CFR 1926.502(d)(20)) and safely to prevent further injury.

Using a Fall Restraint System

Employers can use a fall restraint system to protect workers from fall hazards. A fall restraint system stops workers from reaching the edge of the walking/working area even if they lose their footing and slide. OSHA recommends that fall restraint systems have the capacity to withstand 3,000 pounds or twice the maximum expected force needed to restrain the employee from exposure to the fall hazard. www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=INTERPRETATIONS&p_id=22006.

When employers use fall restraint systems to prevent workers from reaching unprotected sides or edges, they must train workers how to determine the appropriate lanyard length prior to beginning work.

Using a Guardrail System

Employers can use guardrail systems around roof openings and at the roof perimeter to protect workers from fall hazards. Temporary guardrail systems that attach to rafters or other structural members are increasingly available through commercial sources.

The top rails of a guardrail system must be 39 to 45 inches above the walking/working surface (29 CFR 1926.502(b)(1)). Intermediate structural members (for example, midrails or screens) must be installed when there is no wall or parapet wall at least 21 inches high (29 CFR 1926.502(b)(2)). Midrails, when used, must be installed midway between the top edge of the guardrail system and the walking/working surface (29 CFR 1926.502(b)(2)(i)).

Guardrail systems must be able to withstand a 200-pound force in any outward or downward direction within 2 inches of the top edge (29 CFR 1926.502(b)(3)).

Midrails, screens, mesh, intermediate vertical members, solid panels, and equivalent structural members must withstand a 150-pound force in any outward or downward direction (29 CFR 1926.502(b)(5)).

Guardrail systems must be surfaced to prevent punctures and lacerations and to prevent clothes from snagging (29 CFR 1926.502(b)(6)).

Warning Lines and Safety Monitors

Employers can elect to protect their workers from falling, while engaged in roofing activities on **low-slope roofs**, by a combination of warning line system and guardrail system, warning line system and safety net system, warning line system and personal fall arrest system, or warning line system and safety monitoring system. Or, on roofs 50 feet (15.25 m) or less in width, the use of a safety monitoring system alone is permitted (29 CFR 1926.501(b)(10)). The safety monitor is always a competent person (29 CFR 1926.500(b)).

The warning line system shall consist of ropes, wires, or chains, and supporting stanchions (29 CFR 1926.502(f)(2)). The warning line system shall:

- be erected not less than 6 feet (1.8 m) from the roof edge (29 CFR 1926.502(f)(1)(i)); not less than 10 feet when mechanical equipment is used (29 CFR 1926.502(f)(1)(ii));
- be flagged at least every 6 feet with high-visibility material (29 CFR 1926.502(f)(2)(i));
- be no less than 34 inches (.9 m) and no more than 39 inches (1.0 m) from the walking/working surface (29 CFR 1926.502(f)(2)(ii));
- be capable of resisting a force of at least 16 pounds (71 N) without tipping over (29 CFR 1926.502(f)(2)(iii));
- have a minimum tensile strength of 500 pounds (2.22 kN) (29 CFR 1926.502(f)(2)(iv));
- be attached in such a way that pulling on the line will not result in slack being taken up in adjacent sections before the stanchion tips over (29 CFR 1926.502(f)(2)(v)).

Covers

Employers can use covers to protect workers from falling through skylights and other holes/openings on roofs (29 CFR 1926.501(b)(4)(i)). If used the covers shall:

- be capable of supporting, without failure, at least twice the weight of employees, equipment, and materials that may be imposed on the cover at any one time (29 CFR 1926.502(i)(2));

- be secured when installed so as to prevent accidental displacement by the wind, equipment, or employees (29 CFR 1926.502(i)(3));
- be color coded or marked with the word "HOLE" or "COVER" to provide warning of the hazard (29 CFR 1926.502(i)(4)).

All Ladders

Ladders can give roofers a convenient way to access upper work levels. Extension ladders and stepladders are the two most common types of ladders on roofing job sites.

Employers must ensure that ladders are inspected by a competent person for visible defects on a periodic basis and after any occurrence that could affect their safe use (29 CFR 1926.1053(b)(15)).

The employer shall train each worker how to recognize hazards related to ladders and in the procedures to be followed to minimize those hazards (29 CFR 1926.1060(a)).

Secure footing for all ladders is important; ladders must be used only on stable and level surfaces unless they are secured to prevent accidental displacement (29 CFR 1926.1053(b)(6)). It may be necessary to take steps to create a secure footing that will support the ladder without the ladder sinking, shifting, or sliding.

Employers must ensure that areas at the top and bottom of the ladder are kept clear (29 CFR 1926.1053(b)(9)), and ladders must not be placed in areas of traffic, such as driveways or doorways, unless they are secured to prevent accidental displacement or protected from the traffic via a barricade (29 CFR 1926.1053(b)(8)).

Worker Position on a Ladder

As a good practice, employers should train workers to maintain three points of contact (two hands and a foot, or two feet and a hand) at all times when ascending or descending a ladder. Additionally, workers must not carry anything that could cause them to lose their balance and fall (29 CFR 1926.1053(b)(22)). (Workers can put tools in a bucket and use a rope to pull them up to the working level.)

Extension Ladders

Employers must ensure that non-self-supporting ladders are set at an angle so the horizontal distance between the top support and the foot of the ladder is approximately one-quarter the working length of the ladder (a 1:4 ratio) (29 CFR 1926.1053(b)(5)(i)). (The working length of the ladder is the distance along the ladder between the foot and the top support.) The side rails of the ladder generally must extend at least 3 feet above the upper landing surface that the worker is trying to access (29 CFR 1926.1053(b)(1)). When such an extension is not possible because of the ladder's length, the ladder must be secured at its top to a rigid support that will not deflect and a grasping device, such as a grabrail, must be provided to assist workers in mounting and dismounting the ladder.

Stepladders

Employers need to ensure that workers use stepladders in the fully open position. Workers must not use the top or the top step of a stepladder as a step; doing so could lead to serious injury (29 CFR 1926.1053(b)(13)).

See these additional resources related to safe ladder work practices:

- Falling Off Ladders Can Kill – Use Them Safely: www.osha.gov/Publications/OSHA3625.pdf
- Safe Use of Extension Ladders – Fact Sheet: www.osha.gov/Publications/OSHA3660.pdf
- Safe Use of Job-made Wooden Ladders – Fact Sheet: www.osha.gov/Publications/OSHA3661.pdf
- Safe Use of Stepladders – Fact Sheet: www.osha.gov/Publications/OSHA3662.pdf
- NIOSH Ladder safety app for mobile devices: www.cdc.gov/niosh/topics/falls

Additional OSHA requirements regarding ladders are provided in 29 CFR 1926.1053.

Scaffolding

Scaffolds must be designed by a qualified person and must be constructed and loaded in accord with that design (29 CFR 1926.451(a)(6)).

Employers must ensure that only experienced and trained workers erect, move, dismantle or alter scaffolds. That work must be done under the supervision and direction of a competent person qualified in scaffold erection, moving, dismantling, or alteration (29 CFR 1926.451(f)(7)).

Access

Workers are most vulnerable to fall hazards when climbing on or off a scaffold. Therefore, employers need to provide safe scaffold access. When scaffold platforms are more than 2 feet above or below a point of access, workers must use portable ladders, hook-on ladders, attachable ladders, stair towers, stairway-type ladders, ramps, walkways, integral pre-fabricated scaffold access, or direct access from another scaffold, structure, personnel hoist or similar surface (29 CFR 1926.451(e)(1)).

Platform

Employers must ensure that each platform on all working levels of scaffolds are fully planked or decked between the front uprights and the guardrail supports as per 29 CFR 1926.451(b)(1). The space between adjacent platform units and the space between the platform and the uprights must be no more than 1 inch (2.5 cm) wide, except where the employer can demonstrate that a wider space is necessary (29 CFR 1926.451(b)(1)(i)).

Guardrails

Employers must ensure that workers on a scaffold more than 10 feet above a lower level are protected from falls (29 CFR 1926.451(g)(1)). Employers often use guardrails to provide this protection.

Guardrails used to comply with OSHA's fall protection requirements for scaffolds must be installed along all open sides and ends of platforms (29 CFR 1926.451(g)(4)(i)). And generally, toprails must be installed between 36 or 38 and 45 inches above the platform surface depending on the type and age of the scaffold (29 CFR 1926.451(g)(4)(ii)). Toprails must be able to withstand, without failure, a force (applied in any downward or horizontal direction at any point along its top edge) of at least 100 pounds for single-point and two-point adjustable suspension scaffolds and of at least 200 pounds for all other scaffolds (29 CFR 1926.451(g)(4)(vii)).

When midrails are used, employers must ensure that they are installed at a height approximately midway between the top edge of the guardrail system and the platform surface (29 CFR 1926.451(g)(4)(iv)).

When screens and mesh are used, employers must ensure they extend from the top edge of the guardrail system to the scaffold platform, and along the entire opening between the supports (29 CFR 1926.451(g)(4)(v)).

Midrails, screens, mesh, intermediate vertical members, solid panels, and equivalent structural members of a guardrail system must be able to withstand, without failure, a force applied in any downward or horizontal direction at any point along the midrail or other member of at least 75 pounds for guardrail systems with a minimum 100 pound toprail capacity, and at least 150 pounds for guardrail systems with a minimum 200 pound toprail capacity (29 CFR 1926.451(g)(4)(ix)).

Falling Object Protection

Employers are required to protect workers from objects falling from scaffolds (29 CFR 1926.451(h)(1)). Where there is a danger of tools, materials, or equipment falling from a scaffold and striking workers below, employers must follow a series of requirements (29 CFR 1926.451(h)(2)). The area below the scaffold must be barricaded and workers must not enter the hazard area (29 CFR 1926.451(h)(2)(i)). Also, toeboards generally must be erected along the edge of platforms more than 10 feet above lower levels for a distance sufficient to protect workers below (29 CFR 1926.451(h)(2)(ii)). When used, toeboards must be at least 3½ inches high from the top edge of the toeboard to the level of the walking/working surface and must be securely fastened at the outermost edge of the platform and have no more than 1/4 inch clearance above the walking/working surface (29 CFR 1926.451(h)(4)(ii)).

Training

Employers must designate a qualified person to train workers how to recognize and control the hazards associated with the type of scaffold being used (29 CFR 1926.454(a)).

Employers must also designate a competent person to train workers who erect, disassemble, move, repair, maintain, operate, or inspect scaffolds to recognize any hazards associated with these activities on the scaffold systems they will use (29 CFR 1926.454(b)). Training must be provided in a language the workers being trained can understand.

Employers must retrain workers when:

- changes at the worksite present new hazards;
- changes in the type of scaffold, fall protection systems, falling object protection systems, or other equipment present new hazards; and
- inadequacies in work involving scaffolds indicate that the worker has not retained the requisite proficiency.

For additional information on what must be included in scaffold training, see 29 CFR 1926.454 – Training Requirements.

Lifts

Aerial Lifts

Employers can use aerial lifts to enable workers to work at the edge of a roof while standing in the lift basket. Employers must only permit authorized workers to operate extensible and articulating boom platforms (29 CFR 1926.453(b)(2)(ii)). Employers must ensure that the controls for extending and articulating arms are tested daily before use to be sure that they are functioning safely (29 CFR 1926.453(b)(2)(i)).

With respect to extensible and articulating boom platforms, employers must ensure that:

- workers stand firmly on the basket floor and do not sit or climb on the edge of the basket or use planks, ladders, or other devices for a work position (29 CFR 1926.453(b)(2)(iv)); and
- workers are tied-off to the boom or basket (29 CFR 1926.453(b)(2)(v)).

See additional OSHA requirements for aerial lifts in 29 CFR 1926.453.

All-Terrain Forklifts

All-terrain forklifts are covered under 29 CFR 1926.602(c). Employers use these vehicles for raising equipment and materials to the roof and, in conjunction with manufacturer-approved man-baskets, to raise workers (29 CFR 1926.602(c)(1)(ii)). When elevating workers, a safety platform firmly secured to the lifting carriage and/or forks must be used (29 CFR 1926.602(c)(1)(viii)(A)).

Employers must ensure that forklift operators are appropriately trained (29 CFR 1926.602(d); 29 CFR 1910.178(l)).

Safe Debris Disposal

Employers must consider worker safety when selecting a method for handling debris. If not managed properly, debris can become a trip hazard and contribute to falls. Falling debris can hit workers on the ground below. One effective method employers can use to manage debris is to use a forklift to raise a collection box to the roof level. When the box is full, or when the job is complete, the box of debris can be lowered to the ground without putting workers at risk. As an added benefit, this practice makes the cleanup process more efficient.

Electrical Safety

Most electrocutions involving roofers usually result from contact with overhead powerlines (service drops are the most common). Workers can also be exposed to potential electrocution hazards by contacting electrical conduit that may be buried in old roofing material that must be removed. Employers must protect workers from electrical hazards by de-energizing the circuits, grounding, or by guarding it effectively by insulation (29 CFR 1926.416(a)(1)).

See additional requirements related to electrical safety under 29 CFR 1926, Subpart K.

Integrity of Older Buildings

Before work begins, employers must ensure that any roof to be worked on has the strength and structural integrity to safely support workers (29 CFR 1926.501(a)(2)). Sometimes it may be necessary to inspect a roof from the inside of the structure to identify integrity issues.

Roofing Operations

Built-up Roofing

While hot tar built-up roofing represents a small percentage of residential work, it is used often in commercial roofing.

Working with hot tar at 500°F can cause severe burns if the tar is mishandled.

Fires are obvious hazards around kettles and tankers. Fire prevention is critical during hot work. A kettle can catch fire or even explode if the tar heats to its flash point. Employers must develop a fire protection program that includes provisions for required firefighting equipment at their job sites (29 CFR 1926.150(a)(1)).

Employers must have fire extinguishers, rated not less than 10B, within 50 feet of wherever more than 5 gallons of flammable or combustible liquids or 5 pounds of flammable gas are being used on the job site (29 CFR 1926.150(c)(1)(vi)). Employers should also ensure that workers follow the precautions specified by the manufacturer of the bitumen and the kettle.

Employers must ensure that workers are trained to operate equipment safely and to identify and avoid hazards (29 CFR 1926.20(b)(4) and 29 CFR 1926.21(b)(2)).

Because of the nature of built-up roofing work, employers need to provide necessary personal protective equipment. Working around kettles, tankers, luggers, and mop buckets can lead to spills and splashes from hot tar. To protect workers from burns, proper clothing like gloves, work boots, long sleeve cotton shirts, long cotton pants without cuffs, eye protection or face shields must be provided.

Torch Applied Roofing

Torch applied roofing uses an open flame system that can reach temperatures of 2,000°F at the torch end. When heat from the torch is improperly applied to the roofing ply, it can conduct enough heat to ignite combustible materials underneath, such as wood decking or trusses, without the knowledge of the roofer. Preconstruction surveys, following the ply manufacturer's application techniques, and posting a fire watch can prevent a catastrophic loss and personal injury from fires. Regular fire-watch inspections should be done throughout the day by a competent person and for a minimum of two hours starting when the last torch is extinguished on a roof. Inspections should include the roof's entire field, flashings and the underside of the roof deck.

Working around unprotected or improperly stored propane tanks is a recipe for a serious accident. Never heat a propane tank with a torch, lay a tank on its side, or use the wrong gauge or pressure beyond the specifications of the tank or application instructions.

Employers must ensure that propane tank storage meets local building codes and OSHA requirements at 29 CFR 1926.153(j), 29 CFR 1926.153(k) and 29 CFR 1926.153(l).

Single-ply Roofing

While there are some single-ply roofing applications that involve hot work, most applications of single-ply roofing use solvent-based adhesives. These adhesives are usually highly flammable. Employers need to ensure that open flames and smoking are not permitted while these adhesives are used.

Employers need to ensure that workers understand the warnings on the adhesive container labels and follow the personal protective equipment (PPE) handling and use recommendations found in the applicable safety data sheets (SDSs).

Roofing Tool Safety

Roofing hand and power tools and equipment can be hazardous and can cause severe injuries if used incorrectly. Employers can reduce the risk of injuries by providing tool guards, PPE and training workers.

Power tools (e.g., nail guns, saws, etc.) should have the proper shields, guards, or safety attachments specified by the manufacturer. Employers must ensure that workers using power tools wear appropriate eye protection (29 CFR 1926.102(a)(1)). Always be sure to replace damaged or missing tool guards (29 CFR 1926.300(b)(1)).

Employers need to train workers on the proper use of roofing tools and equipment. In this training, it is important to discuss tool safety features, safe operating procedures, and safe work practices, such as proper body placement and how to use PPE.

Personal Protective Equipment

Employers have a duty to protect workers from recognized hazards. Where the hazard cannot be eliminated by other types of controls (e.g., engineering or administrative controls), employers must ensure that workers wear appropriate PPE (29 CFR 1926.28 and 29 CFR 1926.95). Employers need to ensure that workers are properly trained in the inspection, care, fit and use of required PPE.

Typical PPE Used with Various Roofing Tools and Equipment

- **Nail guns:** Wear hearing protection and eye protection. Also use safety devices that prevent the nail gun from discharging unless it is in contact with the work surface. Avoid carrying the nail gun against the body, or with a finger on the trigger, or while connected to the air compressor.

See Publication on Nail Guns on OSHA's website at: www.osha.gov/doc/topics/nailgun

- **Generator/air compressor:** Wear hearing protection and eye protection while working near the equipment.
- **Compressed air:** Wear hearing protection and eye protection. Also use a whip check or wire connections to prevent separation. Confirm that the pressure is adjusted appropriately for the tool.
- **Shingle stripper (manual):** Wear proper footwear and eye protection.
- **Tin snips:** Wear work gloves and safety glasses. Discard waste or scrap metal appropriately.
- **Power saw:** Wear hearing protection, eye protection, and work gloves. Ensure that blades are sharp and that guards are in place and functioning correctly.
- **Working near mobile equipment or traffic:** Wear high-visibility clothing (e.g., vest).
- **Unprotected work at heights 6 feet or greater:** Use fall arrest or fall restraint equipment.
- **Hazardous substance present:** Wear an appropriate respirator[1] if permissible dust, mist, or fume levels are exceeded.
- **General:** Employers must determine when it is appropriate for workers to wear hard hats, safety glasses, and work boots. Additionally, workers should know how to inspect the PPE and put it on so that it will protect them from the hazards they could encounter at the work site.

---

[1] Workers who are required to wear respirators must be covered by a respiratory protection program and meet other requirements of 29 CFR 1926.103 and 29 CFR 1910.134 – Respiratory Protection.

Protecting Workers Who Work with Hazardous Substances

Hazard Communication

If workers are exposed to hazardous substances, their employers must develop a hazard communication program that trains workers how to read and understand safety data sheets, container labeling, and other forms of warning. The training must also include the measures workers must use to protect themselves. The employer also must share information about hazardous chemicals with other employers whose workers on the site could be exposed. See 29 CFR 1926.59 and 29 CFR 1910.1200.

Specific Health Hazards

Roofers may come across hazardous chemicals such as:

- **Asbestos** – Asbestos enters the body primarily through inhalation. It can also enter the digestive tract if workers eat or smoke in a contaminated area. Breathing asbestos fibers can cause a buildup of scar-like tissue in the lungs called "asbestosis" and result in loss of lung function that often progresses to disability and death. Asbestos also causes cancer of the lung and other diseases. Employers must protect roofers from asbestos exposure which is found in some insulation products and other roofing and siding materials on older homes. For protection requirements related to working with asbestos-containing materials, see 29 CFR 1926.1101 – Asbestos.
- **Lead** – Lead enters the body primarily through inhalation and ingestion. Workers are mainly exposed to lead by breathing in lead-containing dust and fumes. Lead passes through the lungs into the blood

where it can harm many of the body's organ systems. Employers must protect roofers from lead exposure which is found in lead-based paints, including old paint on exposed woodwork and steel. For protection requirements related to working with lead-containing materials, see 29 CFR 1926.62 – Lead.

- **Silica** – Workers who inhale very small crystalline silica particles are at risk for silicosis. Symptoms of silicosis can include shortness of breath, cough and fatigue, and may or may not be obviously attributable to silica. Workers exposed to airborne crystalline silica also are at increased risk for lung cancer, chronic obstructive pulmonary disease and kidney disease. Employers must protect roofers from silica exposure which may be found in concrete and ceramic roof tiles. For protection requirements related to working with silica-containing materials, see 29 CFR 1926.55 – Appendix A, Gases, Vapors, Fumes, Dusts and Mists.
- **Other.** See 29 CFR 1926.55 – Appendix A, Gases, Vapors, Fumes, Dusts and Mists.

Coordinating with Other Contractors

All contractors on site need to be aware of all operations. For example, contractors should be aware of other employers' barricaded areas so as to minimize the possibility of workers being hit by falling debris or being struck by moving equipment.

Housekeeping

Effective housekeeping will help keep the worksite organized and minimize hazards that may cause workers to trip or fall. Specifically, watch for loose cords and air hoses that can roll underfoot and cause workers to lose their footing on a roof. Keep supplies and hand tools secured so that they do not present a tripping hazard. Secure tools when not in use to ensure that they will not fall off the roof. See 29 CFR 1926.25.

Emergency Action Plan (EAP)

Emergency Services

Employers must train workers in any emergency action plan required by OSHA standards (29 CFR 1926.35(e)(2)). EAPs must include, among other information, the preferred means of reporting emergencies and procedures for evacuating the area (29 CFR 1926.35(b)). Workers should always know the street address of where they are working in case they need to give emergency services their location. Post the site street address and emergency contact information in prominent locations. This will allow workers to quickly contact emergency services with necessary information.

First Aid and Medical Emergencies

When there is no infirmary, clinic, hospital, or physician within a reasonably accessible time and distance, employers must ensure that someone is available at the site with first-aid training verified by documentary evidence (such as a training certificate) (29 CFR 1926.50(c)). Required first-aid supplies must be easily accessible (29 CFR 1926.50(d)(1)). Where the eyes or body of any person may be exposed to injurious corrosive materials, suitable facilities for quick drenching or flushing of the eyes and body must be provided within the work area for immediate emergency use (29 CFR 1926.50(g)). See 29 CFR 1926.50 – Medical Services and First Aid, for additional requirements.

General Duty to Protect Workers from Other Hazards

Roofers are routinely exposed to the elements, which means there is often a threat of overexposure to hot or cold conditions, the sun, or stinging or biting insects. Employers have a duty to protect workers from recognized serious hazards on the job site (Section 5(a)(1) of the *Occupational Safety and Health Act*).

Heat Illnesses

Every year, thousands of workers become sick from occupational heat exposure, and some even die. These illnesses and deaths are preventable. Symptoms of heat illnesses include:

- Throbbing headache
- Dizziness and light-headedness
- Lack of sweating despite the heat
- Red, hot, and dry skin
- Muscle weakness or cramps
- Nausea and vomiting
- Rapid heartbeat, which may be either strong or weak
- Rapid, shallow breathing
- Behavioral changes such as confusion, disorientation, or staggering
- Seizures
- Unconsciousness

Employers should plan for preventing — and treating workers who are experiencing symptoms of — heat-related illnesses. Heat illnesses range from heat rash and heat cramps to heat exhaustion and heat stroke. Heat stroke requires immediate medical attention and can result in death. Employers should provide workers with water, rest and shade; should gradually increase workloads and allow more frequent breaks for new workers or workers who have been away for a week or more (acclimatization); and should educate workers about the symptoms of heat-related illnesses and how to prevent them. Always remember: WATER, REST, SHADE.

Note: Get more information on how to prevent heat illnesses, as well as planning and training resources, from OSHA's Heat Illness Prevention website at www.osha.gov/heat.

Cold Stress

Prolonged exposure to freezing or cold temperatures can cause serious health problems such as trench foot, frostbite and hypothermia. In extreme cases, including cold water immersion, exposure can lead to death. Employers need to train workers how to recognize the danger signs of cold stress, which can include uncontrolled shivering, slurred speech, clumsy movements, fatigue, and confused behavior. If these signs are observed, workers should know how to get emergency help.

Note: Get more information on how to prevent cold weather injuries, illnesses and fatalities, as well as planning and training resources, from OSHA's Winter Weather website: www.osha.gov/dts/weather/winter_weather.

Other Weather Conditions

High winds, wet weather, and icy conditions are especially hazardous for roofing workers. It is important for employers to consider suspending operations in bad weather. This is especially important when working on any roofing surface that can be particularly slippery when wet, including slate, tile, metal roofs and some single ply membranes.

Workers' Rights

Workers have the right to:

- Working conditions that do not pose a risk of serious harm.
- Receive information and training (in a language and vocabulary the worker understands) about workplace hazards, methods to prevent them, and the OSHA standards that apply to their workplace.
- Review records of work-related injuries and illnesses.
- File a complaint asking OSHA to inspect their workplace if they believe there is a serious hazard or that their employer is not following OSHA's rules. OSHA will keep all identities confidential.
- Exercise their rights under the law without retaliation, including reporting an injury or raising health and safety concerns with their employer or OSHA. If a worker has been retaliated against for using their rights, they must file a complaint with OSHA as soon as possible, but no later than 30 days.

For more information, see OSHA's Workers page.

OSHA Assistance, Services and Programs

OSHA has a great deal of information to assist employers in complying with their responsibilities under OSHA law. Several OSHA programs and services can help employers identify and correct job hazards, as well as improve their injury and illness prevention program.

Establishing an Injury and Illness Prevention Program

The key to a safe and healthful work environment is a comprehensive injury and illness prevention program.

Injury and illness prevention programs are systems that can substantially reduce the number and severity of workplace injuries and illnesses, while reducing costs to employers. Thousands of employers across the United States already manage safety using injury and illness prevention programs, and OSHA believes that all employers can and should do the same. Thirty-four states have requirements or voluntary guidelines for workplace injury and illness prevention programs. Most successful injury and illness prevention programs are based on a common set of key elements. These include management leadership, worker participation, hazard identification, hazard prevention and control, education and training, and program evaluation and improvement. Visit OSHA's Injury and Illness Prevention Programs web page at www.osha.gov/dsg/topics/safetyhealth for more information.

Compliance Assistance Specialists

OSHA has compliance assistance specialists throughout the nation located in most OSHA offices. Compliance assistance specialists can provide information to employers and workers about OSHA standards, short educational programs on specific hazards or OSHA rights and responsibilities, and information on additional compliance assistance resources. For more details, visit www.osha.gov/dcsp/compliance_assistance/cas.html or call 1-800-321-OSHA (6742) to contact your local OSHA office.

Free On-site Safety and Health Consultation Services for Small Business

OSHA's On-site Consultation Program offers free and confidential advice to small and medium-sized businesses in all states across the country, with priority given to high-hazard worksites. Each year, responding to requests from small employers looking to create or improve their safety and health management programs, OSHA's On-site Consultation Program conducts over 29,000 visits to small business worksites covering over 1.5 million workers across the nation.

On-site consultation services are separate from enforcement and do not result in penalties or citations. Consultants from state agencies or universities work with employers to identify workplace hazards, provide advice on compliance with OSHA standards, and assist in establishing safety and health management programs.

For more information, to find the local On-site Consultation office in your state, or to request a brochure on Consultation Services, visit www.osha.gov/consultation, or call 1-800-321-OSHA (6742).

Under the consultation program, certain exemplary employers may request participation in OSHA's **Safety and Health Achievement Recognition Program (SHARP)**. Eligibility for participation includes, but is not limited to, receiving a full-service, comprehensive consultation visit, correcting all identified hazards and developing an effective safety and health management program. Worksites that receive SHARP recognition are exempt from programmed inspections during the period that the SHARP certification is valid.

Occupational Safety and Health Training Courses

The OSHA Training Institute partners with 27 OSHA Training Institute Education Centers at 42 locations throughout the United States to deliver courses on OSHA standards and occupational safety and health topics to thousands of students a year. For more information on training courses, visit www.osha.gov/otiec.

OSHA Educational Materials

OSHA has many types of educational materials in English, Spanish, Vietnamese and other languages available in print or online. These include:

- Brochures/booklets;
- Fact Sheets;
- Guidance documents that provide detailed examinations of specific safety and health issues;
- Online Safety and Health Topics pages;
- Posters;
- Small, laminated QuickCards™ that provide brief safety and health information; and
- *QuickTakes*, OSHA's free, twice-monthly online newsletter with the latest news about OSHA initiatives and products to assist employers and workers in finding and preventing workplace hazards. To sign up for *QuickTakes* visit www.osha.gov/quicktakes.

To view materials available online or for a listing of free publications, visit www.osha.gov/publications. You can also call 1-800-321-OSHA (6742) to order publications.

OSHA's web site also has information on job hazards and injury and illness prevention for employers and workers. To learn more about OSHA's safety and health resources online, visit www.osha.gov. Use the A-Z index to help find information and assistance.

NIOSH Health Hazard Evaluation Program

Getting Help with Health Hazards

The National Institute for Occupational Safety and Health (NIOSH) is a federal agency that conducts scientific and medical research on workers' safety and health. At no cost to employers or workers, NIOSH can help identify health hazards and recommend ways to reduce or eliminate those hazards in the workplace through its Health Hazard Evaluation (HHE) Program.

Workers, union representatives and employers can request a NIOSH HHE. An HHE is often requested when there is a higher than expected rate of a disease or injury in a group of workers. These situations may be the result of an unknown cause, a new hazard, or a mixture of sources. To request a NIOSH Health Hazard Evaluation go to www.cdc.gov/niosh/hhe/request.html. To find out more about the Health Hazard Evaluation Program:

- Call (513) 841-4382, or to talk to a staff member in Spanish, call (513) 841-4439; or
- Send an email to HHERequestHelp@cdc.gov.

OSHA Regional Offices

Region I
Boston Regional Office
(CT*, ME, MA, NH, RI, VT*)
JFK Federal Building, Room E340
Boston, MA 02203
(617) 565-9860 (617) 565-9827 Fax

Region II
New York Regional Office
(NJ*, NY*, PR*, VI*)
201 Varick Street, Room 670
New York, NY 10014
(212) 337-2378 (212) 337-2371 Fax

Region III
Philadelphia Regional Office
(DE, DC, MD*, PA, VA*, WV)
The Curtis Center
170 S. Independence Mall West
Suite 740 West
Philadelphia, PA 19106-3309
(215) 861-4900 (215) 861-4904 Fax

Region IV
Atlanta Regional Office
(AL, FL, GA, KY*, MS, NC*, SC*, TN*)
61 Forsyth Street, SW, Room 6T50
Atlanta, GA 30303
(678) 237-0400 (678) 237-0447 Fax

Region V
Chicago Regional Office
(IL*, IN*, MI*, MN*, OH, WI)
230 South Dearborn Street
Room 3244
Chicago, IL 60604
(312) 353-2220 (312) 353-7774 Fax

Region VI
Dallas Regional Office
(AR, LA, NM*, OK, TX)
525 Griffin Street, Room 602
Dallas, TX 75202
(972) 850-4145 (972) 850-4149 Fax
(972) 850-4150 FSO Fax

Region VII
Kansas City Regional Office
(IA*, KS, MO, NE)
Two Pershing Square Building
2300 Main Street, Suite 1010
Kansas City, MO 64108-2416
(816) 283-8745 (816) 283-0547 Fax

Region VIII
Denver Regional Office
(CO, MT, ND, SD, UT*, WY*)
Cesar Chavez Memorial Building
1244 Speer Boulevard, Suite 551
Denver, CO 80204
(720) 264-6550 (720) 264-6585 Fax

Region IX
San Francisco Regional Office
(AZ*, CA*, HI*, NV*, and American Samoa, Guam and the Northern Mariana Islands)
90 7th Street, Suite 18100
San Francisco, CA 94103
(415) 625-2547 (415) 625-2534 Fax

Region X
Seattle Regional Office
(AK*, ID, OR*, WA*)
300 Fifth Avenue, Suite 1280
Seattle, WA 98104
(206) 757-6700 (206) 757-6705 Fax

* These states and territories operate their own OSHA-approved job safety and health plans and cover state and local government employees as well as private sector employees. The Connecticut, Illinois, New Jersey, New York and Virgin Islands programs cover public employees only. (Private sector workers in these states are covered by Federal OSHA). States with approved programs must have standards that are identical to, or at least as effective as, the Federal OSHA standards.

Note: To get contact information for OSHA area offices, OSHA-approved state plans and OSHA consultation projects, please visit us online at www.osha.gov or call us at 1-800-321-OSHA (6742).

How to Contact OSHA

For questions or to get information or advice, to report an emergency, report a fatality or catastrophe, order publications, sign up for OSHA's e-newsletter *QuickTakes*, or to file a confidential complaint, contact your nearest OSHA office, visit www.osha.gov or call OSHA at 1-800-321-OSHA (6742), TTY 1-877-889-5627.

For assistance, contact us.
We are OSHA. We can help.

OSHA®
www.osha.gov

U.S. Department of Labor

For more information:

OSHA®
Occupational
Safety and Health
Administration

www.osha.gov (800) 321-OSHA (6742)


Photo: Clark Construction

10 YEARS

NATIONAL SAFETY STAND-DOWN

TO PREVENT FALLS IN CONSTRUCTION

MAY 1–5, 2023

Stop Falls Stand-Down

- Plan a toolbox talk or other safety activity
- Take a break to talk about how to prevent falls
- Provide training for all workers

For more information:

osha.gov/PreventFalls

#StandDown4Safety

1-800-321-OSHA (6742) • TTY 1-877-889-5627

OSHA® Occupational Safety and Health Administration

CDC Centers for Disease Control and Prevention

National Institute for Occupational Safety and Health NIOSH

NORA

Safety Pays. Falls Cost.

OSHA 3774-02-2023

OSHA® FactSheet

Confined Spaces in Construction: Pits

Confined spaces can present conditions that are immediately dangerous to workers if not properly identified, evaluated, tested, and controlled. This fact sheet highlights many of the confined space hazards associated with pits and how employers can protect their workers in these environments.

OSHA has developed a new construction standard for Confined Spaces (29 CFR 1926 Subpart AA)— any space that meets the following three criteria:

- Is large enough for a worker to enter it;
- Has limited means of entry or exit; and
- Is not designed for continuous occupancy.

A space may also be a **permit-required confined space** if it has a hazardous atmosphere, the potential for engulfment or suffocation, a layout that might trap a worker through converging walls or a sloped floor, or any other serious safety or health hazard.

Fatal Incidents

Confined space hazards in pits have led to worker deaths. Several tragic incidents included:

- Two workers suffocated while attempting to close gate valves in a valve pit.
- A worker lost consciousness, fell, and was killed while climbing down a ladder into an unventilated underground valve vault to turn on water valves.
- While replacing a steam-operated vertical pump, an equipment repair technician died from burns and suffocation after falling into an industrial waste pit.

Training

The new Confined Spaces standard requires employers to ensure that their workers know about the existence, location, and dangers posed by each permit-required confined space, and that they may not enter such spaces without authorization.

Employers must train workers involved in permit-required confined space operations so that they can perform their duties safely and understand the hazards in permit spaces and the methods used to isolate, control or protect workers from these hazards. Workers not authorized to perform entry rescues must be trained on the dangers of attempting such rescues.

Safe Entry Requirements

The new Confined Spaces standard includes several requirements for safe entry.

Preparation: Before workers can enter a confined space, employers must provide pre-entry planning. This includes:

- Having a competent person evaluate the work site for the presence of confined spaces, including permit-required confined spaces.
- Once the space is classified as a permit-required confined space, identifying the means of entry and exit, proper ventilation methods, and elimination or control of all potential hazards in the space.
- Ensuring that the air in a confined space is tested, before workers enter, for oxygen levels, flammable and toxic substances, and stratified atmospheres.
- If a permit is required for the space, removing or controlling hazards in the space and determining rescue procedures and necessary equipment.
- If the air in a space is not safe for workers, ventilating or using whatever controls or protections are necessary so that employees can safely work in the space.

Ongoing practices: After pre-entry planning, employers must ensure that the space is monitored for hazards, especially atmospheric hazards. Effective communication is important because there can be multiple contractors operating on a site, each with its own workers needing to enter the confined space. Attendants outside confined spaces must make sure that unauthorized workers do not enter them. Rescue attempts by untrained personnel can lead to multiple deaths.

Confined Spaces in Pits

Even though a pit is typically open on top and over 4 feet deep, it can still be a confined space or permit-required confined space. Additionally, pits can be completely underground or below grade, such as a utility vault within a sewer system or a pit within a pit in a wastewater treatment plant.

Pits are found in many environments. Examples include sump pits, valve pits or vaults (e.g., wastewater treatment plants, municipal water systems), electrical pits/vaults, steam pits/vaults, vehicle service/garage pits, elevator pits, dock leveler pits, industrial chemical waste pits, and many more. Many of these spaces qualify as permit-required confined spaces.

Employers must take all necessary steps to keep workers safe in confined spaces, including following the OSHA Construction Confined Spaces standard. This standard applies to both new construction in a pit and alterations and/or upgrades. Among the pit-related tasks covered by the standard are:

- Opening or closing valves during renovation work.
- Installing or upgrading pump equipment, cables, or junction boxes.

Construction work can create confined spaces, even if there are none at the start of a project. Changes to the entry/exit, the ease of exit, and air flow could produce a confined space or cause one to become permit-required.

Personal protective equipment: Employers should assess the worksite to determine what personal protective equipment (PPE) is needed to protect workers. Employers should provide workers with the required PPE and proper training on its use and about any related hazards before the work starts.

How to Contact OSHA

For questions or to get information or advice, to find out how to contact OSHA's free on-site consultation program, order publications, report a fatality or severe injury, or to file a confidential complaint, visit www.osha.gov or call 1-800-321-OSHA (6742).

Additional Information

OSHA's Confined Spaces in Construction Standard (29 CFR 1926 Subpart AA)

Confined Spaces: OSHA Construction Industry Topics by Standard

OSHA Fact Sheet: Procedures for Atmospheric Testing in Confined Spaces

Confined Spaces: NIOSH Workplace Safety and Health Topics Page

State Plan Guidance: States with OSHA-approved state plans may have additional requirements for confined space safety.

Help for Small and Medium-Sized Employers: OSHA's On-site Consultation Program offers free and confidential advice to businesses nationwide.

Occupational Safety and Health Administration

DOC FS-3788 05/2015

OSHA®

Occupational
Safety and Health
Administration

www.osha.gov

Protecting Construction Workers in Confined Spaces:
Small Entity Compliance Guide

OSHA 3825-09 2015

www.osha.gov

Occupational Safety and Health Act of 1970

"To assure safe and healthful working conditions for working men and women; by authorizing enforcement of the standards developed under the Act; by assisting and encouraging the States in their efforts to assure safe and healthful working conditions; by providing for research, information, education, and training in the field of occupational safety and health."

This information will be made available to sensory-impaired individuals upon request. Voice phone: (202) 693-1999; teletypewriter (TTY) number: 1-877-889-5627.

Cover photo: NIOSH

Protecting Construction Workers in Confined Spaces:
Small Entity Compliance Guide

U.S. Department of Labor
Occupational Safety and Health Administration

OSHA 3825-09 2015

U.S. Department of Labor

This guidance document is advisory in nature and informational in content. It is not a standard or regulation, and it neither creates new legal obligations nor alters existing obligations created by the Occupational Safety and Health Administration (OSHA) standards or the *Occupational Safety and Health Act of 1970* (OSH Act or Act). Pursuant to the OSH Act, employers must comply with safety and health standards and regulations issued and enforced either by OSHA or by an OSHA-approved state plan. In addition, the Act's General Duty Clause, Section 5(a)(1), requires employers to provide their workers with a workplace free from recognized hazards that are causing or likely to cause death or serious physical harm.

In addition, Section 11(c)(1) of the Act provides that "No person shall discharge or in any manner discriminate against any employee because such employee has filed any complaint or instituted or caused to be instituted any proceeding under or related to this Act or has testified or is about to testify in any such proceeding or because of the exercise by such employee on behalf of himself or others of any right afforded by this Act." Reprisal or discrimination against an employee for reporting an incident or injury related to workplace violence, related to this guidance, to an employer or OSHA would constitute a violation of Section 11(c) of the Act. In addition, 29 CFR 1904.36 provides that Section 11(c) of the Act prohibits discrimination against an employee for reporting a work-related fatality, injury or illness.

Table of Contents

Introduction 1

CHAPTER 1 Confined Spaces and Permit Spaces 3

CHAPTER 2 Work Covered by the Standard 6

CHAPTER 3 Employer Responsibilities 7

CHAPTER 4 Overview of the Standard 10

CHAPTER 5 Identifying Permit Spaces (Section 1203(a)) 13

CHAPTER 6 Content of Permit Space Program (Sections 1204-1206) 18

CHAPTER 7 Reclassifying a Permit Space as a Non-Permit Space (Section 1203(g)) 21

CHAPTER 8 Alternate Procedures for Certain Permit Spaces — Section 1203(e)) 23

CHAPTER 9 Entrants, Attendants, and Entry Supervisors (Sections 1208-1210) 26

CHAPTER 10 Worker Training (Section 1207) 29

CHAPTER 11 Rescue and Emergency Services (Section 1211) . . 30

CHAPTER 12 Sewer System Entry 33

CHAPTER 13 Additional Information 36

APPENDIX A Example of a Permit-Required Confined Space Program 38

APPENDIX B Sample Entry Permit 44

Workers' Rights 49

OSHA Assistance, Services and Programs 49

NIOSH Health Hazard Evaluation Program 53

OSHA Regional Offices 54

How to Contact OSHA 57

Introduction

1. The special dangers of confined spaces.

A ***confined space*** is a space whose configuration and/or contents may present special dangers not found in normal work areas. Confined spaces may be poorly ventilated and, as a result, contain insufficient oxygen or hazardous levels of toxic gases. Working in a tight space can prevent a worker from keeping a safe distance from mechanical and electrical hazards in the space. Fumes from a flammable liquid that is used in a poorly ventilated area can reach explosive levels. Such hazards endanger both the workers in the confined space and others who become exposed to the hazards when they attempt to rescue injured workers. In a number of cases, rescue workers have themselves died or been injured because they did not have the training and equipment necessary to conduct the rescue safely.

Because confined spaces are potentially dangerous, employers must evaluate all confined spaces in which their employees work to determine whether hazards exist or whether the work to be done in the space can create hazards. If a confined space contains an actual or potential hazard that can cause death, injury or acute illness, incapacitation, entrapment, or otherwise interfere with a worker's ability to leave the space in an emergency, it is a ***permit-required confined space***, or ***permit space***. Employers must take certain precautions whenever workers enter a permit space. These include (1) specifying the precautions to be taken to protect the workers in the space; (2) training the workers who are covered by the standard to give them the knowledge to protect themselves and others; and (3) planning how to rescue injured workers promptly and safely.

2. The purpose and limits of this guide.

This guide is intended to help small businesses comply with the Confined Spaces standard. **It addresses the most common compliance issues that employers will face and provides sufficient detail to serve as a useful compliance guide. It does not, however, describe all provisions of the standard or alter the compliance responsibilities set forth in the standard, which is published at 29 CFR §§ 1926.1200-1213. The reader must refer to the standard itself, which is available on OSHA's website and in the *Code of Federal Regulations*, to determine all of the steps that must be taken to comply with the standard.**

CHAPTER 1
Confined Spaces and Permit Spaces

The distinction between ***confined spaces*** and ***permit spaces*** is crucial to understanding what the standard requires. Briefly, a ***permit space*** is a ***confined space*** containing a serious hazard or hazards. Employers must evaluate all ***confined spaces*** to determine whether they are ***permit spaces*** but must take steps to protect workers only if a space is classified as a ***permit space***.

What is a "confined space?"

A ***confined space*** is a space that:

(1) Is large enough and so arranged that an employee can bodily enter it;

(2) Has limited or restricted means for entry and exit; and

(3) Is not designed for continuous employee occupancy.

A space has a **limited or restricted means of exit** if a person could not readily escape from the space in an emergency. Any of the following factors indicate that a work space has a limited or restricted means of exit:

- The need to use a ladder or movable stairs, or stairs that are narrow or twisted;
- A door that is difficult to open or a doorway that is too small to exit while walking upright;
- Obstructions such as pipes, conduits, ducts, or materials that a worker would need to crawl over or under or squeeze around;
- The need to travel a long distance to a point of safety.

A space is **not designed for continuous employee occupancy** if it is not designed with features such as ventilation, lighting, and sufficient room to work and move about that are needed if people are to occupy it continuously.

Confined spaces that may be found on construction sites include, but are not limited to:

- Manholes (such as sewer, storm drain, electrical, communication, or other utility)
- Sewers
- Storm drains
- Water mains
- Lift stations
- Tanks (such as fuel, chemical, water or other liquid, solid or gas)
- Pits (such as elevator, escalator pump, valve or other equipment)
- Bins
- Boilers
- Incinerators
- Scrubbers
- Concrete pier columns
- Transformer vaults
- Heating, ventilation, and air-conditioning (HVAC) ducts
- Precast concrete and other pre-formed manhole units
- Drilled shafts
- Enclosed beams
- Vessels
- Digesters
- Cesspools
- Silos
- Air receivers
- Sludge gates
- Air preheaters
- Transformers
- Turbines
- Chillers
- Bag houses
- Mixers/reactors
- Crawl spaces
- Attics
- Basements (before steps are installed).

What is a “permit space?”

A ***permit-required confined space (permit space)*** is a confined space that:

(1) Contains or has the potential to contain a hazardous atmosphere;

(2) Contains a material that has the potential for engulfing an entrant;

(3) Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross section; or

(4) Contains any other recognized serious safety or health hazard.

As mentioned above, employers must take steps to protect workers only if they work in a permit space. In addition, they must take effective steps to prevent workers they control from entering the space unless the workers are authorized to enter. Chapter 5 describes how to decide whether a confined space meets any of the four criteria for a permit space.

CHAPTER 2
Work Covered by the Standard

The Confined Spaces standard applies to construction work performed in confined spaces, except for certain construction activities that are subject to confined space provisions in other OSHA construction standards. The activities excluded from this standard are:

- Diving – regulated by 29 CFR Part 1926 subpart Y.
- Excavations – regulated by 29 CFR Part 1926 subpart P.
- Underground Construction, Caissons, Cofferdams and Compressed Air – regulated by 29 CFR Part 1926 subpart S.

Note, however, that employers engaged in these activities must comply with this standard if their workers are exposed to confined space hazards that are not addressed by the standards listed above. For example, the Excavation standard (subpart P) protects workers in a trench (a type of confined space) against the hazards associated with the trench itself. However, the Excavation standard would not protect workers **inside** a sewer line that is installed in an open trench from confined space hazards associated with the sewer line. The employer must comply with the Excavation standard to protect workers in the trench and with the Confined Spaces standard to protect workers in the sewer line.

Employers engaged in the following activities in confined spaces must also comply with other applicable OSHA standards, such as:

- Process Safety Management: 29 CFR § 1926.64.
- Hazardous Waste Operations: 29 CFR § 1926.65.
- Welding and Cutting: 29 CFR § 1926 Subpart J.

CHAPTER 3
Employer Responsibilities

All employers engaged in construction work must (1) identify any confined spaces in which their workers will be working, and (2) determine whether any such spaces are permit spaces. When workers work in permit spaces, they must be protected against the hazards in those spaces. To ensure such protection, the Confined Spaces standard imposes duties on "entry employers," "host employers," and "controlling contractors." If an employer knows that a permit space is present at its worksite, it must inform its workers of the location and danger posed by each space. It may do this by making sure that warning signs are posted. In addition, where an employer's workers have no work to do in the space, that employer must ensure that its workers stay out. One way to do this is for employers to make sure that workers recognize permit space warning signs and understand their significance.


Photo: NIOSH

Important Definitions

An ***entry employer*** is an employer who decides that an employee it directs will enter a permit space. There may be more than one entry employer if the employees of multiple employers must enter the space. Each entry employer is responsible for complying with all provisions in the Confined Spaces standard except those specifically imposed on the controlling contractor and host employer.

A ***controlling contractor*** is the employer with overall responsibility for construction at the worksite. The controlling contractor is responsible for coordinating entry operations when there is more than one entry employer and when other activities on the site could foreseeably result in a hazard in the permit space. In addition, controlling contractors must provide any information they have about any permit space hazards and precautions previously used in the space.

A ***host employer*** is the employer that owns or manages the property where the construction work is taking place. Where the host employer has information about permit space hazards on the site, it must share that information with the controlling contractor, who is then responsible for sharing it with the other employers on the site.

In no case will there be more than one host employer. If the owner of the property on which the construction activity occurs has contracted with another employer to manage the property and provided any relevant information it has about permit spaces on the property to the managing entity, the managing entity is the host employer. Absent such a contract and exchange of information, the owner of the property is the host employer. If the controlling contractor owns or manages the property, it is both the controlling contractor and the host employer.

The following table summarizes the responsibilities of the various categories of employer.

Duties of Employers under the Confined Spaces Standard

Category of Employer	Employer Responsibilities
All Employers	• Identify all confined spaces in which their workers may work and determine whether any are permit spaces. If its workers are supposed to enter permit spaces, the employer is an "entry employer." • Employers who are not "entry employers" must make sure their workers stay out of any permit spaces present on the site, unless the workers are authorized for entry.
Entry Employers	• Protect workers against permit space hazards by complying with the standard. • Inform controlling contractor of the program followed and hazards encountered in permit spaces.
Controlling Contractors	• Share information it has about permit space hazards with entry employers and other employers whose activities may create hazards in the permit space. • Coordinate entry operations when there is more than one entry employer. • Coordinate operations when permit space entry occurs during other activities at the site that might create a hazard in the space.
Host Employers	• Share information it has about permit space hazards with the controlling contractor.

CHAPTER 4
Overview of the Standard

This chapter contains an overview of the Confined Spaces standard's requirements and identifies the chapters of this guide where more detailed information on specific topics can be found.

Employers must take the following steps to protect workers against confined space hazards.

- **Have a competent person identify all confined spaces in which its employees may work.**

  A ***competent person*** is "one who is capable of identifying existing and predictable hazards in the surroundings or working conditions which are unsanitary, hazardous, or dangerous to employees, and who has the authority to take prompt corrective measures to eliminate them." The competent person need not be an employee of any particular employer. The various contractors on a site may use a single individual to perform the duties required of a competent person.

- **If confined spaces are present, the employer must have the competent person determine whether the confined spaces are "permit spaces."**

  A ***permit space*** has one or more of the following characteristics:

  (1) contains or has the potential to contain a hazardous atmosphere;

  (2) contains a material that has the potential for engulfing an entrant;

  (3) has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross section; or

  (4) contains any other recognized serious safety or health hazard.

Chapter 5 describes how to determine whether a confined space is a permit space.

- **If the workplace contains a permit space, the entry employer must protect its workers against the hazards in the permit space.**

The protection that is required depends on the type and severity of the hazards present in the permit space. The following table lists the three categories of permit spaces for which different levels of protection are specified.

Characteristics of Space	**Protective Action**
Permit spaces that do not qualify for one of the following two exceptions.	If the employer's workers will enter the space, develop and follow a written ***permit-required confined space program***, or ***permit space program***. The permit space program specifies, among other things, how the employer will (1) regulate worker entry into permit spaces; and (2) control permit space hazards. Chapter 6 describes the features that a permit space program must contain. All employers must inform their workers about the locations and dangers of each permit space (e.g., post signs), and take additional steps to ensure that workers do not enter permit spaces if they are not authorized to do so.
Exception 1: Spaces that contain only physical (non-atmospheric) hazards.	If the physical hazards are eliminated or isolated so that they no longer present a hazard, the space may be reclassified as a non-permit space, with no further precautions required. See Chapter 7.
Exception 2: Spaces containing an atmospheric hazard that can be controlled by continuous forced air ventilation.	As long as the atmospheric hazard is controlled by continuous forced air ventilation and any physical hazards are eliminated or isolated, the alternate procedures listed in Chapter 8 may be used instead of full permit space procedures, although the space is still classified as a permit space.

- **The entry employer must train workers who work in a permit space.**

  Employers must identify (1) the worker(s) authorized to enter the space; (2) an attendant who must remain outside the space and monitor the workers within; and (3) an entry supervisor with overall responsibility for seeing that the program is followed. The duties of these workers are discussed in Chapter 9. All workers covered by the permit space program, including entrants, attendants, entry supervisors, and rescue workers, must be trained to have the knowledge and skills needed to recognize confined space hazards and protect themselves and their co-workers against permit space hazards. Chapter 10 describes the nature and extent of the training these workers must receive.

- **The entry employer must plan to rescue entrants who cannot exit the space under their own power.**

  The entry employer must ensure that a worker who becomes sick or injured in a permit space can be rescued in a safe and timely manner. Its permit space program must specify whether the employer plans to use its own workers, a rescue team of another on-site employer, or an outside rescue service if the need for a rescue arises. The requirements for rescue and emergency services are addressed in Chapter 11.

CHAPTER 5
Identifying Permit Spaces (Section 1203(a))

Identification of permit spaces is critical because it determines whether precautions are required before employees enter the space. Failure to take those precautions can result in death or serious injury to workers.

As discussed in Chapter 4, each employer engaged in construction work must ensure that a ***competent person*** identifies all confined spaces in which its workers may work on its worksite and evaluates each confined space to determine whether it is a permit-required confined space (permit space). The competent person must answer the following four questions to determine whether a confined space is a permit space. If the answer to one or more of the questions is "yes," the space is a permit space.

- **Does the space contain or have the potential to contain a hazardous atmosphere?**

  Most deaths and injuries in confined spaces result from atmospheric hazards. Such hazards include insufficient oxygen and toxic or flammable chemicals. The competent person must evaluate, including testing as necessary, whether the following hazards are or may be present, before workers enter the space:

  - Oxygen deficiency (concentration less than 19.5 percent) or excess (concentration above 23.5 percent).
  - Concentration of any flammable gas, vapor, or mist in excess of 10 percent of its lower explosive limit:
  - Airborne combustible dust at a concentration equal to or greater than its lower explosive limit.
  - Atmospheric concentration of any substance that can cause death, incapacitation, impairment of ability to self-rescue, injury or acute illness.

In evaluating atmospheric hazards, the competent person must consider (1) the hazards present in the space before any workers enter; and (2) whether the work that will be performed can introduce toxic, flammable, or combustible air contaminants or lead to an excess or deficiency of oxygen. To perform the second part of this evaluation, the competent person must be familiar with the work to be done in the space and the potential for that work to introduce atmospheric hazards. For example, a confined space that is safe when entered can become deadly if inert gas welding inside the space leads to the inert gas displacing oxygen in the worker's breathing zone.

TOXIC CHEMICALS REGULATED BY OSHA: Subparts D and Z of Part 1926 list chemicals for which OSHA has established airborne permissible exposure limits (PELs). The presence in a confined space of a substance listed in Subpart D or TOXIC CHEMICALS REGULATED BY OSHA: Subparts D and Z of Part 1926 list chemicals for which OSHA has established airborne permissible exposure limits (PELs). The presence in a confined space of a substance listed in Subpart D or Subpart Z in a concentration exceeding a PEL does not necessarily require the space to be classified as a permit space. The space must only be classified as a permit space if the concentration of that substance can cause death, incapacitation, impairment of ability to self-rescue, injury, or acute illness. However, worker exposure exceeding a PEL would violate Subpart D or Z even if it does not violate the Confined Spaces standard.

The competent person must also evaluate chemicals for which no PEL is set by OSHA. For example, if a product's label or the product manufacturer's safety data sheet warns that a product is harmful if inhaled and should not be used without adequate ventilation, the competent person must evaluate whether use of that product in a confined space requires the space to be classified as a permit space.

OXYGEN-DEFICIENT SPACES: Asphyxiation due to insufficient oxygen is one of the leading causes of death during construction work in confined spaces. An oxygen-deficient atmosphere endangers both the workers assigned to enter the space and others who may attempt a rescue without proper equipment and training. Therefore, in evaluating a confined space to determine whether it is a permit space, particular consideration should be given to whether it contains or has the potential to contain an oxygen concentration of less than 19.5 percent. Any space that is to be entered after being isolated from the atmosphere for a period of time could be oxygen-deficient, and the oxygen concentration should be measured to determine whether the space must be classified as a permit space. Direct reading instruments that measure the concentration of oxygen in the air are available for this purpose. Such instruments must be properly calibrated and used to give reliable results.

- **Does the space contain a material with the potential to engulf an entrant?**

Engulfment means the surrounding and effective capture of a person by a liquid or finely divided (flowable) solid substance that can be aspirated to cause death by filling or plugging the respiratory system or that can exert enough force on the body to cause death by strangulation, constriction, or crushing, or the substance suffocates the individual. The competent person must consider whether any liquid or flowable solid (such as sand) could enter the space. Any pipe or manhole in an operating water or sewer system in which a worker works is a confined space that could potentially engulf an entrant and must be treated as a permit space.

- **Does the space have an internal configuration such that an entrant could be trapped by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross section?**

  An area of a confined space with a small cross section can develop a hazardous atmosphere if ventilation is inadequate. In addition, a space of this configuration could prevent an injured worker from escaping the space and add to the difficulty of rescuing the worker.

- **Does the space contain any other recognized serious safety or health hazard(s) that pose an immediate danger to a worker's life or health or would impair the worker's ability to escape from the space in the event of injury?**

  Hazards that the competent person should consider include fire and explosion hazards, the presence of mechanical, electrical, hydraulic and pneumatic energy, temperature extremes, radiation, noise, corrosive chemicals, and biological hazards (such as venomous animals or insects).

If a workplace contains a permit space or spaces, the employer must inform workers in the vicinity of the location of the danger posed by each space. This can be done by posting warning signs like that to the right at each possible point of entry, or by other equally effective means.

In addition to posting warning signs, an employer who learns about a permit space must also notify its employees' authorized representative and the controlling contractor of the location and danger of the space. The controlling contractor must then notify other employers on the site, whose activities could create a hazard in the permit space, of the presence and location of such spaces and the hazards associated with them before workers enter the space.

An employer whose workers will not be authorized to enter a permit space must take steps in addition to posting the warnings above, to prevent workers from entering the space. An employer might accomplish this by providing effective training on, and enforcement of, a work rule against entry.

If an employer's workers will enter a permit space, the employer must develop a written permit space program, and entry is only permitted under the terms of the program. (Chapters 7 and 8, respectively, describe exceptions to the permit space program requirement for spaces where all physical hazards are eliminated or isolated and where any atmospheric hazards have been controlled by continuous forced air ventilation). That employer, who is an "entry employer" under the standard, must keep any unauthorized persons from entering the permit space, and remove any unauthorized persons who do enter the space.

CHAPTER 6
Content of Permit Space Program (Sections 1204-1206)

The permit space program must establish a system for preparing, using, and canceling ***entry permits***, which are written or printed documents that allow and control entry into permit spaces.

A permit space program must:

- Implement measures to prevent unauthorized entry;
- Identify and evaluate permit space hazards before allowing employee entry;
- Provide for the atmospheric conditions in the permit space to be tested before entry operations and for the space to be monitored during entry;
- Require appropriate testing for the following atmospheric hazards in this sequence: oxygen, combustible gases or vapors, and toxic gases or vapors;
- Establish and implement the means, procedures and practices to eliminate or control hazards necessary for safe permit space entry operations;
- Identify employee job duties;
- Provide and maintain, at no cost to the employee, personal protective equipment and any other equipment necessary for safe entry, and require employees to use the equipment properly;
- Ensure that at least one attendant is stationed outside the permit space during entry operations;
- Implement the procedures that any attendant who is required to monitor multiple spaces will follow during an emergency in one or more of those spaces;
- Coordinate entry operations (in consultation with the controlling contractor) when employees of more than one employer are working in the permit space; and

- Establish procedures for summoning rescue and emergency services and preventing unauthorized personnel from attempting rescue.

The employer must review the program and correct any deficiencies whenever it learns that the program may not be protecting employees adequately. Circumstances requiring such review include an injury or near-miss during entry, unauthorized entry, detection of a new hazard or a condition prohibited by the permit, or an employee complaint about the program's effectiveness. In addition, the employer must annually review the program using the cancelled permits, and revise the program as necessary to ensure that employees are protected.

An example of a permit space program can be found in Appendix A of this guide.

With the exceptions discussed in Chapters 7 and 8, the permit space program must provide that entry is only permitted pursuant to a written ***entry permit***. The permit must include:

- Name of the permit space to be entered, authorized entrant(s), current attendants, and current entry supervisors;
- Purpose of entry;
- Date and authorized duration of entry;
- Means of detecting an increase in atmospheric hazard levels;
- Name and signature of supervisor who authorizes entry;
- Known hazards in the space;
- Measures to be taken to isolate permit spaces and to eliminate or control space hazards;
- Acceptable entry conditions;
- Test results, date and time of test(s), and tester's initials or signature;
- Name and telephone numbers of rescue and emergency services and means to be used to contact them;
- Communication procedures and equipment to maintain contact during entry;

- Special equipment and procedures, including personal protective equipment and alarm systems;
- Any other information needed to ensure employee safety; and
- Additional permits, such as for hot work, that have been issued authorizing work in the permit space.

The permit must be posted at the entrance to the space or be otherwise made available to authorized entrants and their authorized representatives at the time of entry. Appendix B of this guide contains a sample entry permit that includes the information required by the standard.

Canceling Entry Permits

The employer must make sure that the entry supervisor cancels entry permits when an assignment is completed or when new conditions exist. Once a permit is cancelled, entry under it is no longer permitted. New conditions must be noted on the canceled permit and used in revising the permit space program. The employer must keep all canceled entry permits for at least one year.

Suspending Entry Permits

An entry supervisor may suspend an entry permit instead of cancelling it if a temporary condition has occurred in or near the space that, once corrected, is not expected to reoccur. The permit may be reinstated and entry may occur under the permit if the entry supervisor has determined that the conditions in the space match the allowable conditions listed on the permit.

CHAPTER 7
Reclassifying a Permit Space as a Non-Permit Space (Section 1203(g))

A permit space that contains only physical hazards may be reclassified as a non-permit space if (1) the physical hazards are eliminated or isolated without entering the space; or (2) the physical hazards are eliminated or isolated by entering the space using permit space procedures. Physical hazards include all hazards that are not atmospheric hazards, including: explosives (other than explosive atmospheres); mechanical, electrical, hydraulic and pneumatic energy; radiation; temperature extremes; engulfment; noise; inwardly converging surfaces; and chemicals that can cause death or serious physical harm through skin or eye contact (rather than through inhalation).

Example: A confined space contains electrical machinery that presents mechanical and/or electric shock hazards. If the hazards presented by the machinery are eliminated by deenergizing and locking out the machinery at an electrical panel outside the space, the space can be reclassified as a non-permit space as long as the equipment remains deenergized and locked out. If it is necessary to enter the space to deenergize and lock out the machinery, the entry must be conducted pursuant to a full permit program. However, once the machinery is deenergized and locked out, the space may then be reclassified as a non-permit space.

Whenever a permit space is reclassified as a non-permit space, the entry employer must document the basis for determining that all hazards in the permit space have been eliminated, through a certification that contains the date, the location of the space, and the signature of the person making the determination. The certification must be made available to each worker entering the space or to that worker's authorized representative.

If any hazards arise within a permit space that has been reclassified as a non-permit space, each worker in the space must exit the space. The entry employer must then reevaluate the space and determine how to proceed. If the new hazards are physical hazards that can be eliminated or isolated, the employer can reclassify the space as a non-permit space after that has been accomplished. If the new hazard is an atmospheric hazard that can be made safe for entry by continuous forced air ventilation, the employer can proceed in accordance with the procedures discussed in Chapter 8. In all other situations, further entry can only be made pursuant to a full permit space program.

CHAPTER 8
Alternate Procedures for Certain Permit Spaces — Section 1203(e))

Unlike a space that contains only physical hazards, a space containing an atmospheric hazard cannot be reclassified as a non-permit space. However, if the atmospheric hazard in a permit space can be controlled by forced air ventilation, the employer may use less stringent procedures instead of full permit space procedures when workers enter the space. The alternate procedures may be used if the employer can show that:

- All physical hazards are eliminated or isolated;
- The only hazard is an actual or potential hazardous atmosphere that can be and is made safe for entry using continuous forced air ventilation; and
- In the event the ventilation system stops working, entrants can exit the space safely.

An employer who uses the alternate procedures must document the reasons, and the supporting data, for concluding that these criteria are met. The documentation must be made available to each worker who enters the space or to that worker's authorized representative.

The **alternate procedures** are as follows:

Entry and Exit

- Any conditions making it unsafe to remove an entrance cover must be eliminated before the cover is removed.
- When entrance covers are removed, the opening must be immediately guarded by a railing, temporary cover, or other temporary barrier that will prevent an accidental fall through the opening and that will protect each employee working in the space from foreign objects entering the space.
- Before a worker enters the space, the internal atmosphere must be tested, with calibrated direct-reading instruments, for oxygen content, for flammable gases and vapors, and for potential toxic air contaminants, in that order. The testing

must demonstrate that the atmosphere in the space is not hazardous. Any worker who enters the space, or that worker's authorized representative, must be provided an opportunity to observe the pre-entry testing.

- The employer must verify that the space is safe for entry and that the pre-entry measures discussed above have been taken, through a written certification that contains the date, the location of the space, and the signature of the person providing the certification. The certification must be made before entry and must be made available to each worker entering the space or to that worker's authorized representative.
- The employer must provide workers with a safe method of entering and exiting the space. Any hoisting system that is used must either (1) be designed and manufactured for personnel hoisting; or (2) be approved for personnel hoisting by a registered professional engineer prior to use.

Ventilation Requirements

- Continuous forced air ventilation must be used. (Exhaust ventilation is not an acceptable substitute for forced air ventilation.)
- If the forced air ventilation stops for any reason, the entrant(s) must immediately leave the space.
- The forced air ventilation must be directed to ventilate the immediate areas where each entrant is or will be located within the space and must continue until all employees have left the space.
- The air supply for the forced air ventilation must be from a clean source and must not increase the hazards in the space.

During Entry

- The atmosphere within the space must be monitored to ensure that the forced air ventilation is preventing the accumulation of a hazardous atmosphere. Monitoring must be conducted continuously unless the entry employer can demonstrate that equipment for continuous monitoring is not commercially available or that periodic monitoring is sufficient to ensure that the atmosphere remains non-hazardous. Employers must provide any worker who enters the space, or that worker's authorized representative, with an opportunity to observe the testing required by this paragraph.

- If a hazard is detected during entry: (A) Employers must make sure each worker leaves the space immediately; (B) The space must be evaluated to determine how the hazard developed; and (C) The employer must implement measures to protect workers from the hazard before any subsequent entry takes place.

The following table compares the requirements for spaces where permits are required and for spaces where alternate procedures are permitted.

Comparison of Requirements for Permit-Required Spaces and Alternate Procedure Spaces

Precautions Required	Permit-Required Space	Alternate Procedures Space
Written Permit Space Program Meeting Requirements of Sections 1926.1204-1206	Yes	No
Worker Training Meeting Section 1926.1207	Yes	Yes
Duties of Authorized Attendants (Section 1926.1208), Attendants (Section 1926.1209), and Entry Supervisors (Section 1926.1210)	Yes	No
Rescue and Emergency Services (Section 1926.1211)	Yes	No
Information exchange between controlling contractor and entry employer(s) (Section 1926.1203(h))	Yes	Yes
Permit Space Warning Signs and Entry Restrictions (Sections 1926.1203(b) and (c))	Yes	Yes

CHAPTER 9
Entrants, Attendants, and Entry Supervisors (Sections 1208-1210)

Three categories of workers have specific duties whenever work is performed in a permit space: authorized entrants; attendants, and entry supervisors. The entry employer is responsible for ensuring that these workers carry out those duties.

- An ***authorized entrant*** is a worker who is authorized by the entry supervisor to enter a permit space.
- An ***attendant*** is an individual stationed outside one or more permit spaces who monitors conditions within the space(s) and prevents unauthorized entry.
- An ***entry supervisor*** is a qualified person (such as the employer, foreman, or crew chief) responsible for overseeing entry operations. An entry supervisor also may serve as an attendant or as an authorized entrant, as long as that person is trained and equipped as required by this standard for each role he or she fills. The duties of entry supervisor may be passed from one individual to another during the course of an entry operation.

Authorized entrants must:

- Know space hazards, including information on the means of exposure such as inhalation or skin contact, and symptoms of the exposure;
- Use appropriate personal protective equipment properly;
- Stay in communication with attendants as necessary to enable the attendants to monitor the entrant's status and alert the entrant to evacuate when necessary;
- Exit from the permit space as soon as possible when:

  (1) Ordered by the attendant or entry supervisor;

  (2) He or she recognizes the warning signs or symptoms of exposure;

(3) A prohibited condition exists; or

(4) An automatic alarm is activated.

- Alert the attendant when a prohibited condition exists or when warning signs or symptoms of exposure exist.

The ***attendant*** must:

- Remain outside the permit space during entry operations unless relieved by another authorized attendant;
- Perform non-entry rescues when specified by the employer's rescue procedure;
- Know existing and potential hazards, including information on the mode of exposure, and signs or symptoms, and consequences, and possible behavioral effects of exposure;
- Maintain communication with and keep an accurate account of those workers entering the permit space;
- Assess conditions inside and outside the space and order evacuation of the permit space when:

  (1) A prohibited condition exists;

  (2) A worker shows behavioral effects of hazard exposure;

  (3) A situation exists outside the confined space that could endanger entrants; or

  (4) The attendant cannot effectively and safely perform required duties.

- Summon rescue and other services during an emergency;
- Ensure that unauthorized people stay away from permit spaces or exit immediately if they have entered the permit space;
- Inform authorized entrants and the entry supervisor if any unauthorized person enters the permit space; and
- Perform no other duties that interfere with the attendant's primary duties.

Entry supervisors must:

- Know space hazards including information on the mode of exposure, signs or symptoms and consequences;
- Verify that specified entry conditions are satisfied, including permits, tests, procedures and equipment before allowing entry;
- Terminate entry and cancel or suspend permits when entry operations are completed or if a condition that is not allowed under the permit arises;
- Verify that rescue services are available and that the means for summoning them are operable;
- Take appropriate measures to remove unauthorized entrants; and
- Ensure that entry operations remain consistent with the entry permit and that acceptable entry conditions are maintained.

CHAPTER 10
Worker Training (Section 1207)

Before any worker works in a permit space, the entry employer must train authorized entrants, attendants, entry supervisors, and other employees with duties under the standard (such as persons who test and monitor the atmosphere in a permit space) to understand the hazards in the permit space and the methods used to protect against those hazards. If a worker is not authorized to perform entry rescues, the training must include the dangers of attempting such rescues. All training must be provided at no cost to workers. After the training, the employer must ensure that the workers have the understanding, knowledge and skills necessary to safely perform their assigned duties.

The required training must be provided:

- In both a language and vocabulary that the worker can understand;
- Before the worker is first assigned duties under this standard and before there is a change in the worker's assigned duties;
- Whenever there is a change in permit space entry operations that presents a new hazard about which the worker has not previously been trained;
- Whenever the worker's actions show inadequacies in the worker's knowledge or use of entry procedures.

As discussed below in chapter 11, rescue personnel must also be trained to perform their duties.

The employer must keep a record showing that the required worker training has been completed. The record must contain the worker's name, the trainer's signature or initials and the dates of the training. The employer must make the record available for inspection by workers and their authorized representatives.

CHAPTER 11
Rescue and Emergency Services (Section 1211)

Effective emergency planning is vital to ensure that any entrant who becomes sick or is injured in a permit space can be evacuated quickly and safely. The entry employer's permit space program must therefore include procedures for entrants to be rescued in a timely manner by qualified personnel.

Role of the attendant: Whenever an entrant is in a permit space, there must be an attendant outside the space who must maintain communication with all entrants and keep track of their condition. If one or more entrants suffers an injury or illness and is unable to exit the space without help, the attendant must initiate a rescue.

Non-entry rescue: It is preferable if the entrant(s) can be rescued without others entering the space to avoid having additional personnel exposed to the hazard that caused the injury or illness. Therefore, the employer's rescue procedures must provide for non-entry rescue using retrieval equipment unless the retrieval equipment would increase the overall risk of entry or would not contribute to the rescue of the entrant, such as when obstructions can snag the retrieval line or the line can become entangled with air lines or electric cords. The attendant must be prepared to perform non-entry rescues when required by the employer's rescue procedures.

When the rescue procedures provide for non-entry rescue, each entrant must wear a chest or full body harness, with a retrieval line attached at the D-ring in the center of the back or another point which positions the entrant so that he or she is small enough to be pulled out of the space. The other end of the retrieval line must be attached to a mechanical device or a fixed point outside the permit space. A mechanical device must be available to retrieve someone from vertical type permit spaces more than five feet deep.

Wristlets or anklets may be used instead of a chest or full body harness only if the employer can demonstrate that use of a chest or full body harness if infeasible or would create a greater hazard and that the use of wristlets or anklets is the safest and most effective alternative.

When non-entry rescue is selected, the entry employer must also confirm, before entry begins, that emergency assistance would be available if the non-entry rescue fails. Emergency assistance would usually be provided by a local fire department or similar service.

Entry rescue: Non-entry rescue might not be feasible. If so, the only way to rescue the entrant is for others to enter the permit space.

For entry rescue, the employer may plan to use an on-site rescue team (consisting of its own or another contractor's employees) or an off-site team, such as a local fire department or other rescue service. In either case, the employer must make sure that the rescue service is able to respond in time to enable the injured worker to receive needed medical attention in light of the hazards present in the permit space by contacting the rescue service prior to entry and informing them of the nature of the space and the hazards involved. In some cases, this may require a standby rescue team, such as when the entrant is working in an atmosphere that is immediately dangerous to life or health and is wearing an airline respirator or a self-contained breathing apparatus.

Whenever entry rescue takes place, an attendant must be stationed outside the permit space so that additional help can be summoned if needed. If the original attendant is to enter the space as part of the rescue team, a new attendant must be in position before the first attendant enters the space.

Rescue and emergency services: The employer of the members of the designated rescue team (whether entry or non-entry) must ensure that the team members have received the training required for authorized entrants and have also been trained to perform their assigned rescue duties. That employer must provide the rescue team members with personal protective and rescue equipment, including respirators, and must train them on how to use it. All rescuers must be trained in first aid and CPR. At a minimum, one rescue team member must be currently certified in first aid and CPR. Employers must ensure that the team practices or performs rescue exercises at least yearly and that rescue services are provided access to permit spaces so they can practice rescue operations. Rescuers also must be informed of the hazards of the permit space before they enter the space. The rescue service must agree to notify the employer in the event the service becomes unavailable, and the employer must provide the service with access to the permit space so the service can develop an appropriate rescue plan and practice rescue as necessary.

If the entry employer designates an off-site rescue service, it must determine that the service has the ability and equipment to carry out a rescue in the particular permit space or type of permit space in which the entrant is working. It must contact the rescue service and make sure that it will be able to respond in a timely manner whenever an entrant is in the permit space.

CHAPTER 12
Sewer System Entry

Sewer systems present one of the most common and dangerous type of confined space. Numerous workers have suffered fatal and other serious injuries from confined space hazards in sewer manholes, pipes, and lift stations. This section is designed to help inform employers engaged in sewer work of what they must do to protect their workers.

Sewer entry differs in three vital respects from other permit entries; first, there rarely exists any way to completely isolate the space (a section of a continuous system) to be entered; second, because isolation of the space is not complete, the atmosphere may suddenly and unpredictably become lethally hazardous (toxic, flammable or explosive) from causes beyond the control of the entrant or employer; and third, material flowing through the sewer system may engulf entrants. However, experienced sewer workers are especially knowledgeable about entry and work in their permit spaces because of their frequent entries. Unlike other employments where permit space entry is a rare and exceptional event, sewer workers' usual work environment is a permit space.

OSHA believes that if employers reinforce and follow the four procedures below that the risks of sewer work can be controlled and employees protected from the many unpredictable hazards of sewers.

(1) **Adherence to procedure.** Designate as entrants only employees who are thoroughly trained in the employer's sewer entry procedures and who demonstrate that they follow these entry procedures exactly as prescribed when performing sewer entries.

(2) **Atmospheric monitoring.** Train entrants in the use of, and equip entrants with, atmospheric monitoring equipment which sounds an audible alarm, in addition to its visual readout. Sewer conditions to be monitored will often include oxygen concentration less than 19.5 percent or above 23.5 percent; flammable gas or vapor at 10 percent

or more of the lower flammable limit (LFL); or hydrogen sulfide or carbon monoxide at or above 10 ppm or 35 ppm, respectively, measured as an 8-hour time-weighted average. Atmospheric monitoring equipment needs to be calibrated according to the manufacturer's instructions. The oxygen sensor/broad range sensor is best suited for initial use in situations where the actual or potential contaminants have not been identified, because broad range sensors, unlike substance-specific sensors, enable employers to obtain an overall reading of the hydrocarbons (flammables) present in the space. However, such sensors only indicate that a hazardous threshold of a class of chemicals has been exceeded. They do not measure the levels of contamination of specific substances. Therefore, substance-specific devices, which measure the actual levels of specific substances, are best suited for use where actual or potential contaminants have been identified. The measurements obtained with substance-specific devices are of vital importance to the employer when decisions are made concerning the measures necessary to protect entrants (such as ventilation or personal protective equipment) and the setting and attainment of appropriate entry conditions. However, the sewer environment may suddenly and unpredictably change, and the substance-specific devices may not detect the potentially lethal atmospheric hazards which may enter the sewer environment.

Although OSHA considers the information and guidance provided above to be appropriate and useful in most sewer entry situations, the agency emphasizes that each employer must consider the unique circumstances, including the predictability of the atmosphere, of the sewer permit spaces in the employer's workplace in preparing for entry. Only the employer can decide, based upon his or her knowledge of, and experience with permit spaces in sewer systems, what the best type of monitoring equipment may be for any specific entry operation.

The entrant must use the selected monitoring equipment in sewer line work to monitor the atmosphere in the entrant's environment, and in advance of the entrant's direction of movement, to warn the entrant of any deterioration in atmospheric conditions. Where several entrants are working together in the same immediate location, one instrument, used by the lead entrant, is acceptable.

(3) Surge flow and flooding. Develop and maintain liaison, to the extent possible, between the sewer crew and the local weather bureau and the fire and emergency services in the area so that sewer work may be delayed or interrupted and entrants withdrawn whenever sewer lines might be suddenly flooded by rain or fire suppression activities, or whenever flammable or other hazardous materials are released into sewers during emergencies due to industrial or transportation accidents. In addition, train workers in the use of, and make sure that they use, an early-warning system placed sufficiently far upstream of the work area to provide crews with enough notice of a surge to exit the space safely.

(4) Special equipment. Entry into large bore sewers may require the use of special equipment. Such equipment might include such items as self-contained breathing apparatus (SCBA) with at least a 10-minute air supply (or other NIOSH-approved self-rescuer), and waterproof flashlights, and may also include boats and rafts, radios and rope stand-offs for pulling around bends and corners as needed.

CHAPTER 13
Additional Information

Where other information can be found.

OSHA's website contains other information that will help employers comply with the standard (www.osha.gov/confinedspaces), including fact sheets and FAQs developed for the construction rule. The standard for construction work is similar to the standard regulating confined spaces in general industry (29 CFR § 1910.146), and information on OSHA's website addressing the General Industry standard will therefore be useful in complying with the Construction standard. In particular, OSHA's Confined Spaces Advisor for the General Industry standard (www.dol.gov/elaws/confined.htm) offers a computer-based, step-by-step guide to compliance as well as explanations of key terms used in the standard. The website also lists publications that can be ordered from the OSHA Publications Office.

Consultation services.

OSHA's On-site Consultation Program offers free and confidential safety and health compliance assistance to small and medium-sized businesses in all states across the country, with priority given to high-hazard worksites. On-site Consultation services are separate from enforcement and do not result in penalties or citations. Consultants from state agencies and universities work with employers to identify workplace hazards, provide advice on compliance with OSHA standards, and help establish and improve their safety and health management systems. To find the OSHA On-site Consultation Program office nearest you, go to: www.osha.gov/dcsp/smallbusiness/consult_directory.html.

State plans.

There are 26 states and 2 U.S. territories that have their own OSHA-approved occupational safety and health programs called state plans. The following 22 states or territories operate state plans that cover both private sector and state and local government employers: Alaska, Arizona, California, Hawaii, Indiana, Iowa, Kentucky, Maryland, Michigan, Minnesota, Nevada, New Mexico, North Carolina, Oregon, Puerto Rico, South Carolina, Tennessee, Utah, Vermont, Virginia, Washington and Wyoming. Five additional states and one U.S. territory operate state plans that cover private sector workers only: Connecticut, Illinois, Maine, New Jersey, New York, and the Virgin Islands.

State plans have and enforce their own occupational safety and health standards that are required to be at least as effective as OSHA's, but may have different or additional provisions. Therefore, state plans must adopt a standard for confined spaces in construction that is at least as effective as OSHA's standard. If you are operating a business in one of the above-listed states, you should contact your state plan to determine whether any additional requirements apply. A list of the state plans and more information is available at: www.osha.gov/dcsp/osp.

APPENDIX A
Example of a Permit-Required Confined Space Program

Workplace. Sewer entry.

Potential hazards. The employees could be exposed to the following:

Engulfment.

Presence of toxic gases. Equal to or more than 10 ppm hydrogen sulfide measured as an 8-hour time-weighted average, and equal to or more than 35 ppm carbon monoxide measured as an 8-hour time-weighted average. If the presence of other toxic contaminants is suspected, specific monitoring programs will be developed.

Presence of explosive/flammable gases. Equal to or greater than 10% of the lower flammable limit (LFL).

Oxygen deficiency. A concentration of oxygen in the atmosphere equal to or less than 19.5% by volume.

A. *Entry Without Permit/Attendant*

Certification. Confined spaces may be entered without the need for a written permit or an attendant provided that the space can be maintained in a safe condition for entry by mechanical ventilation alone, as provided in §1926.1203(e). All spaces must be considered permit-required confined spaces until the pre-entry procedures demonstrate otherwise. Any employee required or permitted to pre-check or enter an enclosed/confined space must have successfully completed, at a minimum, the training as required by the following sections of these procedures. *A written copy of operating and rescue procedures as required by these procedures must be at the work site for the duration of the job.* The Confined Space Pre-Entry Check List must be completed by the LEAD WORKER before entry into a confined space. This list verifies completion of the items listed below. This checklist must be kept at the job site for the duration of the job. If circumstances dictate an interruption in the work, the permit space must be re-evaluated and a new checklist must be completed.

Control of atmospheric and engulfment hazards.

Pumps and lines. All pumps and lines which may reasonably cause contaminants to flow into the space must be disconnected, blinded and locked out, or effectively isolated by other means to prevent development of dangerous air contamination or engulfment. Not all laterals to sewers or storm drains require blocking. However, where experience or knowledge of industrial use indicates that there is a reasonable potential for contamination of air or engulfment into an occupied sewer, then all affected laterals must be blocked. If blocking and/or isolation requires entry into the space the provisions for entry into a permit-required confined space must be implemented.

Surveillance. The surrounding area must be surveyed to avoid hazards such as drifting vapors from the tanks, piping, or sewers.

Testing. The atmosphere within the space will be tested to determine whether dangerous air contamination and/or oxygen deficiency exists. Detector tubes, alarm-only gas monitors and explosion meters are examples of monitoring equipment that may be used to test permit space atmospheres. Testing must be performed by the LEAD WORKER who has successfully completed the Gas Detector training for the monitor he or she will use. The minimum parameters to be tested are oxygen deficiency, LFL, and hydrogen sulfide and carbon monoxide concentrations. A written record of the pre-entry test results must be made and kept at the work site for the duration of the job. The supervisor will certify in writing, based upon the results of the pre-entry testing, that all hazards have been eliminated. Affected employees must be able to review the testing results. The most hazardous conditions must govern when work is being performed in two adjoining, connecting spaces.

Entry Procedures. If there are no non-atmospheric hazards present and if the pre-entry tests show there is no dangerous air contamination and/or oxygen deficiency within the space and there is no reason to believe that any is likely to develop, entry into and work within may proceed. Continuous monitoring of the atmosphere in the immediate vicinity of the workers within the space must be accomplished. The workers will immediately leave the permit space when any of the gas monitor alarm set points are reached as defined. Workers will not return to the area until a SUPERVISOR who has completed the gas detector training has used a direct reading gas detector to evaluate the situation and has determined that it is safe to enter.

Rescue. Arrangements for rescue services are not required where there is no attendant. See the rescue portion of section B., below, for instructions regarding rescue planning where an entry permit is required.

B. Entry Permit Required

Confined Space Entry Permit. All spaces must be considered permit-required confined spaces until the pre-entry procedures demonstrate otherwise. Any employee required or permitted to pre-check or enter a permit-required confined space must have successfully completed, at a minimum, the training as required by the following sections of these procedures. *A written copy of operating and rescue procedures as required by these procedures must be at the work site for the duration of the job.* The Confined Space Entry Permit must be completed before approval can be given to enter a permit-required confined space. This permit verifies completion of the items listed below. This permit must be kept at the job site for the duration of the job. If circumstances cause an interruption in the work or a change in the alarm conditions for which entry was approved, a new Confined Space Entry Permit must be completed.

Control of atmospheric and engulfment hazards.

Surveillance. The surrounding area must be surveyed to avoid hazards such as drifting vapors from tanks, piping or sewers.

Testing. The confined space atmosphere must be tested prior to entry to determine whether dangerous air contamination and/or oxygen deficiency exists. A direct reading gas monitor must be used. Initial testing must be performed by the SUPERVISOR who has successfully completed the gas detector training for the monitor he will use. The minimum parameters to be tested are oxygen deficiency, LFL, hydrogen sulfide concentration and carbon monoxide concentration. A written record of the pre-entry test results must be made and kept at the work site for the duration of the job. Affected employees and their representatives must be able to review the results. The most hazardous conditions must govern when work is being performed in two adjoining, connected spaces.

Space Ventilation. Mechanical ventilation systems, where applicable, must be set at 100% outside air. Where possible, open additional manholes to increase air circulation. Use portable blowers to augment natural circulation if needed. After a suitable ventilating period, repeat the testing. Entry may not begin until testing has demonstrated that the hazardous atmosphere has been eliminated.

Early-warning system. Whenever the possibility of engulfment is present at the work site, an employee must be stationed far enough upstream with a two-way radio to alert entrants at the first sign of an approaching flood hazard, or an alarm activated by remote detector(s) placed to detect an approaching flood hazard must be used, so the entrants have time to exit the space safely.

Entry Procedures. The following procedure must be observed under any of the following conditions: (1) Testing demonstrates the existence of dangerous or deficient conditions and additional ventilation cannot reduce concentrations to safe levels; (2) The atmosphere tests as safe but unsafe conditions can reasonably be expected to develop; (3) It is not feasible to provide for ready exit from spaces equipped with automatic fire suppression systems and it is not practical or safe to deactivate such systems; or (4) An emergency exists and it is not feasible to wait for pre-entry procedures to take effect.

All personnel must be trained. A self-contained breathing apparatus must be worn by any person entering the space. At least one worker must stand by the outside of the space ready to give assistance in case of emergency. The standby worker must have a self-contained breathing apparatus available for immediate use. There must be at least one additional worker within sight or call of the standby worker. Continuous powered communications must be maintained between the worker within the confined space and standby personnel.

If at any time there is any questionable action or non-movement by the worker inside, a verbal check will be made. If there is no response, the worker will be moved immediately. *Exception:* If the worker is disabled due to falling or impact, he/she must not be removed from the confined space unless there is immediate danger to his/her life. Local emergency services must be notified immediately. The standby worker may only enter the confined space in case of an emergency (wearing the self-contained breathing apparatus) and only after being relieved by another worker. A safety belt or harness with an attached lifeline must be used by all workers entering the space with the free end of the line secured outside the entry opening. The standby worker must attempt to remove a disabled worker via his lifeline before entering the space.

When practical, these spaces must be entered through side openings—those within 3 1/2 feet (1.07 m) of the bottom. When entry must be through a top opening, the safety belt must be of the harness type that suspends a person upright and a hoisting device or similar apparatus must be available for lifting workers out of the space.

In any situation where their use may endanger the worker, use of a hoisting device or safety belt and attached lifeline may be discontinued. (See the rescue section below.)

When dangerous air contamination is attributable to flammable and/or explosive substances, lighting and electrical equipment must be Class 1, Division 1 rated as per National Electrical Code and no ignition sources must be introduced into the area.

Continuous gas monitoring must be performed during all confined space operations. The minimum parameters to be monitored are oxygen deficiency, LFL, hydrogen sulfide concentration and carbon monoxide concentration. If alarm conditions change adversely, entry personnel must exit the confined space and a new confined space permit issued.

Rescue. Use of harnesses, lifelines, and a winch outside the space is the preferred method of rescue. Entrants and attendants will be trained in proper use of harnesses and rescue equipment. If harnesses and lifelines may not be used due to the configuration of the space, or could expose workers to greater hazards than entry rescue, call the local emergency services (or other rescue service) and evaluate them for entry rescue capability, informing them of the nature and exact location of the space and the anticipated hazards within. Where immediate hazards to injured personnel are present, workers at the site must implement emergency procedures to fit the situation.

APPENDIX B
Sample Entry Permit

Entry Permit **Pseudo Construction Co.**
General Information
Identity (e.g., location) of the space: 1500 K Street, northwest corner.
Purpose of entry: Replace communication cable in sewer line.
Duration of entry: First entry on January 22, 2007; complete work and terminate entry operations on January 26, 2007.
Identify the physical hazards in the space: (1) Engulfment—sewer water. (2) Electrical—communication cables.
Describe the methods for isolating or controlling the physical hazards, or used to protect authorized entrants: (1) Engulfment—Disconnect and lockout all sewer-system overflow pumps, and disconnect, blind, and lockout, all water lines within 100 feet of the work area, including lateral lines. (2) Electrical—de-energize, tag, and ground all communication cables in work area. Use heavy duty, insulated work gloves for handling cables and conduits.
Identify the atmospheric hazards in the space (e.g., oxygen deficiency, flammable/explosive gases/vapors, others (including toxic particulates, gases, and vapors)): (1) Oxygen deficiency—possibility that oxygen level may be less than 19.5%. (2) Flammable/explosive gases/vapors—methane may be present. (3) Other—hydrogen sulfide and/or carbon monoxide may be present.

Entry Permit
Pseudo Construction Co.

Describe the methods for isolating or controlling the atmospheric hazards, or used to protect authorized entrants:

Space ventilation—mechanical ventilation systems set at 100% outside air. Where possible, open additional manholes to increase air circulation. Use portable blowers to augment natural ventilation if needed. Repeat atmospheric testing after ventilating the space for 10 minutes.

Describe the determination made to show that if the ventilation system stops working, atmospheric hazards will remain at safe levels long enough for entrants to recognize the problem and safely exit the space:
Fully ventilated the unoccupied space and got non-detect readings for methane and hydrogen sulfide. After securing the mechanical ventilation system, ports, and portable blowers, found that both methane and hydrogen sulfide reached maximum limits in two hours, which is well outside the 60-minute period used to monitor and record atmospheric-hazard values in the space.

Planned Conditions

Safe conditions and/or monitoring determined for physical hazards:

(1) Water levels—pooling water level inside PRCS not to exceed 2 inches; survey PRCS every hour to assess pooling water level and seeping water from piping and sewer.

(2) Electrical—visually confirm every hour that electrical cables remain disconnected and tagged.

(3) Early-warning system when alarm sounds, evacuate authorized employees immediately.

Safe levels of atmospheric hazards:

Hazard	Minimum limit	Maximum limit
Oxygen	19.50%	23.00%
Flammable gas/ vapors (specify): (1) Methane	0% LFL	10% LFL

Entry Permit **Pseudo Construction Co.**		
Others (specify): (1) Hydrogen sulfide (2) Carbon monoxide	 0 ppm 0 ppm	 20 ppm 35 ppm
Atmospheric-testing/-monitoring results: (see attachment)		
Personnel		
Current Entry Supervisor: Name: S. Smith Signature/initial: /s/ Name: J. Jones Signature/initial: /s/ Name: ______________________ Signature/initial: ___________________ Name: ______________________ Signature/initial: ___________________ Name: ______________________ Signature/initial: ___________________		
Current Attendants: Name: J. James Name: ____________________________ Name: B. Bills Name: ____________________________ Name: ______________________ Name: ___________________________ Name: ______________________ Name: ___________________________ Name: ______________________ Name: ___________________________		
Authorized entrants: Refer to daily tracking roster for names of authorized entrants.		

Entry Permit **Pseudo Construction Co.**
Identity of the rescue service: (Check one) _x_ **Non-entry rescue. Identity of the non-entry rescue service:** the attendant ___ **Entry rescue. Identity of the entry rescue service:**
Identity of the emergency service: Washington, DC Fire and Rescue Service, Station 1. Each attendant and entry supervisor has cell phone pre-programmed with DC Fire and Rescue Service emergency hotline number (e.g., 202-123-4567).
Name and signature/initials of the entry supervisor who first verified this entry permit and authorized initial entry into this PRCS:
Equipment
Methods of communication between attendants and authorized entrants: Attendant and authorized entrants will use Type X walkie-talkies.
Equipment Needed: (1) Lighting equipment: two explosion-proof and waterproof lights with 50-ft. extension cords. (2) Ventilation: one explosion-proof blower and 15-foot of duct. (3) Atmospheric monitoring: One multi-gas meter equipped with sensors for oxygen, methane, hydrogen sulfide, and carbon monoxide. (4) Heating: N/A (5) Guardrails, barriers, and covers: one portable guardrail and tent assembly. (6) Controlled descent/retrieval systems: N/A (7) Ladders: a 16-foot fixed ladder for access/egress. (8) Scaffolding: N/A (9) Early warning system: remote high-water-level detector and alarm installed 100 yards upstream from the work area in the inflow conduit. (10) Rescue equipment: one retrieval system with adjustable harness and 50-foot of retrievable lanyard. (11) Other: portable gas-powered electric generator with GFCI.

Entry Permit **Pseudo Construction Co.**	
Other Information	
Information not documented elsewhere on this permit (see § 1926.1206(o): (1) Describe any condition making it unsafe to remove an entrance cover, and how the condition was eliminated: Determined that the entrance cover was vented, which eliminated the potential for hazardous pressure conditions to exist in the space. (2) Describe any actions taken to guard holes and openings into the space from falling individuals and objects: A portable guardrail system was erected around the entry point, in addition to placing warning cones to divert pedestrian traffic around the space. (3) Describe the method used for entering and exiting the space: a 16-foot fixed ladder. **Additional information:** Hot-work permit issued for welding work.	
Entry Permit Cancellation	
Reason for cancellation: Completed work in PRCS.	
Name and signature/initials of the individual who cancelled the entry permit: Name: J. Jones	Signature/initials: /s/
Date and time this entry permit was cancelled: January 26, 2007; 4:00 PM	

Workers' Rights

Workers have the right to:

- Working conditions that do not pose a risk of serious harm.
- Receive information and training (in a language and vocabulary the worker understands) about workplace hazards, methods to prevent them, and the OSHA standards that apply to their workplace.
- Review records of work-related injuries and illnesses.
- File a complaint asking OSHA to inspect their workplace if they believe there is a serious hazard or that their employer is not following OSHA's rules. OSHA will keep all identities confidential.
- Exercise their rights under the law without retaliation, including reporting an injury or raising health and safety concerns with their employer or OSHA. If a worker has been retaliated against for using their rights, they must file a complaint with OSHA as soon as possible, but no later than 30 days.

For more information, see OSHA's Workers page.

OSHA Assistance, Services and Programs

OSHA has a great deal of information to assist employers in complying with their responsibilities under OSHA law. Several OSHA programs and services can help employers identify and correct job hazards, as well as improve their injury and illness prevention program.

Establishing an Injury and Illness Prevention Program

The key to a safe and healthful work environment is a comprehensive injury and illness prevention program.

Injury and illness prevention programs are systems that can substantially reduce the number and severity of workplace injuries and illnesses, while reducing costs to employers.

Thousands of employers across the United States already manage safety using injury and illness prevention programs, and OSHA believes that all employers can and should do the same. Thirty-four states have requirements or voluntary guidelines for workplace injury and illness prevention programs. Most successful injury and illness prevention programs are based on a common set of key elements. These include management leadership, worker participation, hazard identification, hazard prevention and control, education and training, and program evaluation and improvement. Visit OSHA's Injury and Illness Prevention Programs web page at www.osha.gov/dsg/topics/safetyhealth for more information.

Compliance Assistance Specialists

OSHA has compliance assistance specialists throughout the nation located in most OSHA offices. Compliance assistance specialists can provide information to employers and workers about OSHA standards, short educational programs on specific hazards or OSHA rights and responsibilities, and information on additional compliance assistance resources. For more details, visit www.osha.gov/dcsp/compliance_assistance/cas.html or call 1-800-321-OSHA (6742) to contact your local OSHA office.

Free On-site Safety and Health Consultation Services for Small Business

OSHA's On-site Consultation Program offers free and confidential advice to small and medium-sized businesses in all states across the country, with priority given to high-hazard worksites. Each year, responding to requests from small employers looking to create or improve their safety and health management programs, OSHA's On-site Consultation Program conducts over 29,000 visits to small business worksites covering over 1.5 million workers across the nation.

On-site consultation services are separate from enforcement and do not result in penalties or citations. Consultants from state agencies or universities work with employers to identify workplace hazards, provide advice on compliance with OSHA standards, and assist in establishing safety and health management programs.

For more information, to find the local On-site Consultation office in your state, or to request a brochure on Consultation Services, visit www.osha.gov/consultation, or call 1-800-321-OSHA (6742).

Under the consultation program, certain exemplary employers may request participation in OSHA's **Safety and Health Achievement Recognition Program (SHARP).** Eligibility for participation includes, but is not limited to, receiving a full-service, comprehensive consultation visit, correcting all identified hazards and developing an effective safety and health management program. Worksites that receive SHARP recognition are exempt from programmed inspections during the period that the SHARP certification is valid.

Cooperative Programs

OSHA offers cooperative programs under which businesses, labor groups and other organizations can work cooperatively with OSHA. To find out more about any of the following programs, visit www.osha.gov/cooperativeprograms.

Strategic Partnerships and Alliances

The OSHA Strategic Partnerships (OSP) provide the opportunity for OSHA to partner with employers, workers, professional or trade associations, labor organizations, and/or other interested stakeholders. OSHA Partnerships are formalized through unique agreements designed to encourage, assist, and recognize partner efforts to eliminate serious hazards and achieve model workplace safety and health practices. Through the Alliance Program, OSHA works with groups committed to worker safety and health to prevent workplace fatalities, injuries and illnesses by developing compliance assistance tools and resources to share with workers and employers, and educate workers and employers about their rights and responsibilities.

Voluntary Protection Programs (VPP)

The VPP recognize employers and workers in private industry and federal agencies who have implemented effective safety and health management programs and maintain injury and illness rates below the national average for their respective industries. In VPP, management, labor, and OSHA work cooperatively and proactively to prevent fatalities, injuries, and illnesses through a system focused on: hazard prevention and control, worksite analysis, training, and management commitment and worker involvement.

Occupational Safety and Health Training

The OSHA Training Institute partners with 27 OSHA Training Institute Education Centers at 42 locations throughout the United States to deliver courses on OSHA standards and occupational safety and health topics to thousands of students a year. For more information on training courses, visit www.osha.gov/otiec.

OSHA Educational Materials

OSHA has many types of educational materials in English, Spanish, Vietnamese and other languages available in print or online. These include:

- Brochures/booklets;
- Fact Sheets;
- Guidance documents that provide detailed examinations of specific safety and health issues;
- Online Safety and Health Topics pages;
- Posters;
- Small, laminated QuickCards™ that provide brief safety and health information; and
- *QuickTakes*, OSHA's free, twice-monthly online newsletter with the latest news about OSHA initiatives and products to assist employers and workers in finding and preventing workplace hazards. To sign up for *QuickTakes* visit www.osha.gov/quicktakes.

To view materials available online or for a listing of free publications, visit www.osha.gov/publications. You can also call 1-800-321-OSHA (6742) to order publications.

Select OSHA publications are available in e-Book format. OSHA e-Books are designed to increase readability on smartphones, tablets and other mobile devices. For access, go to www.osha.gov/ebooks.

OSHA's web site also has information on job hazards and injury and illness prevention for employers and workers. To learn more about OSHA's safety and health resources online, visit www.osha.gov or www.osha.gov/html/a-z-index.html.

NIOSH Health Hazard Evaluation Program

Getting Help with Health Hazards

The National Institute for Occupational Safety and Health (NIOSH) is a federal agency that conducts scientific and medical research on workers' safety and health. At no cost to employers or workers, NIOSH can help identify health hazards and recommend ways to reduce or eliminate those hazards in the workplace through its Health Hazard Evaluation (HHE) Program.

Workers, union representatives and employers can request a NIOSH HHE. An HHE is often requested when there is a higher than expected rate of a disease or injury in a group of workers. These situations may be the result of an unknown cause, a new hazard, or a mixture of sources. To request a NIOSH Health Hazard Evaluation go to www.cdc.gov/niosh/hhe/request.html. To find out more, in English or Spanish, about the Health Hazard Evaluation Program:

E-mail HHERequestHelp@cdc.gov or call 800-CDC-INFO (800-232-4636).

OSHA Regional Offices

Region I
Boston Regional Office
(CT*, ME*, MA, NH, RI, VT*)
JFK Federal Building, Room E340
Boston, MA 02203
(617) 565-9860 (617) 565-9827 Fax

Region II
New York Regional Office
(NJ*, NY*, PR*, VI*)
201 Varick Street, Room 670
New York, NY 10014
(212) 337-2378 (212) 337-2371 Fax

Region III
Philadelphia Regional Office
(DE, DC, MD*, PA, VA*, WV)
The Curtis Center
170 S. Independence Mall West
Suite 740 West
Philadelphia, PA 19106-3309
(215) 861-4900 (215) 861-4904 Fax

Region IV
Atlanta Regional Office
(AL, FL, GA, KY*, MS, NC*, SC*, TN*)
61 Forsyth Street, SW, Room 6T50
Atlanta, GA 30303
(678) 237-0400 (678) 237-0447 Fax

Region V
Chicago Regional Office
(IL*, IN*, MI*, MN*, OH, WI)
230 South Dearborn Street
Room 3244
Chicago, IL 60604
(312) 353-2220 (312) 353-7774 Fax

Region VI
Dallas Regional Office
(AR, LA, NM*, OK, TX)
525 Griffin Street, Room 602
Dallas, TX 75202
(972) 850-4145 (972) 850-4149 Fax
(972) 850-4150 FSO Fax

Region VII
Kansas City Regional Office
(IA*, KS, MO, NE)
Two Pershing Square Building
2300 Main Street, Suite 1010
Kansas City, MO 64108-2416
(816) 283-8745 (816) 283-0547 Fax

Region VIII
Denver Regional Office
(CO, MT, ND, SD, UT*, WY*)
Cesar Chavez Memorial Building
1244 Speer Boulevard, Suite 551
Denver, CO 80204
(720) 264-6550 (720) 264-6585 Fax

Region IX
San Francisco Regional Office
(AZ*, CA*, HI*, NV*, and American Samoa,
Guam and the Northern Mariana Islands)
90 7th Street, Suite 18100
San Francisco, CA 94103
(415) 625-2547 (415) 625-2534 Fax

Region X
Seattle Regional Office
(AK*, ID, OR*, WA*)
300 Fifth Avenue, Suite 1280
Seattle, WA 98104
(206) 757-6700 (206) 757-6705 Fax

* These states and territories operate their own OSHA-approved job safety and health plans and cover state and local government employees as well as private sector employees. The Connecticut, Illinois, Maine, New Jersey, New York and Virgin Islands programs cover public employees only. (Private sector workers in these states are covered by Federal OSHA). States with approved programs must have standards that are identical to, or at least as effective as, the Federal OSHA standards.

Note: To get contact information for OSHA area offices, OSHA-approved state plans and OSHA consultation projects, please visit us online at www.osha.gov or call us at 1-800-321-OSHA (6742).

How to Contact OSHA

For questions or to get information or advice, to report an emergency, fatality, inpatient hospitalization, amputation, or loss of an eye, or to file a confidential complaint, contact your nearest OSHA office, visit www.osha.gov or call OSHA at 1-800-321-OSHA (6742), TTY 1-877-889-5627.

For assistance, contact us.
We are OSHA. We can help.

OSHA®
www.osha.gov

U.S. Department of Labor

For more information:

Occupational Safety and Health Administration

www.osha.gov (800) 321-OSHA (6742)

OSHA®
Occupational Safety
and Health Administration
www.osha.gov
OSHA 3886 October 2016

Recommended Practices for Safety & Health Programs in Construction






DISCLAIMER

These practices for safety and health programs for construction worksites are recommendations only. Employers in construction work must have a program that includes measures to detect and correct workplace hazards. However, their program may not contain all of the practices recommended in this document. Employers will not be cited if their safety and health program does not comply with this document.

FOREWORD

Establishing a safety and health program at your job site is one of the most effective ways of protecting your most valuable asset: your workers. Losing workers to injury or illness, even for a short time, can cause significant disruption and cost—to you as well as the workers and their families. It can also damage workplace morale, productivity, turnover, and reputation.

Safety and health programs foster a proactive approach to "finding and fixing" job site hazards before they can cause injury or illness. Rather than reacting to an incident, management and workers collaborate to identify and solve issues before they occur. This collaboration builds trust, enhances communication, and often leads to other business improvements. Employers who have implemented safety and health programs, including many who are in OSHA's Voluntary Protection Programs (VPP) or the Safety and Health Achievement Recognition Program (SHARP) for small and medium-sized businesses, have also found that managing for safety results in higher-quality product or output and higher profits.

These recommended practices reflect current conditions in the construction industry:

- New construction techniques, materials, and equipment have come into common use.
- Greater diversity in the construction workforce means that people from different backgrounds and cultures are working alongside each other, often speaking different languages.
- An aging workforce and the rise of sedentary lifestyle means that some workers are at higher risk for work-related musculoskeletal disorders.

Resources and Tools to Support Implementation of These Recommended Practices

OSHA has created a dedicated Web page to support the implementation of these practices at www.osha.gov/safetymanagement. The page includes a link to these recommended practices as well as the following:

- **Additional resources.** Articles and information sources related to each core element of the recommended practices, plus other topics discussed in the recommended practices.
- **Tools.** Downloadable templates, worksheets, and reference materials you can use as you develop your own safety and health program.

Please visit the recommended practices Web page and explore the resources available. OSHA will update the Web page and add resources and tools as they become available.

- Increased temporary and contract employment means that traditional relationships between workers and employers are shifting, and changes in safety programs and policies will be required to ensure the safety and health of all workers at worksites characterized by these newer and more fluid relationships.

These practices also reflect what we have learned from best-in-class programs and what makes them effective. In particular, these recommended practices place greater emphasis on involving workers, and include a more robust program evaluation element to help drive continuous improvement. These practices also stress the need for communication and coordination on worksites involving more than one employer.

CONTENTS

INTRODUCTION 2

MANAGEMENT LEADERSHIP 9

WORKER PARTICIPATION 11

HAZARD IDENTIFICATION AND ASSESSMENT 15

HAZARD PREVENTION AND CONTROL 20

EDUCATION AND TRAINING 24

PROGRAM EVALUATION AND IMPROVEMENT 27

COMMUNICATION AND COORDINATION FOR EMPLOYERS ON MULTIEMPLOYER WORKSITES 30

LIST OF ABBREVIATIONS 34

GLOSSARY OF TERMS 34

INTRODUCTION

THESE RECOMMENDED PRACTICES provide responsible employers, workers, and worker representatives[1] with a sound, flexible framework for addressing safety and health issues on diverse construction job sites. They may be used by any construction company or job site, but they will be particularly helpful to small and medium-sized contractors. They also include guidance specifically aimed at general contractor employment, staffing agency employment, and multiemployer work situations. These recommended practices have been developed solely for the construction industry. Separate recommended practices are available for all other industries.

The recommended practices emphasize a proactive approach to managing occupational safety and health. Traditional approaches are often reactive—that is, actions are taken only *after* a worker is injured or becomes sick, a new standard or regulation is published, or an outside inspection finds a problem that must be fixed. Finding and fixing hazards *before* they cause injury or illness is a far more effective approach. Doing so avoids the direct and indirect costs of worker injuries and illnesses, and promotes a positive work environment.

1 Worker participation is vital to the success of the program. In several places in these recommended practices, OSHA refers not just to workers but also to their representatives, such as labor unions or religious or community groups.

These best practices present principles and approaches to implementing and maintaining a safety and health program for the entire construction company. OSHA recognizes that a wide variety of small and large construction job sites exist. Some are short-duration, while others may take years to complete; some sites are characterized by frequently changing conditions, while other sites' conditions may change less often. An effective program emphasizes top-level ownership, participation by employees, and a "find and fix" approach to workplace hazards.

The "find and fix" approach to workplace hazards refers to the "Hazard Identification" and "Hazard Prevention and Control" core elements. Because of the wide variety of site conditions, these two core elements should be implemented on a site-specific basis in order to effectively detect and correct hazards.

The concept of continuous improvement is central to these recommended practices. As with any journey, the first step is often the most challenging. The idea is to begin with a basic program and grow from there. By initially focusing on achieving modest goals, monitoring performance, and evaluating outcomes, you can help your company progress over time along the path to higher levels of safety and health.

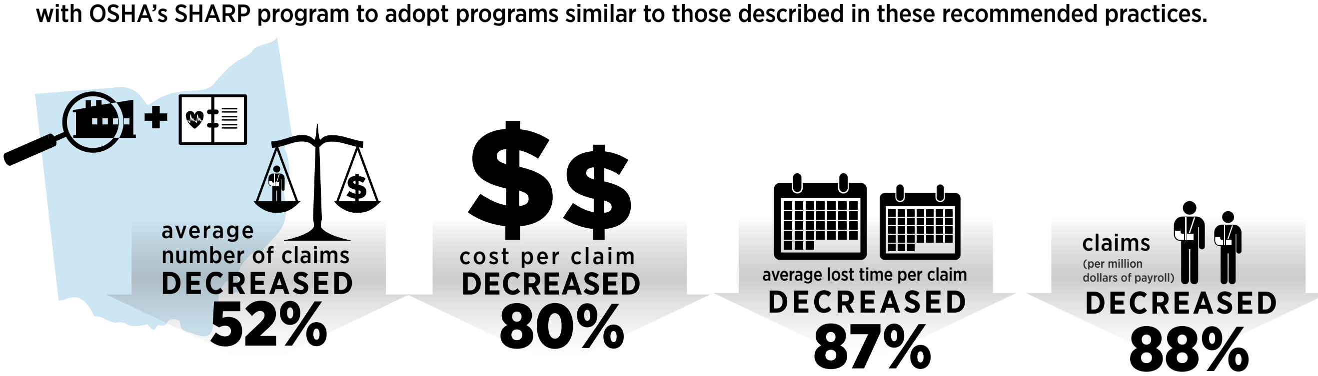
THE BENEFITS OF IMPLEMENTING THESE RECOMMENDED PRACTICES

Responsible employers know that the main goal of a safety and health program is to prevent work-related injuries, illnesses, and deaths, as well as the suffering and financial hardship these events can cause for workers, their families, and their employers.

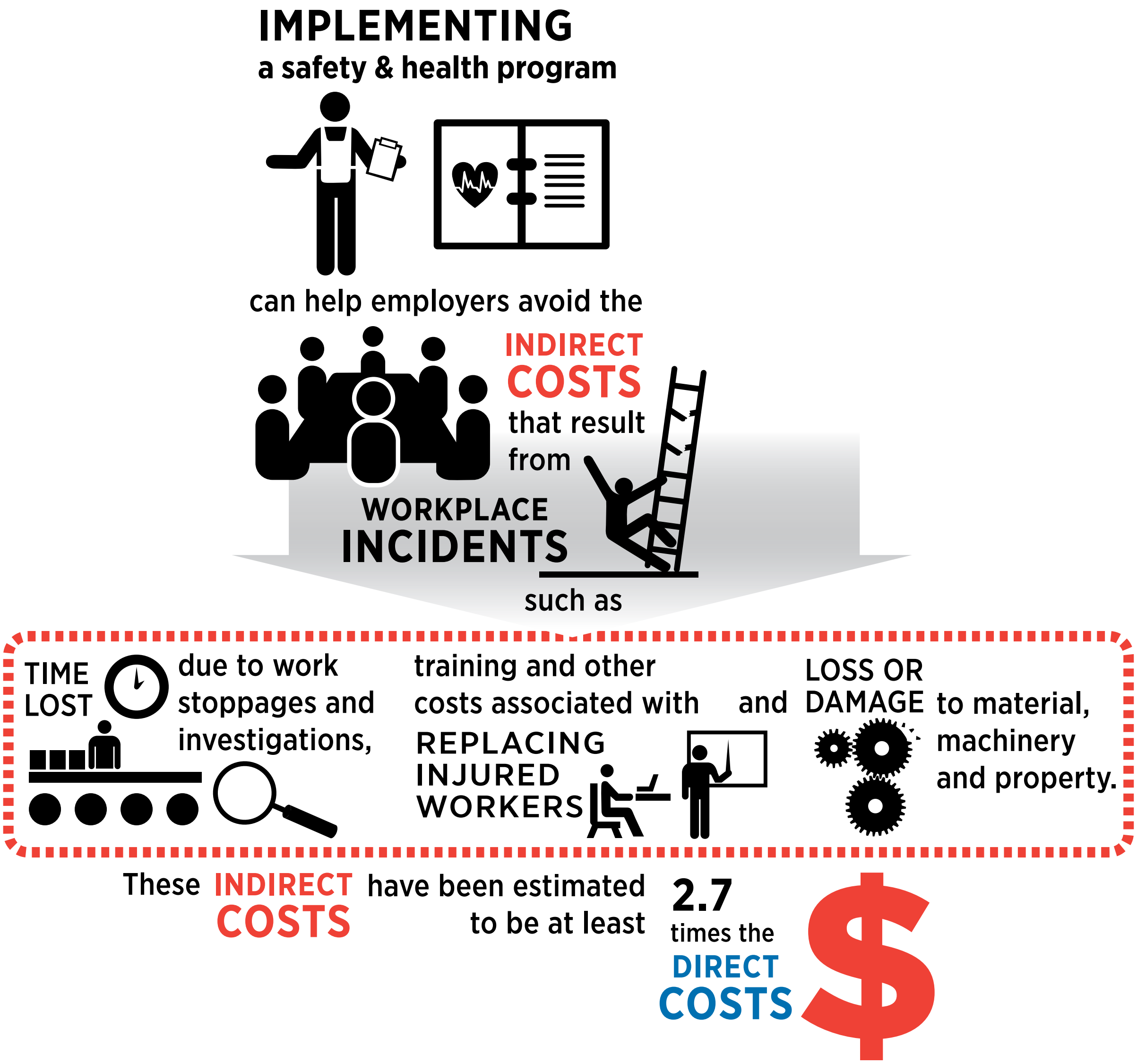
Employers may find that implementing these recommended practices brings other benefits as well. The renewed or enhanced commitment to safety and health and the cooperative atmosphere between employers and workers have been linked to:

- Improvements in production and quality.
- Better employee morale.
- Improved employee recruiting and retention.
- A more favorable image and reputation (among customers, suppliers, and the community).

A study of small employers in Ohio found that workers' compensation claims fell dramatically after working with OSHA's SHARP program to adopt programs similar to those described in these recommended practices.



Source: Ohio Bureau of Workers' Compensation (2011), Ohio 21(d) SHARP Program Performance Assessment.



Source: Leigh, J.P. (2011), Economic Burden of Occupational Injury and Illness in the United States. Milbank Quarterly, 89:728-772.[2]

HOW TO USE THE RECOMMENDED PRACTICES

Each section of the recommended practices describes a core program element (see page 7), followed by several action items. Each action item is an example of steps that general contractors, subcontractors, managers, supervisors, and workers can take to establish, implement, maintain, and improve safety and health programs. A general self-evaluation tool can be found on the recommended practices Web page. It can be tailored to your construction site to track your progress and document how you have implemented (or will implement) each action item.

Seven interrelated elements

The seven core elements are interrelated and are best viewed as part of an integrated system. Actions taken under one core element can

2 The 2.7 multiplier for indirect costs includes some social costs, such as workers' compensation costs not covered by insurance.

(and likely will) affect actions needed under one or more other elements. For example, workers must be trained in reporting procedures and hazard identification techniques in order to be effective participants. Thus, the "Education and Training" core element supports the "Worker Participation" core element. Similarly, setting goals (as described under "Management Leadership") will be more effective if you routinely evaluate your progress in meeting those goals (see "Program Evaluation and Improvement"). Progress in each core element is important to achieve maximum benefit from the program.

One size does not fit all

While the action items under each core element are specific, they are not prescriptive. The process described in these recommended practices can, and should, be tailored to the needs of each construction company and/or job site. Likewise, your safety and health program can and should evolve. Experimentation, evaluation, and program modification are all part of the process. You may also experience setbacks from time to time. What is important is that you learn from setbacks, remain committed to finding out what works best for you, and continue to try different approaches.

Injuries and illnesses occur in all construction trades. The preventive approaches described in these recommended practices work equally well for small and large organizations in the construction industry. Small employers may find that they can best accomplish the actions outlined in these recommended practices using informal communications and procedures. Larger employers, who have more complex work processes and hazards, may require a more formal and detailed program. They may also wish to integrate their safety and health program with other programs that they are using to manage production, quality control, and environmental protection or sustainability.

The importance of worker participation

Throughout these recommended practices, OSHA emphasizes the importance of worker participation in the safety and health program. For a program to succeed, workers (and, if applicable, their representatives) must participate in developing and implementing every element of the safety and health program. This emphasis on worker participation is consistent with the OSH Act, OSHA standards, and OSHA enforcement policies and procedures, which recognize the rights and roles of workers and their representatives in matters of workplace safety and health. Several action items described in these recommended practices rely on perspectives, expertise, and input that can come only from workers and their representatives.

When more than one employer is involved

Employers and workers on "multiemployer" worksites should pay particular attention to the "Coordination and Communication for Employers on Multiemployer Worksites" section. This section describes actions that controlling employers such as general contractors, prime contractors and construction managers, subcontractors, and temporary staffing agencies (and their workers) should take to ensure protection of everyone on the job site.

For tools and resources to help you implement these recommended practices, visit: **www.osha.gov/safetymanagement**

NINE EASY THINGS TO GET YOUR PROGRAM STARTED

If these recommended practices appear challenging, here are some simple steps you can take to get started. Completing these steps will give you a solid base from which to take on some of the more structured actions presented in the recommended practices.

1. ALWAYS SET SAFETY AND HEALTH AS THE TOP PRIORITY

Tell your workers that making sure they finish the day and go home safely is the way you do business. Assure them that you will work with them to find and fix any hazards that could injure them or make them sick.

2. LEAD BY EXAMPLE

Practice safe behaviors yourself and make safety part of your daily conversations with workers.

3. IMPLEMENT A REPORTING SYSTEM

Develop and communicate a simple procedure for workers to report any injuries, illnesses, incidents (including near misses/close calls), hazards, or safety and health concerns without fear of retaliation. Include an option for reporting hazards or concerns anonymously.

4. PROVIDE TRAINING

Train workers on how to identify and control hazards using, for example, OSHA's Hazard Identification Training Tool.

5. CONDUCT INSPECTIONS

Inspect the job site with workers and ask them to identify any activity, piece of equipment, or material that concerns them. Use checklists and other resources, such as OSHA's Construction Industry Digest, to help identify problems.

6. COLLECT HAZARD CONTROL IDEAS

Talk with workers about ideas on safety improvements throughout the project.

7. IMPLEMENT HAZARD CONTROLS

Assign workers the task of choosing, implementing, and evaluating the solutions.

8. ADDRESS EMERGENCIES

Identify foreseeable emergency scenarios and develop instructions on what to do in each case. Meet to discuss these procedures and post them in a visible location at the job site.

9. MAKE IMPROVEMENTS

Set aside a regular time to discuss safety and health issues, with the goal of identifying ways to improve the program.

CORE ELEMENTS OF THE RECOMMENDED PRACTICES FOR SAFETY AND HEALTH PROGRAMS IN CONSTRUCTION

MANAGEMENT LEADERSHIP	• Top management demonstrates its commitment to eliminating hazards and to continuously improving workplace safety and health, communicates that commitment to workers, and sets program expectations and responsibilities. • Managers at all levels make safety and health a core organizational value, establish safety and health goals and objectives, provide adequate resources and support for the program, and set a good example.
WORKER PARTICIPATION	• Workers and their representatives are involved in all aspects of the program—including setting goals, identifying and reporting hazards, investigating incidents, and tracking progress. • All workers, including contractors and temporary workers, understand their roles and responsibilities under the program and what they need to do to effectively carry them out. • Workers are encouraged and have means to communicate openly with management and to report safety and health concerns or suggest improvements, without fear of retaliation. • Any potential barriers or obstacles to worker participation in the program (for example, language, lack of information, or disincentives) are removed or addressed.
HAZARD IDENTIFICATION AND ASSESSMENT	• Procedures are put in place to continually identify workplace hazards and evaluate risks. • Safety and health hazards from routine, nonroutine, and emergency situations are identified and assessed. • An initial assessment of existing hazards, exposures, and control measures is followed by periodic inspections and reassessments, to identify new hazards. • Any incidents are investigated with the goal of identifying the root causes. • Identified hazards are prioritized for control.
HAZARD PREVENTION AND CONTROL	• Employers and workers cooperate to identify and select methods for eliminating, preventing, or controlling workplace hazards. • Controls are selected according to a hierarchy that uses engineering solutions first, followed by safe work practices, administrative controls, and finally personal protective equipment (PPE). • A plan is developed that ensures controls are implemented, interim protection is provided, progress is tracked, and the effectiveness of controls is verified.
EDUCATION AND TRAINING	• All workers are trained to understand how the program works and how to carry out the responsibilities assigned to them under the program. • Employers, managers, and supervisors receive training on safety concepts and their responsibility for protecting workers' rights and responding to workers' reports and concerns. • All workers are trained to recognize workplace hazards and to understand the control measures that have been implemented.
PROGRAM EVALUATION AND IMPROVEMENT	• Control measures are periodically evaluated for effectiveness. • Processes are established to monitor program performance, verify program implementation, and identify program shortcomings and opportunities for improvement. • Necessary actions are taken to improve the program and overall safety and health performance.
COMMUNICATION AND COORDINATION FOR EMPLOYERS ON MULTIEMPLOYER WORKSITES	• General contractors, contractors, and staffing agencies commit to providing the same level of safety and health protection to all employees. • General contractors, contractors, subcontractors, and staffing agencies commmunicate the hazards present at the worksite and the hazards that work of contract workers may create on site. • General contractors establish specifications and qualifications for contractors and staffing agencies. • Prior to beginning work, general contractors, contractors, and staffing agencies coordinate on work planning and scheduling to identify and resolve any conflicts that could impact safety or health.

FOR MORE INFORMATION

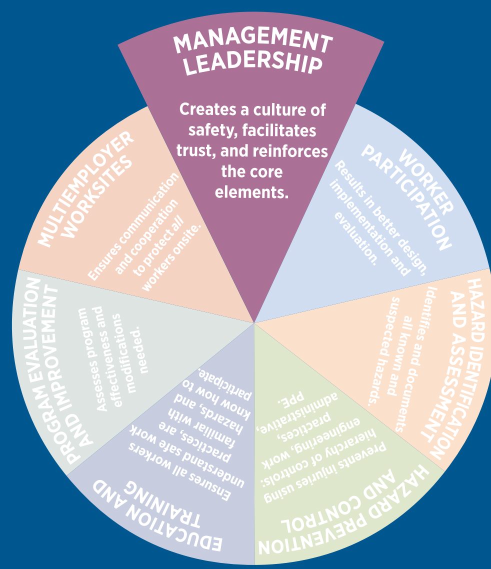
For more information about these recommended practices, tools to help you implement them, and related topics, see the recommended practices Web page. This page includes links to many tools and resources developed by OSHA and others that can help employers and workers implement these recommended practices. OSHA will continue to update and add to this resource list.

OSHA's On-site Consultation Program offers free and confidential occupational safety and health services to small and medium-sized businesses in all states across the country and in several territories, with priority given to high-hazard worksites.

On-site Consultation Program services are separate from enforcement and do not result in penalties or citations. Consultants from state agencies or universities work with employers to identify workplace hazards, provide advice on compliance with OSHA standards, and help them establish and improve their safety and health programs.

For free assistance, including help implementing your program, visit: **www.osha.gov/dcsp/smallbusiness** or call 1-800-321-6742 (OSHA)

MANAGEMENT LEADERSHIP



MANAGEMENT PROVIDES the leadership, vision, and resources needed to implement an effective safety and health program. Management leadership means that business owners, managers, and supervisors:

- Make worker safety and health a core organizational value.
- Are fully committed to eliminating hazards, protecting workers, and continuously improving safety and health on job sites.
- Provide sufficient resources to implement and maintain the safety and health program.
- Visibly demonstrate and communicate their safety and health commitment to workers and others.
- Set an example through their own actions.

Action item 1: Communicate your commitment to a safety and health program

A clear, written policy helps you communicate that safety and health is a primary organizational value—as important as productivity, profitability, product or service quality, and customer satisfaction.

How to accomplish it

Establish a written policy signed by top management describing the organization's commitment to safety and health, and pledging to establish and maintain a safety and health program for all workers.

- Communicate the policy to all workers and, at appropriate times and places, to relevant parties, including:
  - Contractors, subcontractors, staffing agencies, and temporary workers at your worksite(s)
  - Suppliers and vendors
  - Other businesses in a multi-tenant building
  - Visitors
  - Customers
- Reinforce management commitment by considering safety and health in all business decisions, including estimating and bidding on projects, subcontractor and vendor selection, scheduling, and implementing safety designs into construction processes, drawings, and modifications.
- Be visible in operations and set an example by following the same safety and health procedures you expect workers to follow. Conduct weekly or daily toolbox talks on safety and health, and discuss/review safety and health indicators and/or open safety items on a "to do" list.

Action item 2: Define program goals

By establishing specific goals and objectives, management sets expectations for managers, supervisors, and workers, and for the program overall. The goals and objectives should focus on specific actions that will improve worker safety and health.

How to accomplish it

- Establish realistic, measurable goals for improving safety and health.
- Develop plans to achieve the goals by assigning tasks and responsibilities to particular people, setting timeframes, and determining resource needs.

Action item 3: Allocate resources

Management provides the resources needed to implement the safety and health program, pursue program goals, and address program shortcomings when they are identified.

How to accomplish it

- Estimate the resources needed to establish and implement the program. One example is ensuring safety equipment is included in the project budget.
- Allow time in workers' schedules for them to fully participate in the program. Safety can be built into the labor rates when estimating a project.
- Integrate safety and health into planning and budgeting processes, and align budgets with program needs.
- Provide and direct resources to operate and maintain the program, meet safety and health commitments, and pursue program goals.

Note: Resource needs will vary depending on your organization's size, complexity, hazard types, and program maturity and development. Resource needs may include capital equipment and supplies, staff time, training, access to information and tools (e.g., vendor information, Safety Data Sheets, injury/illness data, checklists, online databases) and access to safety and health experts, including OSHA's free and confidential On-site Consultation Program (see "For More Information" in the introduction to these recommended practices).

Action item 4: Expect performance

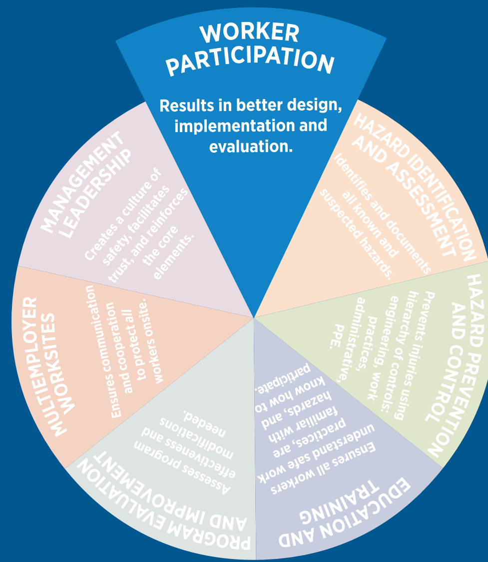
Management leads the program effort by establishing roles and responsibilities and providing an open, positive environment that encourages communication about safety and health.

How to accomplish it

- Identify a frontline person or persons who will lead the safety program effort, make plans, coordinate activities, and track progress. Define and regularly communicate responsibilities and authorities for implementing and maintaining the program, and hold people accountable for performance.
- Provide positive recognition for meeting or exceeding safety and health goals aimed at preventing injury and illness (e.g., reporting close calls/near misses, attending training, conducting inspections).
- Establish ways for management and all workers to communicate freely and often about safety and health issues, without fear of retaliation.

Note: Maintaining a positive and encouraging tone is important. Successful programs reward, rather than discipline, workers who identify problems or concerns, much like successful quality programs. Disciplinary measures should be reserved for situations in which an individual manager or worker is uncooperative or becomes an impediment to progress.

WORKER PARTICIPATION



TO BE EFFECTIVE, any safety and health program needs the meaningful participation of workers and their representatives. Workers have much to gain from a successful program, and the most to lose if the program fails. They also often know the most about potential hazards associated with their jobs. Successful programs tap into this knowledge base.

Worker participation means participation in establishing, operating, evaluating, and improving the safety and health program. All workers at a worksite should participate, including those employed by subcontractors and temporary staffing agencies (see “Coordination and Communication on Multi-employer Worksites”).

IN AN EFFECTIVE safety and health program, all workers:

- Are encouraged to participate in the program and feel comfortable providing input and reporting safety or health concerns.
- Have access to information they need to participate effectively in the program.
- Have opportunities to participate in all phases of program design and implementation.
- Do not experience retaliation when they raise safety and health concerns; report injuries, illnesses, and hazards; participate in the program; or exercise safety and health rights.

Note: Worker participation is vital to the success of safety and health programs. Where workers are represented by a union, it is important that worker representatives also participate in the program, consistent with the rights provided to worker representatives under the Occupational Safety and Health Act of 1970 and the National Labor Relations Act.

RETALIATION AGAINST WORKERS IS ILLEGAL

Section 11(c) of the Occupational Safety and Health Act of 1970 prohibits employers from retaliating against employees for exercising a variety of rights guaranteed under the OSH Act, such as filing a safety and health complaint with OSHA, raising a health and safety concern with their employers, participating in an OSHA inspection, or reporting a work-related injury or illness. OSHA vigorously enforces the anti-retaliation protections provided under 11(c) of the OSH Act and other federal statutes. For more information, see www.whistleblowers.gov.

Action item 1: Encourage workers to participate in the program

By encouraging workers to participate in the program, management signals that it values their input into safety and health decisions.

How to accomplish it

- Give workers the necessary time and resources to participate in the program.
- Acknowledge and provide positive reinforcement to those who participate in the program.
- Maintain an open door policy that invites workers to talk to managers about safety and health and to make suggestions.

Action item 2: Encourage workers to report safety and health concerns

Workers are often best positioned to identify safety and health concerns and program shortcomings, such as emerging job site hazards, unsafe conditions, close calls/near misses, and actual incidents. By encouraging reporting and following up promptly on all reports, employers can address issues before someone gets hurt or becomes ill.

How to accomplish it

- Establish a simple process for workers to report injuries, illnesses, close calls/near misses, hazards, and other safety and health concerns, and respond to reports promptly. Include an option for anonymous reporting to reduce fear of reprisal.[3]
- Report back to workers routinely and frequently about action taken in response to their concerns and suggestions.
- Emphasize that management will use reported information only to improve job site safety and health, and that no worker will experience retaliation for bringing such information to management's attention (see Action item 5).
- Empower all workers to initiate or request a temporary suspension or shutdown of any work activity or operation they believe to be unsafe.
- Involve workers in finding solutions to reported issues.

3 Under OSHA's injury and illness recordkeeping rule (29 CFR 1904), employers are required to establish a "reasonable" procedure for employees to report work-related injuries and illnesses promptly and accurately. A reasonable procedure is defined as one that would not deter or discourage a reasonable employee from accurately reporting a workplace injury or illness.

Action item 3: Give workers access to safety and health information

Sharing relevant safety and health information with workers fosters trust and helps organizations make more informed safety and health decisions.

How to accomplish it

- Give workers the information they need to understand safety and health hazards and control measures on the job site. Some OSHA standards require employers to make specific types of information available to workers, such as:
  - Safety Data Sheets (SDSs)
  - Injury and illness data (prevent disclosure of sensitive and personal information as required)
  - Results of worker exposure monitoring conducted at job sites (prevent disclosure of sensitive and personal information as required)
- Other useful information for workers to review can include:
  - Chemical and equipment manufacturer safety recommendations
  - Job site equipment and vehicle inspection reports
  - Incident investigation reports (prevent disclosure of sensitive and personal information as required)
  - Job hazard analyses (JHAs) and/or job safety analyses (JSAs)

Action item 4: Involve workers in all aspects of the program

Including worker input at every step of program design and implementation improves your ability to identify the presence and causes of job site hazards, creates a sense of program ownership among workers, enhances their understanding of how the program works, and helps sustain the program over time.

How to accomplish it

- Provide opportunities for workers to participate in all aspects of the program, including, but not limited to helping:
  - Develop the program and set goals to reduce or eliminate injuries and illnesses.
  - Report hazards and develop solutions that improve safety and health.
  - Analyze hazards in each step of routine and nonroutine jobs, tasks, and processes.
  - Define and document safe work practices.
  - Conduct site inspections, including equipment and vehicles.
  - Develop and revise safety procedures.
  - Participate in incident and close call/near miss investigations.
  - Train current coworkers and new hires.
  - Develop, implement, and evaluate training programs.
  - Evaluate program performance and identify ways to improve it.
  - Take part in exposure monitoring and medical surveillance associated with health hazards.
- Conduct daily planning meetings, huddles, toolbox talks, or tailgate meetings to engage workers in the safety and health program.

Action item 5: Remove barriers to participation

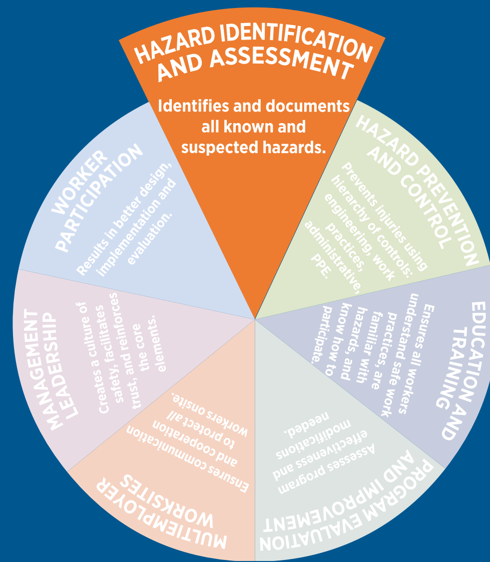
To participate meaningfully in the program, workers must feel that their input is welcome, their voices will be heard, and they can access reporting mechanisms. Participation will be suppressed if language, education, or skill levels on the job site are not considered, or if workers fear retaliation or discrimination for speaking up (for example, if investigations focus on blaming individuals rather than the underlying conditions that led to the incident, or if reporting an incident or concern could jeopardize the award of incentive-based prizes, rewards, or bonuses).

How to accomplish it

- Ensure that workers from all levels of the organization can participate regardless of their skill level, education, or language.
- Provide frequent and regular feedback to show employees that their safety and health concerns are being heard and addressed.
- Authorize sufficient time and resources to facilitate worker participation; for example, hold safety and health meetings during regular working hours.
- Ensure that the program protects workers from being retaliated against for reporting injuries, illnesses, and hazards; participating in the program; or exercising their safety and health rights. Ensure that other policies and programs do not discourage worker participation.
- Post the Section 11(c) fact sheet (found at www.whistleblowers.gov) in the workplace or otherwise make it available for easy access by employees.

Note: Incentive programs (such as point systems, awards, and prizes) should be designed in a manner that does not discourage injury and illness reporting; otherwise, hazards may remain undetected. Although sometimes required by law or insurance providers, mandatory drug testing following injuries can also suppress reporting. Effective safety and health programs recognize positive safety and health activities, such as reporting hazardous conditions or suggesting safer work procedures. (See OSHA's "Employer Safety Incentive and Disincentive Policies and Practices" memorandum, dated March 12, 2012: www.osha.gov/as/opa/whistleblowermemo.html.)

HAZARD IDENTIFICATION AND ASSESSMENT



IN CONSTRUCTION, unanticipated hazards can arise due to changes in project timelines, sequence of events, and the fast pace of some construction projects. Hazard identification and assessment is a crucial part of an effective safety and health program.

One of the "root causes" of construction injuries, illnesses, and incidents is the failure to identify or recognize hazards that are present, or that could have been anticipated. A critical element of any effective safety and health program is a proactive, ongoing process to identify and assess such hazards.

TO IDENTIFY AND ASSESS hazards, employers and workers:

- Collect and review information about the hazards present or likely to be present at the job site.
- Conduct frequent and regular inspections of the job site to identify new or recurring hazards.
- Investigate injuries, illnesses, incidents, and close calls/near misses to identify the underlying hazards, their causes, and safety and health program shortcomings.
- Group similar incidents and identify trends in injuries, illnesses, and hazards reported.
- Consider hazards associated with emergency or nonroutine situations.
- For each hazard identified, determine the severity and likelihood of incidents that could result, and use this information to prioritize corrective actions.

Some hazards, such as housekeeping and tripping hazards, can and should be fixed as they are found. Fixing a hazard on the spot emphasizes the importance of safety and health and takes advantage of a safety leadership opportunity. Fixing other hazards identified using the processes described here will be addressed in the next section, "Hazard Prevention and Control."

Action item 1: Collect existing information about job site hazards

Information on job site hazards may already be available (from both internal and external sources) to employers and workers.

How to accomplish it

- Collect, organize, and review information with workers to determine what types of hazards may be present and which workers may be exposed or potentially exposed.

- Information available may include:
  - Equipment and machinery operating manuals.
  - SDSs provided by chemical manufacturers.
  - Self-inspection reports and inspection reports from insurance carriers, government agencies, and consultants.
  - Records of previous injuries and illnesses, such as OSHA 300 and 301 logs and reports of incident investigations.
  - Workers' compensation records and reports.
  - Patterns of frequently occurring injuries and illnesses.
  - Exposure monitoring results, industrial hygiene assessments, and medical records (appropriately redacted to ensure patient/worker privacy).
  - Existing safety and health programs (hazard communication, confined spaces in construction, respiratory protection, process safety management, PPE, etc.).
  - Input from workers, including surveys or minutes from safety and health committee meetings.
  - Results of job hazard analyses (also known as job safety analyses).
- Information about hazards may be available from outside sources, such as:
  - OSHA, National Institute for Occupational Safety and Health (NIOSH), and Centers for Disease Control and Prevention (CDC) websites, publications, and alerts.
  - Trade associations.
  - Labor unions, state and local occupational safety and health committees/coalitions ("COSH groups"), and worker advocacy groups.
  - Safety and health consultants.

Action item 2: Inspect the job site for safety hazards

Hazards can be introduced over time as conditions on the job site change, for example, as the building goes up, equipment or tools become worn, different trades arrive at and depart from the site, and housekeeping practices decline. Setting aside time to frequently and regularly inspect the job site for hazards can help identify shortcomings so that they can be addressed before an incident occurs.

How to accomplish it

- Designate a competent person to conduct frequent and regular inspections of the job sites, materials, and equipment. Have workers on the inspection team, and talk to them about hazards that they see or report.
- Plan ahead to anticipate the potential introduction of additional hazards by the next group of trades or sequence of construction activies and to address these additional hazards. For example, ensure that structures can handle any additional anticipated loads.
- Be sure to document inspections so you can later verify that hazardous conditions have been corrected. Take photos or video of problem areas to facilitate on-the-job discussion and brainstorming about how to immediately control them.
- Include all areas and activities in these inspections, such as trenching and excavations, staging areas, layout yards, working at heights, materials storage, heavy equipment maintenance, and the activities of on-site contractors, subcontractors, and temporary workers.

- Regularly inspect both mobile construction equipment (e.g., forklifts, bulldozers, aerial lifts and cranes) and transportation vehicles (e.g., cars, trucks).
- Create material delivery areas and internal traffic control plans for the construction site and laydown areas.
- Use checklists that highlight things to look for. Typical hazards fall into several major categories, such as those listed below; each workplace will have its own list:
    - Slip, trip, and fall hazards
    - Electrical hazards
    - General housekeeping
    - Equipment operation
    - Equipment maintenance
    - Fire protection
    - Work organization and process flow (including staffing and scheduling)

    - Work practices
    - Ergonomic problems
    - Lack of emergency procedures
- Before changing operations, workstations, or workflow; making major organizational changes; or introducing new equipment, materials, or processes, seek the input of workers and evaluate the planned changes for potential hazards and related risks.

Note: Many hazards can be identified using common knowledge and available tools. For example, you can easily identify and correct hazards associated with broken stair rails and frayed electrical cords. Workers can be a very useful internal resource, especially if they are trained in how to identify and assess risks.

Action item 3: Identify health hazards

Identifying workers' exposure to health hazards is typically more complex and less obvious than identifying physical safety hazards. For example, gases and vapors may be invisible, often have no odor, and may not have an immediately noticeable harmful health effect. Health hazards include chemical hazards (solvents, adhesives, paints, toxic dusts such as lead and silica, etc.), physical hazards (noise, radiation, heat, etc.), biological hazards (infectious diseases), and ergonomic risk factors (heavy lifting, repetitive motions, vibration from operating tools and earthmoving equipment).

How to accomplish it

- Identify *chemical hazards*—review SDSs and product labels to identify chemicals at your job site that have low exposure limits, are highly volatile, or are used in large quantities or in unventilated spaces. Identify activities that may result in skin exposure to chemicals.
- Identify *physical hazards*—identify any exposures to excessive noise (areas where you must raise your voice to be heard by others), elevated heat (indoor and outdoor), or sources of radiation (radioactive materials, X-rays, or radiofrequency radiation).

- Identify *biological hazards*—determine whether workers may be exposed to sources of infectious diseases, molds, toxic or poisonous plants, or animal materials (fur or scat) capable of causing allergic reactions or occupational asthma.
- Identify *ergonomic risk factors*—examine work activities that require heavy lifting, work above shoulder height, repetitive motions, or tasks with significant vibration.
- Conduct quantitative exposure assessments, when possible, using air sampling or direct reading instruments.
- Review OSHA 300 logs to help identify health hazards associated with job site exposures.

Note: Identifying and assessing health hazards may require specialized knowledge. Small businesses can obtain free and confidential occupational safety and health advice services, including help identifying and assessing workplace hazards, through OSHA's On-site Consultation Program (see www.osha.gov/dcsp/smallbusiness/consult.html).

Action item 4: Conduct incident investigations

Incidents—including injuries, illnesses, close calls/near misses, and reports of other concerns—provide a clear indication of where hazards exist. By thoroughly investigating incidents and reports, you will identify hazards that are likely to cause future harm. The purpose of an investigation must always be to identify the root causes (and there is often more than one) of the incident or concern, in order to prevent future occurrences.

How to accomplish it

- Develop a clear plan and procedure for conducting incident investigations, so that an investigation can begin immediately when an incident occurs. The plan should cover items such as:
  - Who will be involved
  - Lines of communication
  - Materials, equipment, and supplies needed
  - Reporting forms and templates
- Train investigative teams on incident investigation techniques, emphasizing objectivity and open-mindedness throughout the investigation process.
- Conduct investigations with a trained team that includes representatives of both management and workers.
- Investigate close calls/near misses.
- Identify and analyze root causes to address underlying program shortcomings that allowed the incidents to happen.
- Communicate the results of the investigation to managers, supervisors, and workers to prevent recurrence.

Note: OSHA has special reporting requirements for work-related incidents that lead to serious injury or a fatality (29 CFR 1904.39). OSHA must be notified within 8 hours of a work-related fatality, and within 24 hours of an amputation, loss of an eye, or inpatient hospitalization.

Note: Effective incident investigations do not stop at identifying a single factor that triggered an incident. They ask the questions "Why?" and "What led to the failure?" For example, if a piece of equipment fails, a good investigation asks: "Why did it fail?" "Was it maintained properly?" "Was it beyond its service life?" and "How could this failure have been prevented?" Similarly, a good incident investigation does not stop when it concludes that a worker made an error. It asks such questions as: "Was the worker provided with appropriate tools and time to do the work?" "Was the worker adequately trained?" and "Was the worker properly supervised?"

Action item 5: Identify hazards associated with emergency and nonroutine situations

Emergencies present hazards that need to be recognized and understood. Nonroutine or infrequent tasks, including mobilization and demobilization of the site, critical lifts with cranes, concrete pours, or setting critical structural members, also present potential hazards. Plans and procedures need to be developed for responding appropriately and safely to hazards associated with foreseeable emergency scenarios and nonroutine situations.

How to accomplish it

- Identify foreseeable emergency scenarios and nonroutine tasks, taking into account the types of material and equipment in use and the location at the worksite. Scenarios such as the following may be foreseeable:
  - Structural collapse (i.e., bridges, buildings, trenches, and concrete forms)
  - Nonroutine tasks, such as infrequently performed activities (i.e., critical lifts and concrete pours)
  - Fires and explosions
  - Medical emergencies
  - Weather emergencies and natural disasters
  - Hazardous material spills
  - Startups after planned or unplanned equipment shutdowns

Action item 6: Characterize the nature of identified hazards, identify interim control measures, and prioritize the hazards for control

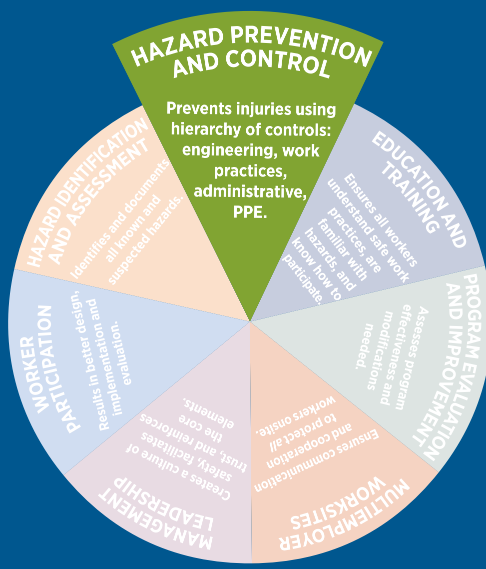
The next step is to assess and understand the hazards identified and the types of incidents that could result from worker exposure to those hazards. This information can be used to develop interim controls and to prioritize hazards for permanent control (see "Hazard Prevention and Control").

How to accomplish it

- Evaluate each hazard by considering the severity of potential outcomes, the likelihood that an event or exposure will occur, and the number of workers who might be exposed.
- Use interim control measures to protect workers until more permanent solutions can be implemented.
- Prioritize the hazards so that those presenting the greatest risk are addressed first. Note, however, that employers have an ongoing obligation to control all serious recognized hazards and to protect workers.

Note: "Risk" is the product of hazard and exposure. Thus, risk can be reduced by controlling or eliminating the hazard, or by reducing workers' exposure to hazards. An assessment of risk helps employers understand hazards in the context of their own workplace, and prioritize hazards for permanent control.

HAZARD PREVENTION AND CONTROL



EFFECTIVE CONTROLS protect workers from hazards; help avoid injuries, illnesses, and incidents; minimize or eliminate safety and health risks; and help employers provide workers with safe and healthful working conditions. The processes described in this section will help employers prevent and control hazards identified in the previous section.

TO EFFECTIVELY CONTROL and prevent hazards, employers should:

- Involve workers, who often have the best understanding of the conditions that create hazards and insights into how they can be controlled.
- Identify and evaluate options for controlling hazards, using a "hierarchy of controls."
- Use a hazard control plan to guide the selection and implementation of controls, and implement controls according to the plan.
- Develop plans with measures to protect workers during emergencies and nonroutine activities.
- Evaluate the effectiveness of existing controls to determine whether they continue to provide protection, or whether different controls may be more effective. Review new technologies for their potential to be more protective, more reliable, or less costly.

Action item 1: Identify control options

A wealth of information exists to help employers investigate options for controlling identified hazards. Before selecting any control options, it is essential to solicit workers' input on their feasibility and effectiveness.

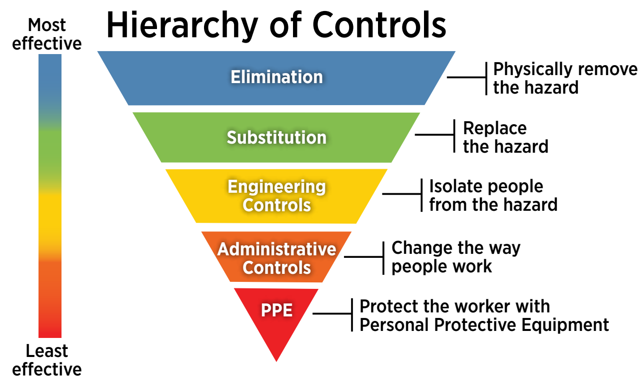
How to accomplish it

- Review sources such as OSHA standards and guidance, industry consensus standards, NIOSH publications, manufacturers' literature, and engineering reports to identify potential control measures. Keep current on relevant information from trade or professional associations.
- Investigate control measures used at other worksites and determine whether they would be effective at your job sites.
- Get input from workers who may be able to suggest and evaluate solutions based on their knowledge of the job site, equipment, and work processes.

- For complex hazards, consult with safety and health experts, including OSHA's On-site Consultation Program.
- Plan the sequencing of various trades to reduce overlap where possible and to avoid exposing other trades to hazards.

Action item 2: Select controls

Employers should select the controls that are the most feasible, effective, and permanent.



Source: NIOSH

How to accomplish it

- Eliminate or control all serious hazards (hazards that are causing or are likely to cause death or serious physical harm) immediately.
- Use interim controls while you develop and implement longer-term solutions.
- Select controls according to a hierarchy that emphasizes engineering solutions (including elimination or substitution) first, followed by safe work practices, administrative controls, and finally PPE.
- Avoid selecting controls that may directly or indirectly introduce new hazards. Examples include exhausting contaminated air into occupied work spaces or using hearing protection that makes it difficult to hear backup alarms.
- Review and discuss control options with workers to ensure that controls are feasible and effective.
- Use a combination of control options when no single method fully protects workers.

Note: Whenever possible, select equipment, machinery, and materials that are inherently safer based on the application of "Prevention through Design" (PtD) principles. Apply PtD when making your own job site or equipment decisions. For more information, see the link to the NIOSH PtD initiative on the recommended practices Web page.

Action item 3: Develop and update a hazard control plan

A hazard control plan describes how the selected controls will be implemented. An effective plan will address serious hazards first. Interim controls may be necessary, but the overall goal is to ensure effective long-term control of hazards. Control plans at a construction site may need to be updated and modified often as the project develops and the site conditions and hazards change.

How to accomplish it

- List the hazards needing controls in order of priority.
- Assign responsibility for installing/implementing the controls to a specific person or persons with the power or ability to implement the controls.
- Establish a target completion date.
- Plan how you will track progress toward completion.
- Plan how you will verify the effectiveness of controls after they are installed or implemented.

Action item 4: Select controls to protect workers during nonroutine tasks and emergencies

A hazard control plan includes provisions to protect workers during nonroutine tasks and foreseeable emergencies, such as falls, cave-ins, fires and explosions, chemical releases, hazardous material spills, infrequent activities, natural and weather disasters, workplace violence, terrorist or criminal attacks, disease outbreaks (e.g., pandemic influenza), and medical emergencies. Nonroutine tasks, or tasks workers don't normally do, should be approached with particular caution. Prior to initiating such work, review JSAs with the workers involved and notify others about the nature of the work, work schedule, and any necessary precautions.

How to accomplish it

- Develop procedures to control hazards that may arise during nonroutine tasks (e.g., mobilization and demobilization of the site, critical lifts with cranes, concrete pours, or setting critical structural members).
- Develop or modify plans to control hazards that may arise in emergency situations.
- Procure any equipment needed to control emergency-related hazards.
- Assign responsibilities for implementing the emergency plan.
- Conduct emergency drills to ensure that procedures and equipment provide adequate protection during emergency situations.

Note: Depending on your location, type of business, and materials stored or used on site, authorities including local fire and emergency response departments, state agencies, the U.S. Environmental Protection Agency, the Department of Homeland Security, and OSHA may have additional requirements for emergency plans. Ensure that your procedures comply with these requirements.

Action item 5: Implement selected controls on the job site

Once hazard prevention and control measures have been identified, they should be implemented according to the hazard control plan.

How to accomplish it

- Implement hazard control measures according to the priorities established in the hazard control plan.
- When resources are limited, implement measures on a "worst-first" basis, according to the hazard ranking priorities (risk) established during hazard identification and assessment. (Note, however, that regardless of limited resources, employers have an obligation to protect workers from recognized, serious hazards.)
- Promptly implement any measures that are easy and inexpensive—such as general housekeeping, removal of obvious tripping hazards such as electrical cords, and basic lighting—regardless of the level of hazard they involve.

Action item 6: Follow up to confirm that controls are effective

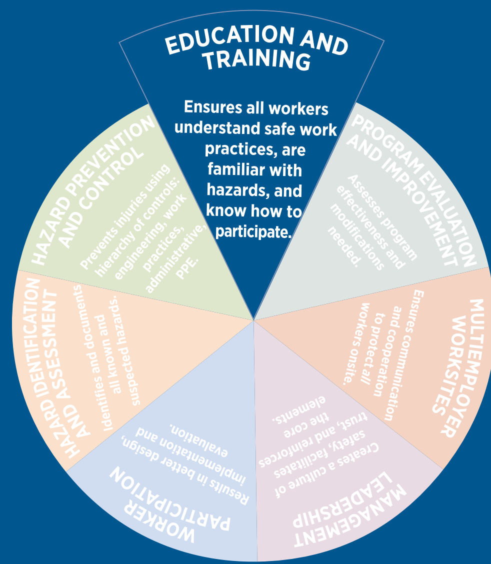
To ensure that control measures are and remain effective, employers should track progress in implementing controls, inspect and evaluate controls once they are installed, and follow routine preventive maintenance practices.

How to accomplish it

- Track progress and verify implementation by asking the following questions:
  - Have all control measures been implemented according to the hazard control plan?
  - Have engineering controls been properly installed and tested?
  - Have workers been appropriately trained so that they understand the controls, including how to operate engineering controls, safe work practices, and PPE use requirements?
  - Are controls being used correctly and consistently?
- Conduct regular inspections (and industrial hygiene monitoring, if indicated) to confirm that engineering controls are operating as designed.
- Evaluate control measures to determine if they are effective or need to be modified. Involve workers in the evaluation of the controls. If controls are not effective, identify, select, and implement further control measures that will provide adequate protection.
- Confirm that work practices, administrative controls, and PPE use policies are being followed.
- Conduct routine preventive maintenance of equipment and controls to help prevent incidents due to equipment failure.

EDUCATION AND TRAINING

EDUCATION AND TRAINING are important tools for informing workers and managers about hazards and controls so they can work more safely and be more productive. Another role of education and training, however, is to provide workers and managers with a greater understanding of the safety and health program itself, so that they can contribute to its development and implementation.



EDUCATION AND TRAINING provides employers (owners and executives), managers, supervisors, and workers with:

- Knowledge and skills needed to do their work safely and avoid creating hazards that could place themselves or others at risk.
- Awareness and understanding of hazards and how to identify, report, and control them.
- Specialized training, when their work involves unique hazards.

Additional training may be needed depending on the roles assigned to employers or individual managers, supervisors, and workers. For example, employers, managers, and supervisors may need specific training to ensure that they can fulfill their roles in providing leadership, direction, and resources for the safety and health program. Workers assigned specific roles in the program (e.g., incident investigation team members) may need training to ensure their full participation in those functions.

Effective training and education can be provided outside a formal classroom setting. Peer-to-peer training, on-the-job training, daily toolbox talks, and worksite demonstrations can be effective in conveying safety concepts, ensuring understanding of hazards and their controls, and promoting good work practices.

Action item 1: Provide program awareness training

Managers, supervisors, and workers all need to understand the program's structure, plans, and procedures. Having this knowledge ensures that everyone can fully participate in developing and implementing the program.

How to accomplish it

- Provide training to all managers; supervisors; workers; and contractor, subcontractor, and temporary agency workers on:
  - Safety and health policies, goals, and procedures
  - Functions of the safety and health program

   - Whom to contact with questions or concerns about the program (including contact information)
   - How to report hazards, injuries, illnesses, and close calls/near misses
   - What to do in an emergency
   - The employer's responsibilities under the program
   - Workers' rights under the OSH Act
- Provide information on the safety and health hazards of the job site and the controls for those hazards.
- Ensure that training is provided in the language(s) and at a literacy level that all workers can understand.
- Emphasize that the program can only work when everyone is involved and feels comfortable discussing concerns; making suggestions; and reporting injuries, incidents, and hazards.

- Confirm, as part of the training, that all workers have the right to report injuries, incidents, hazards, and concerns and to fully participate in the program without fear of retaliation.

Action item 2: Train employers, managers, and supervisors on their roles in the program

Employers, managers, and supervisors are responsible for workers' safety, yet sometimes have little training on safety-related concepts and techniques. They need specific training that allows them to fulfill their leadership roles in the program.

How to accomplish it

- Reinforce employers, managers, and supervisors' knowledge of their responsibilities under the OSH Act and the workers' rights guaranteed by the Act.
- Train employers, managers, and supervisors on procedures for responding to workers' reports of injuries, illnesses, and incidents, including ways to avoid discouraging reporting.
- Instruct employers, managers, and supervisors on fundamental concepts and techniques for recognizing hazards and methods of controlling them, including the hierarchy of controls (see "Hazard Prevention and Control").
- Instruct employers, managers, and supervisors on incident investigation techniques, including root cause analysis.
- As a starting point, consider providing the OSHA 30-hour construction safety course, or a similar course.

Action item 3: Train workers on their specific roles in the safety and health program

Additional training may be needed to ensure that workers can incorporate safety and health responsibilities into their daily routines and activities.

How to accomplish it

- Instruct workers on how to report injuries, illnesses, incidents, and concerns. If a computerized reporting system is used, ensure that all employees have the basic computer skills and computer access sufficient to submit an effective report.
- Instruct workers assigned specific roles within the safety and health program on how they should carry out those responsibilities, including:
    - Hazard recognition and controls (see Action item 4)
    - Participation in incident investigations
    - Program evaluation and improvement
- Provide opportunities for workers to ask questions and provide feedback during and after the training.
- As the program evolves, institute a more formal process for determining the training needs of workers responsible for developing, implementing, and maintaining the program.

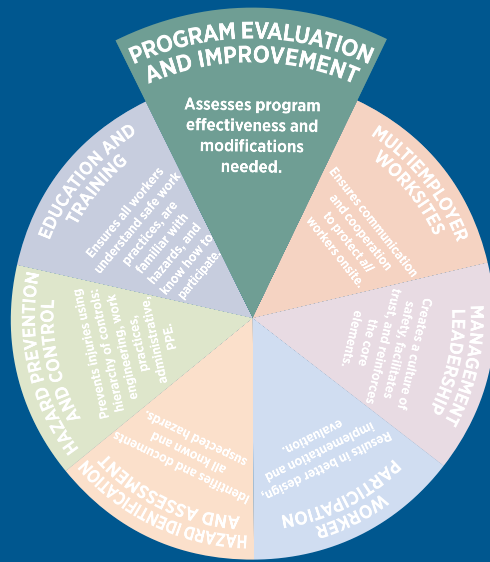
Action item 4: Train workers on hazard identification and controls

Providing workers with an understanding of hazard recognition and control, and actively involving them in the process, can help to eliminate hazards before an incident occurs. Employers are required to instruct each employee in the recognition and avoidance of unsafe conditions and the regulations applicable to his or her work environment to control or eliminate any hazards or other exposure to illness or injury [29 C.F.R. 1926.21(b)(2)]. As a starting point, employers may consider providing the OSHA 10-hour course for construction or a similar course to be supplemented by orientation training and toolbox talks to cover hazards on each specific site.

How to accomplish it

- Train workers on techniques for identifying hazards, such as job hazard analysis (see OSHA Publication 3071).
- Train workers so they understand and can recognize the hazards they may encounter in their own jobs, as well as more general work-related hazards.
- Instruct workers on concepts and techniques for controlling hazards, including the hierarchy of controls and its importance.
- Train workers on the proper use of work practice and administrative controls.
- Train workers on when and how to wear required PPE.
- Provide additional training, as necessary, when construction progresses. Consider situations such as when new trades and/or equipment arrive at the job site to perform the next phase of the project.

PROGRAM EVALUATION AND IMPROVEMENT



ONCE A SAFETY and health program is established, it should be evaluated initially to verify that it is being implemented as intended. After that, employers should periodically, and at least annually, step back and assess what is working and what is not, and whether the program is on track to achieve its goals. Whenever these assessments identify opportunities to improve the program, employers, managers, and supervisors—in coordination with workers—should make adjustments and monitor how well the program performs as a result. Sharing the results of monitoring and evaluation on the job site, and celebrating successes, will help drive further improvement.

PROGRAM EVALUATION and improvement includes:

- Establishing, reporting, and tracking goals and targets that indicate whether the program is making progress.
- Evaluating the program initially, and periodically, to identify shortcomings and opportunities for improvement.
- Providing ways for workers to participate in program evaluation and improvement.

Action item 1: Monitor performance and progress

The first step in monitoring is to define indicators that will help track performance and progress. Next, employers, managers, supervisors, and workers need to establish and follow procedures to collect, analyze, and review performance data.

Both *lagging* and *leading* indicators should be used. Lagging indicators generally track worker exposures and injuries that have already occurred. Leading indicators track how well various aspects of the program have been implemented and reflect steps taken to prevent injuries or illnesses *before* they occur.

How to accomplish it

- Develop and track indicators of progress toward established safety and health goals.
  - Track *lagging indicators*, such as:
    - Number and severity of injuries and illnesses
    - Results of worker exposure monitoring that show that exposures are hazardous
    - Workers' compensation data, including claim counts, rates, and cost

- Track *leading indicators*, such as:
  - Level of worker participation in program activities
  - Number of employee safety suggestions
  - Number of hazards, near misses, and first aid cases reported
  - Amount of time taken to respond to reports
  - Number and frequency of management walkthroughs
  - Number and severity of hazards identified during inspections
  - Number of workers who have completed required safety and health training
  - Timely completion of corrective actions after a job site hazard is identified or an incident occurs
  - Timely completion of planned preventive maintenance activities
  - Worker opinions about program effectiveness obtained from a safety climate or safety opinion survey

- Analyze performance indicators and evaluate progress over time.
- Share results with workers and invite their input on how to further improve performance.
- When opportunities arise, share your experience and compare your results—across similar construction projects within your company, with other companies you know, or through trade or business associations.

Note: Indicators can be either quantitative or qualitative. Whenever possible, select indicators that are measurable (quantitative) and that will help you determine whether you have achieved your program goals. The number of reported hazards and near misses would be a quantitative indicator. A single worker expressing a favorable opinion about program participation would be a qualitative indicator.

Action item 2: Verify that the program is implemented and is operating

Employers need to continuously evaluate the effectiveness of the entire program and newer site-specific programs to ensure they are operating as intended, are effective in controlling identified hazards, and are making progress toward established safety and health goals and objectives. The scope and frequency of program evaluations will vary depending on changes in OSHA standards; the scope, complexity, and maturity of the program; and the types of hazards it must control.

How to accomplish it

- Verify that the core elements of the program have been fully implemented on each of your job sites.
- Involve workers in all aspects of program evaluation, including reviewing information, such as incident reports and exposure monitoring results; establishing and tracking performance indicators; and identifying opportunities to improve the program.
- Verify that the following key processes are in place and operating as intended:
  - Reporting injuries, illnesses, incidents, hazards, and concerns
  - Conducting job site inspections and incident investigations
  - Tracking progress in controlling identified hazards and ensuring that hazard control measures remain effective

- Collecting and reporting any data needed to monitor progress and performance

- Review the results of any compliance audits to confirm that any program shortcomings are being identified. Verify that actions are being taken that will prevent recurrence.

Action item 3: Correct program shortcomings and identify opportunities to improve

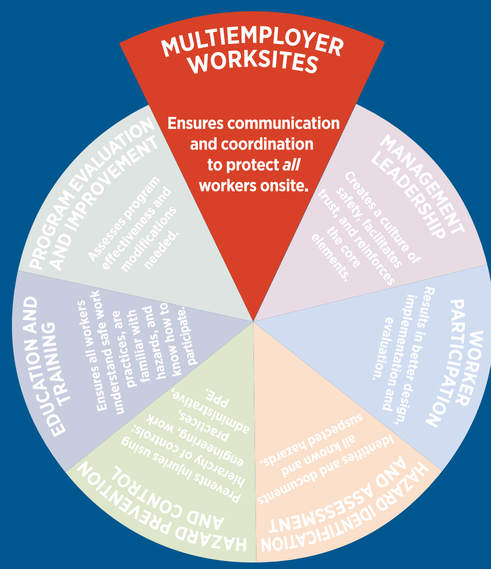
Whenever a problem is identified in any part of the safety and health program, employers—in coordination with supervisors, managers, and workers—need to take prompt action to correct the problem and prevent its recurrence.

How to accomplish it

- If you discover program shortcomings, take actions needed to correct them.
- Proactively seek input from managers, workers, supervisors, and other stakeholders on how you can improve the program.
- Determine whether changes in equipment, materials, key personnel, or work practices trigger any need for changes in the program.
- Determine whether your performance indicators and goals are still relevant and, if not, how you could change them to more effectively drive improvements in safety and health.

Note: The scope and frequency of program evaluations will depend on the scope, complexity, and maturity of the program and on the types of hazards it must control. Program evaluations should be conducted periodically (and at least annually) but might also be triggered by a change in process or equipment, or an incident such as a serious injury, significant property damage, or an increase in safety-related complaints.

COMMUNICATION AND COORDINATION FOR EMPLOYERS ON MULTIEMPLOYER WORKSITES



CONSTRUCTION JOB SITES typically have workers who are employed by a general contractor and other workers who are employed by a contractor or subcontractor, or workers from other sources.

In these circumstances, it is important that each employer and contractor consider how its work and safety activities can affect the safety of other workers at the job site. Examples include electrical or mechanical contractors working for the general contractor at a building construction site. Several subcontractors working together on a job site (such as a subcontractor tying rebar and another subcontractor setting concrete formwork at the same job site) would be another example.

IN TODAY'S ECONOMY, an increasing number of workers are assigned by staffing agencies to work at specific "host" worksites under the direction and control of the host employer. Examples include unskilled laborers or skilled trade workers from a staffing agency who may be placed in either short- or long-term assignments with a general contractor or other contractor. In these situations, it is important for the staffing agency and the host employer to communicate and coordinate to provide and maintain a safe work environment for their workers. (Note: Any employer on a multi-employer worksite may be a "joint employer" with a staffing agency if temporary workers are utilized.)

In both temporary worker and multiemployer situations, safety is enhanced if employers establish mechanisms to coordinate their efforts and communicate effectively regarding their safety and health responsibilities to afford all workers equal protection against hazards. These mechanisms include measures to ensure that all workers on site (and their representatives) can participate in preventing injuries and illnesses. Failure to take these steps may undermine safety programs. For example, if the different employers have inconsistent policies for when and where to wear PPE, workers may mistakenly believe that the equipment is not needed, leading to injury. Inconsistent safety policies may also cause workers to question the credibility of safety and health programs, resulting in less meaningful employee engagement and participation.

Effective communication and coordination among such employers means that:

- General contractors and their workers are aware of:
  - The types of hazards that may arise from the work being done on site by workers employed by contractors, subcontractors, or staffing agencies.
  - The procedures or measures needed to avoid or control exposure to these hazards.
  - How to contact the contractor, subcontractor, or staffing agency if they have a safety concern.
- Before coming on site, contractors, subcontractors, and staffing agencies and their workers are aware of:
  - The previous work done and the types of hazards that may already be present at the job site.
  - The procedures or measures they need to use to avoid or control their exposure to these hazards.
  - How to contact the general contractor to get more information, report an injury, illness, or incident or if they have a safety concern.

Action item 1: Establish effective communication

Each general contractor establishes and implements a procedure to ensure the exchange of information about hazards present on site and the hazard control measures in place. Thus, all workers on the site are aware of worksite hazards, and the methods and procedures needed to control exposures to them.

How to accomplish it

- The general contractor communicates with contractors, subcontractors, and staffing agencies to determine which among them will implement and maintain the various parts of the safety and health program, to ensure protection of all on-site workers before work begins. These determinations can be included in contract documents that define the relationships between the parties and confirmed during pre-construction meetings.
- The general contractor establishes and implements procedures to exchange information with contractors, subcontractors and staffing agencies about hazards present on the job site and the measures that have been implemented to prevent or control such hazards.
- The general contractor gathers and disseminates information sufficient to enable each employer to assess hazards encountered by its workers and to avoid creating hazards that affect workers on the site.
- Contractors, subcontractors, and staffing agencies regularly give the general contractor any information about injuries, illnesses, hazards, or concerns reported by their workers and the results of any tracking or trend analysis they perform.
- Each contractor or subcontractor establishes and implements a procedure for providing the general contractor with information about the hazards and control measures associated with the work being done by its workers, and the procedures it will use to protect workers on the site.
- The general contractor gives contractors, subcontractors, and staffing agencies the right to conduct site visits and inspections and to access injury and illness records and other safety and health information.
- The general contractor provides contractors, subcontractors, and staffing agencies and their workers information on hazards that could occur as a result of nonroutine operations or emergencies and procedures to follow in emergency situations.
- Information is communicated before on-site work starts and, as needed, if conditions change.

Action item 2: Establish effective coordination

General contractors, contractors, subcontractors, and staffing agencies coordinate on work planning, scheduling, and resolving program differences to identify and work out any concerns or conflicts that could impact safety or health.

How to accomplish it

- General contractors:
  - Include in contracts and bid documents any safety-related specifications and pre-qualifications and ensure that contractors, subcontractors, and staffing agencies selected for the work meet those requirements.
  - Identify issues that may arise during on-site work and include procedures to be used by the general contractor, contractors, subcontractors, and staffing agencies for resolving any conflicts before work starts. This may be accomplished through pre-construction meetings.
- General contractors coordinate with contractors, subcontractors, and staffing agencies to:
  - Ensure that work is planned and scheduled to minimize impacts on safety.
  - Ensure that joint-employed workers are adequately trained and equipped before arriving on the worksite.
  - Harmonize their safety and health policies and procedures to resolve important differences, so that all workers at the site have the same protection and receive consistent safety information (i.e., conduct site-specific training).
- General contractors, contractors, subcontractors, and staffing agencies:
  - Work together to deal with unexpected staffing needs by ensuring that enough trained and equipped workers are available or that adequate lead time is provided to train and equip workers.
  - Make sure that managers with decision-making authority are available and prepared to deal with day-to-day coordination issues.

LIST OF ABBREVIATIONS

CDC	Centers for Disease Control and Prevention
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
PPE	personal protective equipment
PtD	Prevention through Design
SDS	Safety Data Sheet
SHARP	Safety and Health Achievement Recognition Program
VPP	Voluntary Protection Programs

GLOSSARY OF TERMS

close call/near miss: An incident that could have, but did not, result in death, injury, or illness. They signal that hazards are not being adequately controlled or that new hazards have arisen.

contractor: An individual or firm that agrees to furnish materials or perform services at a specified price.

elimination: A change in process or workplace condition that removes the hazard or ensures that no worker can be exposed to a hazard under any foreseeable circumstances.

hierarchy of controls: A system for selecting and implementing the most effective control solutions for workplace hazards that includes:

- Elimination.
- Substitution.
- Engineering controls.
- Administrative controls.
- Personal protective equipment.

This is known as the “hierarchy of controls” because they should be considered in the order presented. Controls at the top of the hierarchy are potentially more effective and more protective than those lower in the hierarchy.

host employer:	An employer who has general supervisory authority over the worksite, including controlling the means and manner of work performed and having the power to correct safety and health hazards or require others to correct them.
industrial hygiene:	The science of protecting and enhancing the health and safety of people at work and in their communities.
job hazard analysis:	A technique that focuses on job tasks as a way to identify hazards before they occur. It focuses on the relationships among the worker, the task, the tools, and the work environment.
joint-employed worker:	A worker hired and paid by a staffing agency and assigned to work for a host employer, whether or not the job is actually temporary.
lagging indicators:	Measures of the occurrence and frequency of events in the past such as the number or rate of injuries, illnesses, and fatalities.
leading indicators:	Measures intended to predict the occurrence of events in the future. Leading indicators are proactive, preventative, and predictive measures that provide information about the effective performance of safety and health program activities that can drive the control of workplace hazards.
metrics:	Measures of performance.
multiemployer worksite:	Any worksite where two or more employers are present. See OSHA's Multiemployer Citation Policy.
nonroutine operations:	Operations that do not occur frequently or that occur as a result of an emergency.
peer-to-peer training:	A type of on-the-job training where workers exchange information about hazards, controls, reporting procedures, and work procedures that are relevant to the safety and health program.
Prevention through Design:	A NIOSH national initiative to prevent or reduce occupational injuries, illnesses, and fatalities through the inclusion of prevention considerations in all designs that impact workers. PtD encompasses all of the efforts to anticipate and design out hazards to workers in facilities, work methods and operations, processes, equipment, tools, products, new technologies, and the organization of work.
quantitative exposure assessment:	Techniques used to quantitatively measure workers' exposure to hazards, particularly health hazards, such as sampling for chemicals, dusts, biological organisms, noise, radiation, or other assessments. The purpose of such assessments is to quantify the level of workers' exposure to a hazard. Also known as exposure monitoring.
root cause analysis:	A collective term that describes a wide range of approaches, tools, and techniques used to uncover causes of problems.

Safety and Health Achievement Recognition Program:	An OSHA program that recognizes small business employers who have used OSHA's On-site Consultation Program services and operate an exemplary injury and illness prevention program.
safety data sheet:	Written or printed material used to communicate the hazards of substances and chemical products to employees prepared in accordance with paragraph (g) of OSHA's Hazard Communication standard.
serious hazards:	Hazards that are causing or are likely to cause death or serious physical harm. See OSHA's Field Operations Manual, Chapter 4.
shortcoming:	A fault, deficiency, or gap that results in a failure to meet program design criteria.
staffing agency:	A firm that provides temporary workers to host employers. A staffing agency hires its own employees and assigns them to support or supplement a client's workforce in situations involving employee absences, temporary skill shortages, seasonal workloads, and special projects.
substitution:	The replacement of toxic or hazardous materials (or the equipment or processes used with them) with ones that are less harmful.
Voluntary Protection Programs:	An OSHA initiative that recognizes employers and workers in the private industry and federal agencies who have implemented effective safety and health management systems and maintain injury and illness rates below the U.S. Bureau of Labor Statistics averages for their respective industries.
work practices:	A set of procedures for performing a specific work assignment safely.

OSHA®

Occupational Safety and Health Administration

www.osha.gov

Small Entity Compliance Guide

for the Respirable Crystalline Silica Standard for Construction

OSHA 3902-07R 2017

www.osha.gov

Occupational Safety and Health Act of 1970

"To assure safe and healthful working conditions for working men and women; by authorizing enforcement of the standards developed under the Act; by assisting and encouraging the States in their efforts to assure safe and healthful working conditions; by providing for research, information, education, and training in the field of occupational safety and health."

This information will be made available to sensory-impaired individuals upon request. Voice phone: (202) 693-1999; teletypewriter (TTY) number: 1-877-889-5627.

This publication provides a general overview of a particular standards-related topic. This publication does not alter or determine compliance responsibilities which are set forth in OSHA standards and the *Occupational Safety and Health Act.* Moreover, because interpretations and enforcement policy may change over time, for additional guidance on OSHA compliance requirements the reader should consult current administrative interpretations and decisions by the Occupational Safety and Health Review Commission and the courts.

Cover photo courtesy of OSHA, International Masonry Institute.

Small Entity Compliance Guide

for the Respirable Crystalline Silica Standard for Construction

Occupational Safety and Health Administration
U.S. Department of Labor

OSHA 3902-07R 2017

This guidance document provides an overview of OSHA's Respirable Crystalline Silica Standard for Construction. It is advisory in nature and informational in content. It is not a standard or regulation, and it neither creates new legal obligations nor alters existing obligations created by the Occupational Safety and Health Administration (OSHA) standards or the *Occupational Safety and Health Act of 1970* (OSH Act). Pursuant to the OSH Act, employers must comply with safety and health standards and regulations issued and enforced either by OSHA or by an OSHA-approved state plan. In addition, the Act's General Duty Clause, Section 5(a)(1), requires employers to provide their workers with a workplace free from recognized hazards that are causing or likely to cause death or serious physical harm.

In addition, Section 11(c)(1) of the Act provides that "No person shall discharge or in any manner discriminate against any employee because such employee has filed any complaint or instituted or caused to be instituted any proceeding under or related to this Act or has testified or is about to testify in any such proceeding or because of the exercise by such employee on behalf of himself or others of any right afforded by this Act." Reprisal or discrimination against an employee for reporting an incident, injury, or workplace violation, for participating in medical surveillance, or because of the results of medical surveillance would constitute a violation of Section 11(c) of the OSH Act.

TABLE OF CONTENTS

INTRODUCTION 1

SCOPE – PARAGRAPH (A) OF THE STANDARD 3

DEFINITIONS – PARAGRAPH (B) OF THE STANDARD 5

SPECIFIED EXPOSURE CONTROL METHODS – PARAGRAPH (C) OF THE STANDARD 5

ALTERNATIVE EXPOSURE CONTROL METHODS – PARAGRAPH (D) OF THE STANDARD 34

- Permissible Exposure Limit (PEL) 34
- Exposure Assessment 34
- Methods of Compliance 38

RESPIRATORY PROTECTION – PARAGRAPH (E) OF THE STANDARD 40

HOUSEKEEPING – PARAGRAPH (F) OF THE STANDARD 41

WRITTEN EXPOSURE CONTROL PLAN – PARAGRAPH (G) OF THE STANDARD 42

MEDICAL SURVEILLANCE – PARAGRAPH (H) OF THE STANDARD 48

COMMUNICATION OF HAZARDS – PARAGRAPH (I) OF THE STANDARD 56

RECORDKEEPING – PARAGRAPH (J) OF THE STANDARD 59

DATES – PARAGRAPH (K) OF THE STANDARD 60

APPENDIX I: OSHA RESPIRABLE CRYSTALLINE SILICA STANDARD FOR CONSTRUCTION 61

WORKERS' RIGHTS 93

OSHA ASSISTANCE, SERVICES AND PROGRAMS 93

OSHA REGIONAL OFFICES 94

HOW TO CONTACT OSHA 95

INTRODUCTION

This guide is intended to help small businesses understand and comply with the Occupational Safety and Health Administration's (OSHA) Respirable Crystalline Silica standard for Construction. Workers exposed to respirable crystalline silica are at increased risk of developing serious adverse health effects including silicosis, lung cancer, chronic obstructive pulmonary disease, and kidney disease. This guide describes the steps that employers are required to take to protect employees in construction from the hazards associated with exposure to respirable crystalline silica. Employers in industries other than construction should refer to the small entity compliance guide for occupational exposure to respirable crystalline silica in general industry and maritime.

What is Respirable Crystalline Silica?

Crystalline silica is a common mineral found in many naturally occurring and man-made materials used at construction sites. Materials like sand, concrete, brick, block, stone and mortar contain crystalline silica. Amorphous silica, such as silica gel, is not crystalline silica.

Respirable crystalline silica – very small particles typically at least 100 times smaller than ordinary sand found on beaches or playgrounds – is generated by high-energy operations like cutting, sawing, grinding, drilling and crushing stone, rock, concrete, brick, block and mortar, or when abrasive blasting with sand.

This document provides guidance only, and does not alter or determine compliance responsibilities, which are laid out in OSHA standards and the *Occupational Safety and Health Act*. This guide does not replace the official respirable crystalline silica standard for construction. The employer must refer to the standard to ensure that it is in compliance. Moreover, because interpretations and enforcement policy may change over time, for additional guidance on OSHA compliance requirements the reader should consult current administrative interpretations and decisions by the Occupational Safety and Health Review Commission and the courts.

Overview of the Standard and Guide

This guide is divided into sections that correspond to the major provisions (paragraphs) of the silica standard for construction. Each section describes the provision and gives additional details to help employers better understand the requirements of the standard.

The first step for an employer is to determine if the standard applies to its work. If its work is covered by the standard, an employer has two options for limiting employee exposure to respirable crystalline silica:

- Specified exposure control methods; or
- Alternative exposure control methods.

Employers who choose the specified exposure controls option must fully and properly implement protections for the tasks or equipment listed in Table 1 of the standard. Employers who fully and properly implement the controls in Table 1 do not have to assess employees' silica exposure levels or keep employee exposures at or below the permissible exposure limit (PEL).

Employers who follow alternative exposure control methods must:

- Determine the levels of respirable crystalline silica that employees are exposed to;
- Limit employee exposures to a PEL of 50 micrograms per cubic meter of air (50 $\mu g/m^3$) as an 8-hour time-weighted average (TWA);
- Use engineering and work practice controls, to the extent feasible, to limit employee exposures to the PEL, and supplement the controls with respiratory protection when necessary.
- Keep records of employee exposure to respirable crystalline silica.

All employers covered by the standard must:

- Provide respiratory protection when required;
- Restrict housekeeping practices that expose employees to respirable crystalline silica where feasible alternatives are available;
- Establish and implement a written exposure control plan, including designating a competent person;
- Offer medical exams to employees who will be required to wear a respirator under the standard for 30 or more days a year;
- Communicate hazards and train employees; and
- Keep records of medical examinations.

See the roadmap listed below for more information.

Roadmap for Meeting the Requirements of the Respirable Crystalline Silica Standard

1. Determine if the silica standard applies to your employees.

Could employees be exposed to respirable crystalline silica at or above 25 μg/m^3 as an 8-hour TWA under any foreseeable conditions, including the failure of engineering controls, while performing construction activities?

No: No further action is required under the silica standard.
Yes: Choose to comply with the standard using either the:

- Specified exposure control methods in Table 1, or
- The alternative methods of compliance

2. Determine what additional requirements you must meet under the standard, based on the compliance method you are following.

	Must the Employer Follow this Requirement?	
Requirement	**If Fully and Properly Implementing Table 1**	**If Following Alternative Exposure Controls**
PEL	**No**	**Yes**
Exposure Assessment	**No**	**Yes,** when exposures are reasonably expected to be above the action level.
Methods of Compliance	**No**	**Yes**
Respiratory Protection	**Yes,** if respirator use is required by Table 1	**Yes,** if respirator use is required to reduce exposures to the PEL
Housekeeping	**Yes**	**Yes**
Written Exposure Control Plan	**Yes**	**Yes**
Medical surveillance	**Yes,** for employees who must wear a respirator under the silica standard for 30 or more days a year.	
Communication of Hazards	**Yes**	**Yes**
Recordkeeping	**Yes,** for any employees who are getting medical examinations	**Yes,** for exposure assessments and for any employees who are getting medical examinations

SCOPE – PARAGRAPH (A) OF THE STANDARD

The standard applies to all occupational exposures to respirable crystalline silica in construction work, except where employee exposure will remain below 25 μg/m^3 as an 8-hour TWA under any foreseeable conditions. Exposures to respirable crystalline silica occur when the following tools are used on concrete, brick, block, stone, mortar, and other materials that contain crystalline silica:

- Stationary masonry saws;
- Handheld power saws;
- Walk-behind saws;
- Drivable saws;
- Rig-mounted core saws or drills;
- Handheld and stand-mounted drills (including impact and rotary hammer drills);
- Dowel drilling rigs;
- Vehicle-mounted drilling rigs;
- Jackhammers and handheld powered chipping tools;
- Handheld grinders;
- Walk-behind milling machines and floor grinders;
- Drivable milling machines;
- Crushing machines; and
- Heavy equipment and utility vehicles when used to abrade or fracture silica-containing materials (such as hoe-ramming or rock ripping) or during demolition activities, and for tasks such as grading and excavating.

Exposures to respirable crystalline silica also occur during tunneling operations and during abrasive blasting when sand or other blasting agents containing crystalline silica are used, or when abrasive blasting is performed on substrates that contain crystalline silica, such as concrete.

Where Employee Exposure Will Remain Below 25 μg/m^3 as an 8-Hour TWA

The standard does not apply where employee exposure will remain below 25 μg/m^3 as an 8-hour TWA under any foreseeable conditions. The phrase "any foreseeable conditions" refers to situations that can reasonably be anticipated. OSHA considers failure of engineering controls to be a situation that is reasonably foreseeable. Although engineering controls are usually a reliable means for controlling employee exposures, equipment does occasionally fail. Thus, the standard applies where exposures below 25 μg/m^3 as an 8-hour TWA are expected or achieved, but only because engineering controls are being used to limit exposures.

Employee exposure can reasonably be anticipated to remain below 25 μg/m^3 as an 8-hour TWA when performing certain tasks that involve only minimal exposure to respirable crystalline silica. Such tasks include:

- Mixing concrete for post holes;
- Pouring concrete footers, slab foundation, and foundation walls; and
- Removing concrete formwork.

When these tasks are performed in isolation from tasks that generate significant exposures to respirable crystalline silica, the standard does not apply. These examples are not exclusive, and there may be other tasks that involve exposure under 25 μg/m^3 as an 8-hour TWA under any foreseeable conditions.

Some employees in the construction sector perform tasks involving occasional, brief exposures to respirable crystalline silica that are incidental to their primary work. These workers include carpenters, plumbers, and electricians who occasionally drill holes in concrete or masonry or perform other tasks that involve exposure to respirable crystalline silica. Where employees perform tasks that involve exposure to respirable crystalline silica for a very short period of time, exposures for many tasks will be below 25 μg/m^3 as an 8-hour TWA. For example, for hole drillers using hand-held drills, if the duration of exposure is 15 minutes or less, the 8-hour TWA exposure can reasonably be anticipated to remain under the 25 μg/m^3 threshold (assuming no exposure for the remainder of the shift), and the standard would not apply.

This exception for situations where exposures are not likely to present significant risk to workers allows employers to focus their resources on exposures of greater occupational health concern.

DEFINITIONS – PARAGRAPH (B) OF THE STANDARD

Definitions are included in the standard to describe the meaning of terms used. Some of these terms are further explained as follows:

Action level means an airborne concentration of 25 μg/m^3 calculated as an 8-hour TWA. Exposures at or above the action level trigger requirements for exposure assessment.

Competent person means an individual who is capable of identifying existing and foreseeable respirable crystalline silica hazards in the workplace and who has authorization to take prompt corrective measures to eliminate or minimize them. The competent person must have the knowledge and ability necessary to implement the written exposure control plan required under the standard.

Employee exposure means the exposure to airborne respirable crystalline silica that would occur if the employee were not using a respirator.

High-efficiency particulate air (HEPA) filter means a filter that is at least 99.97 percent efficient in removing mono-dispersed particles of 0.3 micrometers in diameter. HEPA-filtered vacuuming is an example of a housekeeping method that minimizes employee exposure to respirable crystalline silica, and some Table 1 tasks require HEPA-filtered vacuuming.

Objective data means information, such as air monitoring data from industry-wide surveys or calculations based on the composition of a substance, demonstrating employee exposure to respirable crystalline silica associated with a particular product or material or a specific process, task, or activity. The data must reflect workplace conditions closely resembling or with a higher exposure potential than the processes, types of material, control methods, work practices, and environmental conditions in the employer's current operations.

Physician or other licensed health care professional [PLHCP] is an individual whose legally permitted scope of practice (*i.e.*, license, registration, or certification) allows him or her to independently provide or be delegated the responsibility to provide some or all of the particular health care services required by this standard.

Specialist means an American Board Certified Specialist in Pulmonary Disease or an American Board Certified Specialist in Occupational Medicine.

SPECIFIED EXPOSURE CONTROL METHODS – PARAGRAPH (C) OF THE STANDARD

The silica standard for construction provides a flexible approach for construction employers to achieve compliance. The standard includes Table 1, which lists 18 common tasks using various types of tools or equipment found at construction sites. For each employee engaged in a task in Table 1, employers who choose to follow the Table for that task are required to fully and properly implement the engineering controls, work practices, and respiratory protection specified in Table 1. Employers who comply with Table 1 are not required to conduct exposure assessments or comply with a PEL for those employees.

Employees engaged in the Table 1 task means the equipment operator; helpers, laborers and other employees who are assisting with the task; or any other employee responsible for completing the task. For example, an employee operating a walk-behind saw and another employee helping the operator guide the saw are both engaged in the task. An employee operating a jackhammer would be engaged in the task, but another employee directing traffic near the employee jackhammering would not be engaged in the task. When Table 1 requires respiratory protection, employers must provide respirators to all employees engaged in the task. Employers must describe procedures for restricting access of employees not engaged in the task as part of its *Written Exposure Control Plan*.

Fully and properly implemented means that controls are in place, are properly operated and maintained, and employees understand how to use them. Several factors required for full and proper implementation of controls are listed in the discussion for each Table 1 entry below. The presence of large amounts of visible dust generally indicates that controls are not fully and properly implemented. A small amount of dust can be expected from equipment that is operating as intended by the manufacturer; however, a noticeable increase in dust generation during the task is a sign that the dust controls are not operating correctly. The difference between the small amounts of dust generated when control measures are working properly and the large amount of dust generated during tasks when control measures are not used or not operated effectively is easily observed. When this happens, prompt corrective actions are required.

As part of full and proper implementation, many Table 1 tasks require the employer to operate and maintain tools according to manufacturers' instructions for minimizing dust emissions. Manufacturer's instructions for minimizing dust can include:

- Water flow rates,
- Vacuum equipment air flow rate and capacity,
- Rotation of the blade (speed, direction),
- Maintaining and changing blades, and
- Frequency for changing water.

See sections on *Water Delivery Systems* and *Dust Collection Systems* for more information about the use of controls for respirable crystalline silica.

Several entries in Table 1 have requirements for the use of **respiratory protection with a minimum "assigned protection factor" (APF)**. Paragraph (d)(3)(i)(A) of the Respiratory Protection standard (29 CFR 1910.134) includes a table that can be used to determine the type or class of respirator that will provide employees with a particular APF, and it can help employers determine the type of respirator that would meet the required minimum APF specified by Table 1. Employers have the flexibility to provide a more protective respirator to those employees who request one or require the employees to use a more protective respirator. See section on *Determining Task Duration and Requirements for Respirator Use* for information on how to measure task duration to determine respiratory protection requirements for employees doing one or more Table 1 task.

Description of Table 1 Entries

This section lists each Table 1 entry and explains the requirement for that entry.

TABLE 1: Specified Exposure Control Methods When Working with Materials Containing Crystalline Silica

Equipment/Task	Engineering and Work Practice Control Methods	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 hours/shift	> 4 hours/shift
(i) Stationary masonry saws	Use saw equipped with integrated water delivery system that continuously feeds water to the blade. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.	None	None

Stationary masonry saws must be equipped with an integrated water delivery system (commercially developed specifically for the type of tool in use) that continuously feeds water to the blade. The water delivery system usually includes a nozzle for spraying water attached near the blade that is connected to a water basin by a hose and pump. The tool must be operated and maintained in accordance with manufacturer's instructions to minimize dust emissions. Stationary masonry saws equipped with an integrated system for blade cooling also suppress dust and meet the requirements of Table 1.

Full and proper implementation of water controls on stationary masonry saws requires the employer to ensure that:

- An adequate supply of water for dust suppression is used;
- The spray nozzle is working properly to apply water at the point of dust generation;
- The spray nozzle is not clogged or damaged; and
- All hoses and connections are intact.

Table 1 does not specify a minimum flow rate; however, water must be applied at the flow rates specified by the manufacturer.

When using a stationary masonry saw indoors or in an enclosed space (areas where airborne dust can buildup, such as a structure with a roof and three walls), employers must provide additional exhaust as needed to minimize the accumulation of visible airborne dust.

See the section on *Indoors or Enclosed Areas* for more information.

Respiratory protection is not required for work with stationary masonry saws regardless of task duration.

Worker cutting masonry block on a stationary masonry saw equipped with integrated water delivery system that continuously feeds water to the blade. Note water supply hose attached to top of shroud around blade.

Photo courtesy of OSHA, International Masonry Institute. The equipment shown in this picture is for illustrative purposes only and is not intended as an endorsement by OSHA of this company, its products or services.

TABLE 1: Specified Exposure Control Methods When Working with Materials Containing Crystalline Silica

Equipment/Task	Engineering and Work Practice Control Methods	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 hours/shift	> 4 hours/shift
(ii) Handheld power saws (any blade diameter)	Use saw equipped with integrated water delivery system that continuously feeds water to the blade. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.		
	• When used outdoors.	None	APF 10
	• When used indoors or in an enclosed area.	APF 10	APF 10

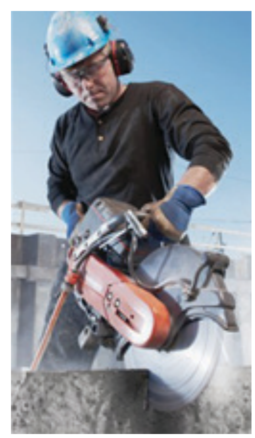
Handheld power saws with any blade diameter must be equipped with an integrated water delivery system (commercially developed specifically for the type of tool in use) that continuously feeds water to the blade. The water delivery system usually includes a nozzle for spraying water attached near the blade that is connected to a water basin via a hose and pump. The tool must be operated and maintained in accordance with manufacturer's instructions to minimize dust emissions. Handheld power saws equipped with an integrated water delivery system for blade cooling also suppress dusts and meet the requirements of Table 1.

Full and proper implementation of water controls on handheld power saws requires the employer to ensure that:

- An adequate supply of water for dust suppression is used;
- The spray nozzle is working properly to apply water at the point of dust generation;
- The spray nozzle is not clogged or damaged;
- All hoses and connections are intact.

Table 1 does not specify a minimum flow rate; however, water must be applied at the flow rate specified by the manufacturer.

When working with handheld power saws of any blade diameter, respiratory protection with a minimum APF of 10 is required for work done outdoors for more than four hours per shift and for work done indoors, or in an enclosed location, regardless of task duration.



A worker cutting a concrete block using a handheld masonry saw with an integrated water delivery system.

Photo courtesy Husqvarna. The equipment shown in this picture is for illustrative purposes only and is not intended as an endorsement by OSHA of this company, its products or services.

When using a handheld saw indoors or in enclosed spaces (areas where airborne dust can buildup, such as a structure with a roof and three walls), employers must provide additional exhaust, as needed to minimize the accumulation of visible airborne dust. See the section on *Indoors or Enclosed Areas* for more information.

TABLE 1: Specified Exposure Control Methods When Working with Materials Containing Crystalline Silica

Equipment/Task	Engineering and Work Practice Control Methods	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 hours/shift	> 4 hours/shift
(iii) Handheld power saws for cutting fiber-cement board (with blade diameter of 8 inches or less)	For tasks performed outdoors only: • Use saw equipped with commercially available dust collection system. • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. • Dust collector must provide the air flow recommended by the tool manufacturer, or greater, and have a filter with 99% or greater efficiency.	None	None

Specialty handheld power saws for cutting fiber-cement board (with a blade diameter of 8 inches or less) must be equipped with commercially available dust collection systems and a filter with a 99 percent or greater efficiency. The saws must be operated and maintained in accordance with the manufacturer's instructions to minimize dust emissions, and provide the air flow rate recommended by the manufacturer or greater. When employers are complying with Table 1, the saws must only be used outdoors.

Full and proper implementation of dust collection systems on handheld power saws for cutting fiber-cement board requires the employer to ensure that:

- The shroud or cowling is intact and installed in accordance with the manufacturer's instructions;
- The hose connecting the tool to the vacuum is intact and without kinks or tight bends;
- The filter(s) on the vacuum are cleaned or changed in accordance with the manufacturer's instructions to prevent clogging; and
- The dust collection bags are emptied to avoid overfilling.

Respiratory protection is not required for work outdoors with specialty handheld power saws while cutting fiber-cement board regardless of task duration.

Worker cutting fiber-cement board outdoors using a handheld power saw and dust collection system. The dust collection system consists of the shroud on the saw, hose, and dust collector positioned between the saw horses.

Photo courtesy of NIOSH.

TABLE 1: Specified Exposure Control Methods When Working with Materials Containing Crystalline Silica

Equipment/Task	Engineering and Work Practice Control Methods	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 hours/shift	> 4 hours/shift
(iv) Walk-behind saws	Use saw equipped with integrated water delivery system that continuously feeds water to the blade. Operate and maintain tool in accordance with manufacturer’s instructions to minimize dust emissions. • When used outdoors. • When used indoors or in an enclosed area.	 None APF 10	 None APF 10

Walk-behind saws must be equipped with an integrated water delivery system (commercially developed specifically for the type of tool in use) that continuously feeds water to the blade. The tool must be operated and maintained in accordance with manufacturer’s instructions to minimize dust emissions. Full and proper implementation of water controls on walk-behind saws requires the employer to ensure that:

- An adequate supply of water for dust suppression is used;
- The spray nozzles are working properly to apply water at the point of dust generation;
- The spray nozzles are not clogged or damaged; and
- All hoses and connections are intact.

Table 1 does not specify a minimum flow rate; however, water must be applied at the flow rate specified by the manufacturer.

Walk-behind saws used to cut roads and cut pavement are most commonly used outdoors, though they can also be used indoors to cut concrete floors. When using walk-behind saws indoors or in enclosed areas (areas where airborne dust can buildup, such as a structure with a roof and three walls), employers must provide additional exhaust, as needed to minimize the accumulation of visible airborne dust. See the section on *Indoors or Enclosed Areas* for more information.

When working outdoors, respiratory protection is not required for work with walk-behind saws regardless of task duration. When working indoors, or in an enclosed location, respiratory protection with a minimum APF of 10 is required regardless of task duration.

Worker using a walk-behind saw with an integrated water delivery system to cut asphalt roadway.

Photo courtesy of OSHA.

TABLE 1: Specified Exposure Control Methods When Working with Materials Containing Crystalline Silica			
Equipment/Task	**Engineering and Work Practice Control Methods**	**Required Respiratory Protection and Minimum Assigned Protection Factor (APF)**	
		≤ 4 hours/shift	**> 4 hours/shift**
(v) Drivable saws	For tasks performed outdoors only: • Use saw equipped with integrated water delivery system that continuously feeds water to the blade. • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.	None	None

Drivable saws used to cut silica-containing materials (such as concrete, asphalt, granite and terrazzo) must be equipped with an integrated water delivery system (commercially developed specifically for the type of tool in use) that continuously feeds water to the blade and must be operated and maintained in accordance with manufacturer's instructions to minimize dust emissions. Employers following Table 1 must only allow the saws to be used outdoors.

Full and proper implementation of water controls on drivable saws requires the employer to ensure that:

- An adequate supply of water for dust suppression is used;
- The spray nozzles produce a pattern that applies water at the point of dust generation;
- The spray nozzles are not clogged or damaged; and
- All hoses and connections are intact.

Respiratory protection is not required for work with drivable saws regardless of task duration.

Worker cutting a groove in concrete roadway with drivable saw using integrated water delivery system.

Photo courtesy of Husqvarna. The equipment shown in this picture is for illustrative purposes only and is not intended as an endorsement by OSHA of this company, its products or services.

TABLE 1: Specified Exposure Control Methods When Working with Materials Containing Crystalline Silica			
		Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
Equipment/Task	**Engineering and Work Practice Control Methods**	**≤ 4 hours/shift**	**> 4 hours/shift**
(vi) Rig-mounted core saws or drills	• Use tool equipped with integrated water delivery system that supplies water to cutting surface. • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.	None	None

Rig-mounted core saws or drills must be equipped with an integrated water delivery system (commercially developed specifically for the type of tool in use) that supplies water to the cutting surface, and must be operated and maintained in accordance with manufacturer's instructions to minimize dust emissions.

Full and proper implementation of water controls on rig-mounted core saws or drills requires the employer to ensure that:

- An adequate supply of water for dust suppression is used;
- The spray nozzles produce a pattern that applies water at the point of dust generation;
- The spray nozzles are not clogged or damaged; and
- All hoses and connections are intact.

When using rig-mounted core saws or drills indoors or in enclosed areas (areas where airborne dust can buildup, such as a structure with a roof and three walls), employers must provide additional exhaust, as needed to minimize the accumulation of visible airborne dust. See the section on *Indoors or Enclosed Areas* for more information.

Respiratory protection is not required for work with rig-mounted core saws or drills regardless of task duration.

A rig-mounted core drill with an integrated water delivery system.

Photo courtesy of Hilti. The equipment shown in this picture is for illustrative purposes only and is not intended as an endorsement by OSHA of this company, its products or services.

TABLE 1: Specified Exposure Control Methods When Working with Materials Containing Crystalline Silica			
		Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
Equipment/Task	**Engineering and Work Practice Control Methods**	**≤ 4 hours/shift**	**> 4 hours/shift**
(vii) Handheld and stand-mounted drills (including impact and rotary hammer drills)	• Use drill equipped with commercially available shroud or cowling with dust collection system. • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. • Dust collector must provide the air flow recommended by the tool manufacturer, or greater, and have a filter with 99% or greater efficiency and a filter-cleaning mechanism. • Use a HEPA-filtered vacuum when cleaning holes.	None	None

Handheld and stand-mounted drills (including impact and rotary hammer drills). Handheld and stand-mounted drills must be equipped with a commercially available shroud or cowling with a dust collection system that provides at least the minimum air flow recommended by the manufacturer. The dust collection system must include a filter cleaning mechanism and be equipped with a filter with 99 percent or greater efficiency. In addition, the tool must be operated and maintained in accordance with manufacturer's instructions to minimize dust emissions.

Full and proper implementation of dust collection systems on handheld drills requires the employer to ensure that:

- The shroud or cowling is intact and installed in accordance with the manufacturer's instructions;

Worker drilling into concrete with a rotary hammer equipped with shroud and dust collection system. Note the shroud around drill bit, silver and black hose, and dust collector are attached conveniently to the drill.

Photo courtesy of DeWalt. The equipment shown in this picture is for illustrative purposes only and is not intended as an endorsement by OSHA of this company, its products or services.

- The hose connecting the tool to the vacuum is intact and without kinks or tight bends;
- The filter(s) on the vacuum are cleaned or changed in accordance with the manufacturer's instructions; and
- The dust collection bags are emptied to avoid overfilling.

A HEPA-filtered vacuum must be used when cleaning holes. Compressed air can be used to clean holes when used in conjunction with a HEPA-filtered vacuum to capture the dust or a hole cleaning kit designed for use with compressed air.

When using handheld and stand-mounted drills indoors or in enclosed areas (areas where airborne dust can buildup, such as a structure with a roof and three walls), employers must provide additional exhaust, as needed to minimize the accumulation of visible airborne dust. See the section on *Indoors or Enclosed Areas* for more information.

Respiratory protection is not required when using handheld or stand-mounted drills equipped with a dust collection system, including for overhead drilling, regardless of task duration.

Worker is drilling horizontal holes in a concrete wall using two stand-mounted drills, each equipped with a dust collector. Note the shrouds around drill bits, black hose, and dust collector are attached to the stand.

Photo courtesy of David Rempel, University of California, San Francisco.

TABLE 1: Specified Exposure Control Methods When Working with Materials Containing Crystalline Silica			
		Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
Equipment/Task	**Engineering and Work Practice Control Methods**	**≤ 4 hours/shift**	**> 4 hours/shift**
(viii) Dowel drilling rigs for concrete	For tasks performed outdoors only: • Use shroud around drill bit with a dust collection system. Dust collector must have a filter with 99% or greater efficiency and a filter-cleaning mechanism. • Use a HEPA-filtered vacuum when cleaning holes.	APF 10	APF 10

Dowel drills for concrete (*i.e.*, gang drills) are drills equipped with multiple drill bits that are used to drill several holes at the same time. Dowel drills must be equipped with a shroud around the drill bit and a dust collection system that has a filter with 99 percent or greater efficiency. The dust collection equipment must be equipped with a filter cleaning mechanism. Employers following Table 1 must allow dowel drilling rigs to only be used outdoors.

Full and proper implementation of dust collection systems on dowel drilling rigs requires the employer to ensure that:

- The shroud is intact and installed in accordance with the manufacturer's instructions;
- The hose connecting the tool to the vacuum is intact and without kinks or tight bends;
- The filter(s) on the vacuum are cleaned or changed in accordance with the manufacturer's instructions; and
- The dust collection bags are emptied to avoid overfilling.

A HEPA-filtered vacuum must be used when cleaning holes. Compressed air can be used to clean holes when used in conjunction with a HEPA-filtered vacuum to capture the dust or a hole cleaning kit designed for use with compressed air.

Respiratory protection with a minimum APF of 10 is required for all work with dowel drilling rigs for concrete regardless of task duration.

Worker drilling horizontal holes in concrete slab with a dowel drilling rig. The shroud surrounds the drill steel where it enters the concrete and the dust collector is the canister on the right. Worker is wearing respiratory protection.

Photo courtesy of NIOSH.

TABLE 1: Specified Exposure Control Methods When Working with Materials Containing Crystalline Silica			
Equipment/Task	**Engineering and Work Practice Control Methods**	**Required Respiratory Protection and Minimum Assigned Protection Factor (APF)**	
		≤ 4 hours/shift	**> 4 hours/shift**
(ix) Vehicle-mounted drilling rigs for rock and concrete	Use dust collection system with close capture hood or shroud around drill bit with a low-flow water spray to wet the dust at the discharge point from the dust collector.	None	None
	OR		
	Operate from within an enclosed cab and use water for dust suppression on drill bit.	None	None

Vehicle-mounted rock and concrete drilling rigs must be equipped with a dust collection system with a close capture hood or shroud around the drill bit, and a low-flow water spray to wet the dust discharged from the dust collector. This combination of local exhaust ventilation (LEV) and water application controls dust at all emission points that can contribute to the operator's and other employees' exposures.

Employers also have the option to have the drill operator work within an enclosed cab and, when necessary, apply water at the drill bit, as described above, to reduce exposures to other employees in the area. See the section on *Enclosed Cabs* for more information on how to make sure cabs meet the requirements of Table 1.

Full and proper implementation of dust collection systems on vehicle-mounted drilling rigs requires the employer to ensure that:

- The shroud or hood is intact and installed in accordance with the manufacturer's instructions;
- The hose connecting the tool to the vacuum is intact and without kinks or tight bends;
- The filter(s) on the vacuum are cleaned or changed in accordance with the manufacturer's instructions; and
- The dust collection bags are emptied to avoid overfilling.

Full and proper implementation of water controls on vehicle-mounted drilling rigs requires the employer to ensure that:

Vehicle-mounted drilling rig using water on the drill bit. The enclosed operator's cab is on the right.

Photo courtesy of NIOSH.

- An adequate supply of water for dust suppression is used;
- The spray nozzles are working properly and produce a pattern that applies water on the discharge point from the dust collector;
- The spray nozzles are not clogged or damaged; and
- All hoses and connections are intact.

Respiratory protection is not required for work with vehicle-mounted drilling rigs regardless of task duration.

TABLE 1: Specified Exposure Control Methods When Working with Materials Containing Crystalline Silica

Equipment/Task	Engineering and Work Practice Control Methods	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 hours/shift	> 4 hours/shift
(x) Jackhammers and handheld powered chipping tools	Use tool with water delivery system that supplies a continuous stream or spray of water at the point of impact.		
	• When used outdoors.	None	APF 10
	• When used indoors or in an enclosed area.	APF 10	APF 10
	OR		
	Use tool equipped with commercially available shroud and dust collection system. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. Dust collector must provide the air flow recommended by the tool manufacturer, or greater, and have a filter with 99% or greater efficiency and a filter-cleaning mechanism.		
	• When used outdoors.	None	APF 10
	• When used indoors or in an enclosed area.	APF 10	APF 10

Jackhammers and handheld powered chipping tools must be operated using either a water delivery system that supplies a continuous stream or spray of water at the point of impact, or a tool equipped with a commercially available shroud and vacuum dust collection system. Jackhammers and other handheld powered chipping tools must be operated and maintained in accordance with manufacturer's instructions to minimize dust emissions.

If using the shroud and dust collection system, the vacuum dust collection system must provide at least the air flow recommended by the tool manufacturer, and have a filter with 99 percent or greater efficiency and a filter cleaning mechanism.

The water delivery system is not required to be integrated or mounted on the tool; it can be assembled and installed by the employer. However, it must deliver a continuous stream or spray of water at the point of impact.

Full and proper implementation of water controls on jackhammers and other handheld powered chipping tools requires the employer to ensure that:

- An adequate supply of water for dust suppression is used;
- The water sprays are working properly and produce a pattern that applies water at the point of dust generation;
- The spray nozzles are not clogged or damaged; and
- All hoses and connections are intact.

Acceptable water delivery systems include direct connections to fixed water lines or portable water tank systems. These water delivery systems can be operated by one worker or could require a second worker to supply the water at the point of impact.

Full and proper implementation of dust collection systems requires the employer to ensure that:

- The shroud is intact and installed in accordance with the manufacturer's instructions;
- The hose connecting the tool to the vacuum is intact and without kinks or tight bends;
- The filter(s) on the vacuum are cleaned or changed in accordance with the manufacturer's instructions; and
- The dust collection bags are emptied to avoid overfilling.

Respiratory protection with an APF of 10 is required when the task is done outdoors for more than four hours per shift, or when the task is done indoors or in an enclosed location regardless of task duration.

When working indoors or in an enclosed space (areas where airborne dust can buildup, such as a structure with a roof and three walls), employers must provide additional exhaust, as needed to minimize the accumulation of visible airborne dust. See the section on *Indoors or Enclosed Areas* for more information.

Jackhammer equipped with water spray delivery system to control dust. The water nozzle is mounted on the jackhammer frame just to the right of the chisel. Note the wet concrete on left from the water spray.

Photo courtesy of CPWR, Norman Zuckerman.

TABLE 1: Specified Exposure Control Methods When Working with Materials Containing Crystalline Silica

Equipment/Task	Engineering and Work Practice Control Methods	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 hours/shift	> 4 hours/shift
(xi) Handheld grinders for mortar removal (i.e., tuckpointing)	Use grinder equipped with commercially available shroud and dust collection system. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. Dust collector must provide 25 cubic feet per minute (cfm) or greater of airflow per inch of wheel diameter and have a filter with 99% or greater efficiency and a cyclonic pre-separator or filter-cleaning mechanism.	APF 10	APF 25

Handheld grinders for mortar removal (i.e., tuckpointing). Tuckpointing involves removing deteriorating mortar from between bricks using a handheld grinder and replacing it with fresh mortar.

The handheld grinders must be equipped with a commercially available shroud and dust collection system and operated and maintained in accordance with manufacturer's instructions to minimize dust emissions. The dust collection system must provide at least 25 cfm of air flow per inch of wheel diameter and have a filter that has a 99 percent or greater efficiency and either a cyclonic pre-separator or a filter-cleaning mechanism. Cyclonic pre-separators and filter-cleaning mechanisms improve the suction of dust collection systems by preventing debris from building up on the filter.

Full and proper implementation of dust collection systems on handheld grinders requires the employer to ensure that:

- The shroud is intact, encloses most of the grinding blade, and is installed in accordance with the manufacturer's instructions;
- The hose connecting the tool to the vacuum is intact and without kinks or tight bends;
- The filter(s) on the vacuum are cleaned or changed in accordance with the manufacturer's instructions;
- The dust collection bags are emptied to avoid overfilling;
- The blade is kept flush against the surface whenever possible; and
- The tool is operated against the direction of blade rotation, whenever practical.

When using handheld grinders for mortar removal indoors or in enclosed areas (areas where airborne dust can buildup, such as a structure with a roof and three walls), employers must provide additional exhaust if needed to minimize the accumulation of visible airborne dust. See the section on *Indoors or Enclosed Areas* for more information on how to determine when those work situations apply.

Respiratory protection with a minimum APF of 10 is required for work with handheld grinders for mortar removal lasting four hours or less in a shift. Respiratory protection with a minimum APF of 25 is required for work lasting more than four hours per shift.

Worker grinding mortar from between bricks with a handheld grinder equipped with a shroud and dust collection system. In addition, worker is using respiratory protection.

Photo courtesy of OSHA, International Masonry Institute.

TABLE 1: Specified Exposure Control Methods When Working with Materials Containing Crystalline Silica

Equipment/Task	Engineering and Work Practice Control Methods	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 hours/shift	> 4 hours/shift
(xii) Handheld grinders for uses other than mortar removal	For tasks performed outdoors only: Use grinder equipped with integrated water delivery system that continuously feeds water to the grinding surface. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.	None	None
	OR		
	Use grinder equipped with commercially available shroud and dust collection system. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. Dust collector must provide 25 cubic feet per minute (cfm) or greater of airflow per inch of wheel diameter and have a filter with 99% or greater efficiency and a cyclonic pre-separator or filter-cleaning mechanism.		
	• When used outdoors.	None	None
	• When used indoors or in an enclosed area.	None	APF 10

Handheld grinders may also be used for tasks other than mortar removal, such as to remove thin layers of concrete and surface coatings. Two control options may be used: (1) A grinder equipped with an integrated water delivery system (commercially developed specifically for the type of tool in use) that continuously feeds water to the grinding surface operated for outdoor work only; and (2) a dust collector equipped with a commercially available shroud and dust collection system with the same features as the dust collection system used for mortar removal for outdoor and indoor work. The dust collector must be rated to provide 25 cfm or greater air flow per inch of wheel diameter, have a filter with a 99 percent or greater efficiency, and a cyclonic pre-separator or filter-cleaning mechanism. Cyclonic pre-separators and filter-cleaning mechanisms improve the suction of dust collection systems by preventing debris from building up on the filter. The grinder and both controls must be operated and maintained in accordance with manufacturer's instructions to minimize dust emissions.

The integrated water delivery system can be a free-flowing water system designed for blade cooling as well as manufacturers' systems designed for dust suppression alone. This option applies only when grinders are used outdoors.

Full and proper implementation of water controls on grinders requires the employer to ensure that:

- An adequate supply of water for dust suppression is used;
- The spray nozzles are working properly and produce a pattern that applies water at the point of dust generation;
- The spray nozzles are not clogged or damaged; and
- All hoses and connections are intact.

Handheld grinders equipped with dust collection systems may be used outdoors or indoors. Full and proper implementation of dust collection systems on handheld grinders requires the employer to ensure that:

- The shroud is intact and installed in accordance with the manufacturer's instructions;
- The hose connecting the tool to the vacuum is intact and without kinks or tight bends;
- The filter(s) on the vacuum are cleaned or changed in accordance with the manufacturer's instructions; and
- The dust collection bags are emptied to avoid overfilling.

Respiratory protection is not required when water-based dust suppression systems are used regardless of task duration. When dust collection systems are used, respiratory protection with a minimum APF of 10 is required only when engaged in a task indoors or in an enclosed location for more than four hours per shift.

When using handheld grinders indoors or in enclosed areas (areas where airborne dust can buildup, such as a structure with a roof and three walls), employers must provide additional exhaust as needed to minimize the accumulation of visible airborne dust. See the section on *Indoors or Enclosed Areas* for more information.

Worker grinding concrete floor with grinder attached to dust collector (background).

Photo courtesy of the University of Washington.

TABLE 1: Specified Exposure Control Methods When Working with Materials Containing Crystalline Silica

Equipment/Task	Engineering and Work Practice Control Methods	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 hours/shift	> 4 hours/shift
(xiii) Walk-behind milling machines and floor grinders	Use machine equipped with integrated water delivery system that continuously feeds water to the cutting surface. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.	None	None
	OR		
	Use machine equipped with dust collection system recommended by the manufacturer. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. Dust collector must provide the air flow recommended by the manufacturer, or greater, and have a filter with 99% or greater efficiency and a filter-cleaning mechanism. When used indoors or in an enclosed area, use a HEPA-filtered vacuum to remove loose dust in between passes.	None	None

Two control options may be used when using **walk-behind milling machines and floor grinders**. Regardless of control option used, the tool must also be operated and maintained in accordance with manufacturer's instructions for minimizing dust emissions.

Option one is to use an integrated water delivery system (commercially developed specifically for the type of tool in use) that continuously feeds water to the cutting surface. Table 1 does not specify a minimum flow rate; however, water must be applied at flow rates specified by the manufacturer.

Full and proper implementation of water controls on walk-behind milling machines and floor grinders requires the employer to ensure that:

- An adequate supply of water for dust suppression is used;

- The spray nozzles are working properly and produce a pattern that applies water at the point of dust generation;
- The spray nozzles are not clogged or damaged; and
- All hoses and connections are intact.

Option two is to use a dust collection system recommended by the manufacturer of the milling machine or floor grinder and a filter with 99 percent or greater efficiency and a filter-cleaning mechanism. The dust collection system used must be capable of maintaining the air flow recommended by the manufacturer.

Full and proper implementation of dust collection systems on walk-behind milling machines and floor grinders requires the employer to ensure that:

- The hose connecting the tool to the vacuum is intact and without kinks or tight bends;
- The filter(s) on the vacuum are cleaned or changed in accordance with the manufacturer's instructions to prevent clogging; and
- The dust collection bags are emptied to avoid overfilling.

When using a dust collector system indoors or in enclosed areas (areas where airborne dust can buildup, such as a structure with a roof and three walls), loose dust must be cleaned with a HEPA-filtered vacuum in between passes of the milling machine or floor grinder to prevent the loose dust from being re-suspended. Removing loose dust with a HEPA vacuum also maximizes vacuum suction by improving the seal between the machine and floor. For indoor and enclosed spaces, employers must provide additional ventilation as needed to minimize the accumulation of visible airborne dust. See the section on *Indoors or Enclosed Areas* for more information.

Respiratory protection is not required for work with walk-behind milling machines and floor grinders regardless of task duration.

Worker milling granite floor indoors with milling machine and dust collection system (background).

Photo courtesy of OSHA.

TABLE 1: Specified Exposure Control Methods When Working with Materials Containing Crystalline Silica

Equipment/Task	Engineering and Work Practice Control Methods	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 hours/shift	> 4 hours/shift
(xiv) Small drivable milling machines (less than half-lane)	Use a machine equipped with supplemental water sprays designed to suppress dust. Water must be combined with a surfactant. Operate and maintain machine to minimize dust emissions.	None	None

Small drivable milling machines must be used with supplemental water sprays designed to suppress dust and must be operated and maintained to minimize dust emissions. The water used must be combined with a surfactant.

Full and proper implementation of water controls on small drivable milling machines requires the employer to ensure that:

- An adequate supply of water for dust suppression is used;
- The spray nozzles are working properly and produce a pattern that applies water at the point of dust generation;
- The spray nozzles are not clogged or damaged; and
- All hoses and connections are intact.

When using small drivable milling machines indoors or in enclosed areas (areas where airborne dust can buildup, such as a structure with a roof and three walls), the employer must provide additional exhaust as needed to prevent the accumulation of visible airborne dust. *See* the section on *Indoors or Enclosed Areas* for more information on how to determine when those work situations apply.

Respiratory protection is not required for work with small drivable milling machines (less than half-lane) regardless of task duration.

Milling machine milling asphalt road and loading debris into haul truck.

U.S. Air Force photo, Beth Holliker. The equipment shown in this picture is for illustrative purposes only and is not intended as an endorsement by OSHA of this company, its products or services.

TABLE 1: Specified Exposure Control Methods When Working with Materials Containing Crystalline Silica			
Equipment/Task	**Engineering and Work Practice Control Methods**	**Required Respiratory Protection and Minimum Assigned Protection Factor (APF)**	
		≤ 4 hours/shift	**> 4 hours/shift**
(xv) Large drivable milling machines (half-lane and larger)	For cuts of any depth on asphalt only: Use machine equipped with exhaust ventilation on drum enclosure and supplemental water sprays designed to suppress dust. Operate and maintain machine to minimize dust emissions.	None	None
	For cuts of four inches in depth or less on any substrate: Use machine equipped with exhaust ventilation on drum enclosure and supplemental water sprays designed to suppress dust. Operate and maintain machine to minimize dust emissions.	None	None
	OR Use a machine equipped with supplemental water spray designed to suppress dust. Water must be combined with a surfactant. Operate and maintain machine to minimize dust emissions.	None	None

Employers whose employees operate large (one-half lane or wider) milling machines have two control options for cuts of four inches in depth or less on any substrate and one control option for cuts of any depth on asphalt. When using any of the control options, the machine must be operated and maintained to minimize dust emissions.

The two control options for making cuts of four inches or less on any combination of roadway material (asphalt and concrete), are to: (1) use a machine equipped with exhaust ventilation on the drum enclosure and supplemental water sprays designed to suppress dust; or (2) use a machine equipped with a supplemental water spray, combined with a surfactant, designed to suppress dust.

When making cuts of any depth on roadway material containing asphalt only, the only control option is to use a machine equipped with exhaust ventilation on the drum enclosure and supplemental water sprays designed to suppress dust.

Respiratory protection is not required for work with large drivable milling machines (half-lane or larger) regardless of task duration.

Milling machine milling asphalt road and loading debris into a haul truck.

Photo courtesy of NIOSH. The equipment shown in this picture is for illustrative purposes only and is not intended as an endorsement by OSHA of this company, its products or services.

TABLE 1: Specified Exposure Control Methods When Working with Materials Containing Crystalline Silica			
Equipment/Task	**Engineering and Work Practice Control Methods**	**Required Respiratory Protection and Minimum Assigned Protection Factor (APF)**	
		≤ 4 hours/shift	**> 4 hours/shift**
(xvi) Crushing machines	Use equipment designed to deliver water spray or mist for dust suppression at crusher and other points where dust is generated (e.g., hoppers, conveyers, sieves/sizing or vibrating components, and discharge points). Operate and maintain machine in accordance with manufacturer's instructions to minimize dust emissions. Use a ventilated booth that provides fresh, climate-controlled air to the operator, or a remote control station.	None	None

When using **crushing machines**, employers must provide workers with a remote control station or ventilated booth that provides fresh, climate-controlled air to the operator. Water sprays or mists must be used for dust suppression at the crusher and other points where dust is generated (*e.g.*, at hoppers, conveyors, sieves/sizing or vibrating components, and discharge points). See the section on *Enclosed Cabs* for more information on how to make sure enclosures meet the requirements of the rule. Table 1 also requires that the machine be operated and maintained according to the manufactures instructions to minimize dust emissions.

The water spray systems can be installed so that they can be activated by remote control. To prevent airborne dust from being generated, full and proper implementation of controls requires that:

- Nozzles are located upstream of dust generation points and positioned to thoroughly wet the material;
- The volume and size of droplets is adequate to sufficiently wet the material (optimal droplet size is between 10 and 150 μm); and
- Spray nozzles are located far enough from the target area to provide complete water coverage but not so far that the water is carried away by wind.

Respiratory protection is not required for crusher operators regardless of task duration.

Crushing machine being loaded with construction debris by an excavator

Photo courtesy of Screen Machine Industries. The equipment shown in this picture is for illustrative purposes only and is not intended as an endorsement by OSHA of this company, its products or services.

Heavy equipment and utility vehicles include a variety of wheeled or tracked vehicles, ranging in size from large heavy construction equipment, such as bulldozers, scrapers, loaders, cranes and road graders, to smaller and medium-sized utility vehicles, such as tractors, bobcats and backhoes with attached tools. Table 1 has two entries for heavy equipment and utility vehicles based on the types of tasks performed with that equipment.

TABLE 1: Specified Exposure Control Methods When Working with Materials Containing Crystalline Silica			
Equipment/Task	**Engineering and Work Practice Control Methods**	**Required Respiratory Protection and Minimum Assigned Protection Factor (APF)**	
		≤ 4 hours/shift	**> 4 hours/shift**
(xvii) Heavy equipment and utility vehicles used to abrade or fracture silica-containing materials (e.g., hoe-ramming, rock ripping) or used during demolition activities involving silica-containing materials	Operate equipment from within an enclosed cab.	None	None
	When employees outside of the cab are engaged in the task, apply water and/or dust suppressants as necessary to minimize dust emissions.	None	None

The next Table 1 entry is **heavy equipment and utility vehicles used to abrade or fracture silica-containing materials (e.g., hoe-ramming, rock ripping) or used during demolition activities involving silica-containing materials.** These include activities such as fracturing or abrading rock and soil; demolishing concrete or masonry structures; and loading, dumping, and removing demolition debris.

The operator must be in an enclosed cab. Modern heavy equipment already comes equipped with enclosed, filtered cabs that meet the requirements of Table 1. See the section on *Enclosed Cabs* for more information on how to make sure that the cab meets the requirements of the rule. When other employees are engaged in the task, water, dust suppressants, or both must also be applied as necessary to minimize dust emissions.

Respiratory protection is not required for heavy equipment operators and laborers who assist heavy equipment operators during demolition activities involving silica-containing materials or activities where silica-containing materials are abraded or fractured, regardless of the duration of the task.

NOTE: When the operator exits the enclosed cab and is no longer actively preforming the task, the operator is considered to have stopped the task. However, if other abrading, fracturing, or demolition work is performed by other heavy equipment and utility vehicles in the area while an operator is outside the cab, that operator is considered to be an employee "engaged in the task" and must be protected by the application of water and/or dust suppressants.

Excavator equipped with an enclosed cab and hoe-ram demolishing a concrete wall.

Photo courtesy of CPWR.

TABLE 1: Specified Exposure Control Methods When Working with Materials Containing Crystalline Silica

Equipment/Task	Engineering and Work Practice Control Methods	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 hours/shift	> 4 hours/shift
(xviii) Heavy equipment and utility vehicles for tasks such as grading and excavating but not including demolishing, abrading, or fracturing silica-containing materials	Apply water and/or dust suppressants as necessary to minimize dust emissions.	None	None
	OR		
	When the equipment operator is the only employee engaged in the task, operate equipment from within an enclosed cab.	None	None

Heavy equipment and utility vehicles used for tasks such as grading and excavating do not involve demolition or the fracturing or abrading of silica. Tasks include earthmoving, grading, and excavating; other activities such as moving, loading, and dumping soil and rock; and dumping and grading of ballast in the railroad industry, which is generally subject to OSHA's Construction standards.

Employers have two control options when the operator is the only employee engaged in the task and one option when employees other than the operator are engaged in the task. The first option requires the equipment operator to operate the equipment within an enclosed cab when the operator is the only employee in the area. Most heavy equipment already comes equipped with enclosed, filtered cabs that meet the requirements of Table 1. See the section on *Enclosed Cabs* for more information on how to make sure that the cab meets the requirements of the rule.

The second option requires the application of water and/or dust suppressants as necessary to minimize dust emissions. Water must be applied at rates sufficient to minimize release of visible dust. The following scenarios are examples of when the employer must use water and/or dust suppressants as necessary to minimize dust emissions: (1) equipment for grading and excavating is not equipped with enclosed, pressurized cabs or (2) employees other than the operator are engaged in the task. If water or dust suppressants are applied as necessary to minimize visible dust, the employer need not provide an enclosed, filtered cab for the operator.

Respiratory protection is not required for work with heavy equipment when it is operated from within an enclosed cab, or when water or other dust suppressants are used, regardless of task duration.

Earthmoving using a dozer equipped with enclosed operator cab.

Photo courtesy of NIOSH.

Water Delivery Systems

Integrated water delivery systems are required for several types of equipment in Table 1. Integrated water systems must be developed specifically for the type of tool in use so they will apply water at the appropriate dust emission points based on tool configuration and do not interfere with other tool components or safety devices. Water systems designed for blade cooling also suppress dust and meet the requirements for Table 1.

The water must be applied at flow rates sufficient to minimize release of visible dust. Effective control of the dust depends on factors such as dust particle size, dust particle velocity, spray nozzle size and location, use of surfactants or other binders, and environmental factors (water hardness, humidity, weather, etc.), all of which must be considered when using wet methods. The appropriate water flow rates for controlling silica dust emissions can vary; therefore, it is necessary to follow manufacturers' instructions when determining the required flow rate for dust suppression systems on a given worksite.

Any slurry generated when using water to suppress dust should be cleaned up to limit secondary exposure to silica dust when the slurry dries following procedures described in the employer's *Written Exposure Control Plan*.

When working in cold temperatures, where there is a risk of water freezing, additional work practices such as insulating drums, wrapping drums with gutter heat tape or adding environmentally-friendly antifreeze additives to water may be needed.

Dust Collection Systems

Commercially available dust collection systems (*i.e.*, LEV) are required for several types of equipment in Table 1. This requirement ensures that employers use equipment that is designed to effectively capture dust generated by the tool being used and does not introduce new hazards such as obstructing or interfering with safety mechanisms.

The "commercially available" limitation is meant only to eliminate on-site improvisations of equipment by the employer. Employers can use products that are made by aftermarket manufacturers (someone other than the original tool manufacturer) that are intended to fit the make and model of the tool. This includes custom-designed products made to meet the particular needs and specifications of the employer purchasing the product. These systems are designed to work effectively with the equipment and not introduce new hazards such as obstructing or interfering with safety mechanisms. When employers use methods other than commercially available systems for dust suppression, they must conduct exposure assessments and comply with the PEL.

Some Table 1 entries for dust collection systems specify use of cyclonic pre-separators and filter cleaning mechanisms to prevent buildup of debris on filters that result in less dust capture. A cyclonic pre-separator collects large debris before the air reaches the filters. A filter cleaning mechanism prevents the need for manually cleaning filters to prevent buildup of debris (caking). Some vacuums are equipped with a gauge indicating filter pressure or an equivalent device (*e.g.*, timer to periodically pulse the filter) to help employees in determining when it is time to run a filter cleaning cycle.

Indoors or Enclosed Areas

Several Table 1 entries refer to tasks performed "outdoors" or "indoors or in an enclosed area." Indoors or in an enclosed areas mean areas where airborne dust can build up unless additional exhaust is used. For example, a work area with only a roof that does not affect the dispersal of dust would not be considered enclosed; however, an open-top structure with three walls and limited air movement or a roof that does limit dispersal would be considered enclosed.

Sufficient air circulation in enclosed or indoor environments is important to ensure the effectiveness of the control strategies and to prevent the accumulation of airborne dust. Employers following Table 1 are required to provide a means of exhaust as needed to minimize the accumulation of visible airborne dust for tasks performed indoors or in enclosed areas. The means of exhaust necessary could include: the use of portable fans (box fans, floor fans, axial fans), portable ventilation systems, or other systems that increase air movement and assist in the removal and dispersion of airborne dust. To be effective, the ventilation must be set up so that movements of employees during work, or the opening of doors and windows, will not negatively affect the airflow.

Enclosed Cabs

Enclosed cabs or booths are specified for rock drilling, crushers, and heavy equipment. Employers must ensure that the enclosed cab or booth is:

- Maintained as free as practicable from settled dust;
- Has door seals and closing mechanisms that work properly;
- Has gaskets and seals that are in good condition and work properly;
- Is under positive pressure maintained through continuous delivery of filtered air;
- Has intake air that is filtered through a pre-filter that is 95% efficient in the 0.3-10.0 μm range (*e.g.*, MERV-16 or better); and
- Has heating and cooling capabilities.

The controls for enclosed cabs lower the potential for dust to be re-suspended inside the cab or enter the enclosed cab or booth. They also ensure that the filtered air provided to the employee does not contain silica particles and that the working conditions in the cab are comfortable so that employees are less likely to open windows and be exposed.

The procedures for maintaining and cleaning the cab or booth, and for frequent and regular inspections of the cabs and booths, must be addressed through the employer's *Written Exposure Control Plan* and *Competent Person* requirements described below.

Determining Task Duration and Requirements for Respirator Use

Respirator requirements in Table 1 are divided by task duration:

- "Less than or equal to four hours/shift" and,
- "Greater than four hours/shift".

Each of the following scenarios is considered a "shift" for purposes of determining the maximum amount of time that an employee may spend on Table 1 tasks without respiratory protection:

- A standard 8-hour work period;
- A day with a break between work periods (*e.g.*, four hours on, two hours off, four hours on);
- Work periods longer than eight hours;
- Double shifts within a single day;
- A work period spanning two calendar days (*e.g.*, 8 p.m. until 4 a.m.).

Task duration time starts when the operator begins using the tool, and continues to be counted until he or she completes the task. This time includes intermittent breaks in tool usage and clean-up. However, tasks that are performed multiple times per day, during distinct time periods, should be counted as separate tasks, and times should be combined.

The requirement to provide respirators is based on the anticipated duration of the task. Employers must make a good-faith judgment of the task's anticipated duration over the work shift, whether performed continuously or intermittently, based on previous experience and all other available information.

Examples of Determining Task Durations

1. Tasks with intermittent breaks. An employee cuts and places bricks, one at a time, for four hours consecutively and then spends 30 minutes cleaning up the saw and emptying slurry or dust collectors. All four hours spent cutting and laying bricks along with the 30 minutes for clean-up count for a total task duration of four and a half hours.
2. Tasks with distinct time periods. An employee cuts multiple bricks for 15 minutes, lays bricks for two hours before returning to cut more bricks for another 30 minutes. The total task duration is 45 minutes

If an employer estimates that an employee will perform a single task for four hours or less during a single shift, then the employer must ensure that the employee uses whichever respirator, if any, is specified in the "≤ 4 hr/shift" column in Table 1. If an employer estimates that the task will take more than four hours, then the employer must ensure that the employee uses any respiratory protection specified in the "> 4 hr/shift" column in Table 1, during the entire task, not just during the time beyond the first four hours that the task is performed.

If an employer anticipates that a task will take four hours or less, but unforeseen difficulties will extend the task duration beyond four hours, the employer is required to provide the listed respiratory protection as soon as it becomes evident that the duration of the task may exceed the 4-hour limit, measured from the beginning of the task.

Where an employee performs more than one task in Table 1 during the course of a shift, and the total duration of all tasks combined is less than four hours, the required respiratory protection for each task is the respiratory protection specified in the less than four hours per shift column. If the total duration of all Table 1 tasks combined is more than four hours per shift, the required respiratory protection for each task is the respiratory protection specified in the more than four hours per shift column. As was discussed for single tasks, if multiple tasks are estimated to last less than 4 hours, but it becomes evident that the tasks will take more than four hours total, the employer must reexamine respiratory protection requirements and immediately provide a respirator, when required.

Examples of Respiratory Protection Requirements for Single Tasks in Table 1

1. An employer anticipates that it will take an employee 3 hours to cut concrete walls using a handheld power saw (outdoors). No respiratory protection is required.
2. An employer anticipates that it will take an employee 5 hours to demolish an asphalt road using a jackhammer (outdoors). The employer must provide a respirator with an APF of 10 and ensure that the employee wears it for the entire duration of the task.
3. An employer anticipates that it will take an employee 3 hours to grind a concrete floor (indoors) and, therefore, determines that respiratory protection is not required under Table 1. However, at two hours, the employer determines that it will take more than 4 hours to complete the task. The employer must provide a respirator with an APF of 10 at that time and ensure that the employee wears it for the remaining duration of the task.

Examples of Respiratory Protection Requirements for Employees who do more than one Table 1 Task

1. An employer anticipates that an employee will use a handheld grinder on a concrete wall outdoors for 3 hours and then use a chipping hammer outdoors for 2 hours (total Table 1 task duration of 5 hours per shift). The employer looks in the "> 4 hour/shift" column for each task to determine that no respiratory protection is required during use of the handheld grinder outdoors, but a respirator with an APF of 10 is required during use of the chipping hammer outdoors.
2. An employer anticipates that an employee will use a stationary masonry saw to cut bricks for 1 hour and use a handheld power saw to cut concrete indoors for 1 hour over the course of a shift (total Table 1 task duration of two hours per shift). The employer looks in the "≤ 4 hour/shift" column for each task to determine that no respiratory protection is required during use of the stationary masonry saw, but a respirator with an APF of 10 is required during use of the handheld power saw indoors.
3. An employer anticipates that an employee will drive a half-lane milling machine for 4 hours and then operate a walk-behind milling machine equipped with an integrated water delivery system for 4 hours (total Table 1 task duration of 8 hours). The employer looks in the "> 4 hour/shift" column for each task to determine that no respiratory protection is required for either task.

ALTERNATIVE EXPOSURE CONTROL METHODS – PARAGRAPH (D) OF THE STANDARD

Employers that conduct tasks not listed in Table 1 or do not fully and properly implement the engineering controls, work practices, and respiratory protection described in Table 1 of the specified exposure control methods approach must follow the alternative exposure control methods approach. The alternative exposure control methods approach involves assessing employee exposure to respirable crystalline silica, and limiting exposure to the PEL using feasible engineering and work practice control methods, and respiratory protection when necessary. Each of the three components of alternative exposure control methods – the PEL, exposure assessment, and methods of compliance – is explained below.

Permissible Exposure Limit (PEL)

Employers complying with the alternative exposure control methods must ensure that their employees' exposures to respirable crystalline silica do not exceed the PEL, which is 50 μg/m^3 as an 8-hour TWA. This means that over the course of any 8-hour work shift, exposures can fluctuate, but the average exposure to respirable crystalline silica cannot exceed 50 μg/m^3. The PEL applies to the three forms of respirable crystalline silica that are covered by the standard: quartz, cristobalite, and trydimite. Quartz is by far the most common form of crystalline silica found at construction workplaces, and in most cases, quartz will be the only form of respirable crystalline silica analyzed in air samples used to measure employee exposures.

Exposure Assessment

Construction employers following alternative exposure control methods must assess the 8-hour TWA exposure for each employee who is or may reasonably be expected to be exposed to respirable crystalline silica at or above the action level of 25 μg/m^3 as an 8-hour TWA. The purposes of assessing employee exposures include: identifying where exposures are occurring; helping the employer select control methods and make sure those methods are effective; preventing employees from being exposed above the PEL; providing employees with information about their exposure levels; and allowing the employer to give the PLHCP performing medical examinations information about employee exposures.

Calculation of TWA Exposures

Both the PEL and the action level are expressed as TWA exposures. TWA measurements account for variable exposure levels over the course of a work shift by averaging periods of higher and lower exposures. The TWA exposure for an 8-hour work shift is calculated using a simple formula:

$$TWA = (C_a T_a + C_b T_b \ldots C_n T_n) \div 8$$

Where:

TWA is the time-weighted average exposure for the work shift

C is the concentration during any period of time (T) where the concentration remains constant; and

T is the duration in hours of the exposure at the concentration (C)

For example, assume that an employee is exposed to respirable crystalline silica in an 8-hour workday as follows:

Two hours exposure at 100 μg/m^3
Two hours exposure at 50 μg/m^3
Four hours exposure at 10 μg/m^3

Entering this information in the formula, we get:

$$(2 \times 100 + 2 \times 50 + 4 \times 10) \div 8 = 42.5\ \mu g/m^3$$

Because 42.5 μg/m^3 is higher than 25 μg/m^3, this employee's TWA exposure would be above the action level, but below the PEL of 50 μg/m^3.

Employers can choose between two options for assessing exposures:

- The performance option; or
- The scheduled monitoring option.

Performance Option. The performance option gives employers flexibility to determine the 8-hour TWA exposure for each employee based on any combination of air monitoring data or objective data that can accurately characterize employee exposures to respirable crystalline silica.

Air monitoring data are any results of air monitoring (analyzed according to the procedures and requirements in Appendix A) that the employer has done to meet the requirements of the standard.

Objective data is information that demonstrates employee exposure to respirable crystalline silica associated with a particular product or material or a specific process, task, or activity. The data must reflect workplace conditions that closely resemble or could result in higher exposures than the processes, types of material, control methods, work practices, and environmental conditions in the employer's current operations.

Examples of objective data are information such as:

- Air monitoring data from industry-wide surveys;
- Calculations based on the composition of a substance;
- Area sampling results and exposure mapping profile approaches; and
- Historical air monitoring data collected by the employer.

Employers choosing the performance option must:

- Conduct the exposure assessment before work begins;
- Reassess exposures whenever a change in production, process, control equipment, personnel, or work practices may reasonably be expected to result in new or higher exposures at or above the action level, or when the employer has any reason to believe that new or additional exposures at or above the action level have occurred;
- Be able to demonstrate that employee exposures have been accurately characterized; and
- Make sure that the exposure assessment reflects the exposures of employees on each shift, for each job classification, in each work area.

Examples of Using Objective Data to Conduct Exposure Assessments under the Performance Option

1. Industry-wide surveys of typical tasks or operations, which include well-documented procedures for measuring exposures and methods for controlling dust, could be used by employers to characterize employee exposures where employees perform tasks consistent with those described in the survey.
2. Employers can use direct-reading instruments to measure real-time levels of respirable dust in the air. If the employer has information on the percentage of respirable crystalline silica in that dust (for example, from the analysis of a bulk sample or information from a safety data sheet), he or she can then calculate the level of respirable crystalline silica in air.
3. Historical air monitoring data collected by the employer could be used to assess employee exposures if the employer can show that the data were collected during work operations and conditions that are consistent with the processes, types of material, control methods, work practices, and environmental conditions in the employer's current operations.

The performance option may be especially useful when measuring employee exposures is challenging, such as when tasks are conducted for short durations of time or performed under different weather conditions.

The performance option gives employers flexibility for characterizing the exposures of all employees. For example, instead of conducting air monitoring on two employees who perform the same job on different shifts, the employer could determine that there are no differences in exposure between those two employees, and characterize the exposure of the second employee based on the air monitoring results of the first employee.

Under the performance option, employers can characterize employee exposure within a range to account for exposure variability. Employers can also use that option to show that exposures exceed the PEL by a certain level, such as less than 10 times the PEL, after using all feasible controls. The employer would then know that he or she must provide respiratory protection with an APF of at least 10, as well as medical surveillance for employees required to wear a respirator under the silica standard for 30 or more days per year.

Scheduled Monitoring Option. The scheduled monitoring option lets employers know when and how often they must perform exposure monitoring to measure employee exposures. When following the scheduled monitoring option, employers must make sure that:

- Results represent the employee's TWA exposure to respirable crystalline silica over an eight-hour workday;
- Samples are collected from the employee's breathing zone; and
- Samples are collected outside respirators so that they represent the exposure that would occur without the use of the respirator.

OSHA intends for employers using the scheduled monitoring option to conduct initial monitoring as soon as work begins so that they are aware of exposure levels and where control measures are needed.

Under the scheduled monitoring option, just as under the performance option, employers must correctly characterize each employee's exposure to respirable crystalline silica.

Exposure monitoring must include, at a minimum, one full-shift sample taken for each job function in each job classification, in each work area, and on each shift. Characterizing each employee's exposure may involve monitoring all exposed employees or a smaller number of employees whose exposures can then represent those of other employees.

Representative sampling involves monitoring the employee or employees reasonably expected to have the highest exposure to respirable crystalline silica (for example, the employee closest to an exposure source). This exposure is then assigned to the other employees in the group who perform the same tasks on the same shift and in the same work area.

Representative monitoring is allowed when several employees perform the same job on the same shift and under the same conditions.

How Often Employers Must Monitor under the Scheduled Monitoring Option. Under the scheduled monitoring option, how often monitoring must be done depends on the results of initial monitoring and, thereafter, any required further monitoring, as follows:

- If the initial monitoring indicates that employee exposures are below the action level, no further monitoring is required.
- If the most recent exposure monitoring reveals employee exposures at or above the action level but at or below the PEL, the employer must repeat monitoring within six months of the most recent monitoring.

- If the most recent exposure monitoring reveals employee exposures above the PEL, the employer must repeat monitoring within three months of the most recent monitoring.
- When two non-initial monitoring results taken consecutively, at least 7 days apart but within 6 months of each other, are below the action level, employers may stop monitoring for employees represented by those results, as long as no changes occur that could reasonably be expected to result in new or additional exposures at or above the action level.

Reassessment of Exposures. The employer must reassess exposures whenever a change in production, process, control equipment, personnel, or work practices may reasonably be expected to result in new or additional exposures to respirable crystalline silica at or above the action level, or when the employer has any reason to believe that new or additional exposures at or above the action level have occurred. For example, reassessment would be required when a task performed in an open, outdoor location is moved to an enclosed or confined space, because the change in conditions could reasonably be expected to result in higher exposures to respirable crystalline silica.

Employers do not have to conduct additional monitoring simply because a change has occurred, so long as the change is not reasonably expected to result in new or additional exposures to respirable crystalline silica at or above the action level. For example, reassessment is not required when a task is moved from an indoor to an outdoor location, or when a product is replaced with another product that has lower crystalline silica content in the same process.

Methods of Sample Analysis (Appendix A of the Standard). Appendix A of the silica standard lists laboratory procedures for measuring respirable crystalline silica in air samples. Employers must make sure that all air samples taken to meet the requirements of the silica standard are analyzed by a laboratory that follows the procedures in Appendix A. If employers hire an outside laboratory to do the analyses for respirable crystalline silica, they can rely on a statement from that laboratory that it follows Appendix A. For example, the laboratory could indicate that it analyzes samples according to Appendix A of the standard in the laboratory report or on its website.

Employee Notification. Employers must notify each affected employee of the results of the exposure assessment within 5 working days of completing it. “Affected” means all employees whose exposures were assessed, including employees whose exposures were represented by other employees’ exposure measurements, and those whose exposure assessments were based on objective data. The 5-day period for notification starts when:

- An employer following the performance option finishes the exposure assessment; or
- An employer following the scheduled monitoring approach receives the laboratory results.

Employers must either notify each employee in writing or post the results in a location that all affected employees can access. In cases where an employee might have moved onto another job or jobsite, the assessment results could be included with the employees’ final paycheck.

Exposures can be characterized and reported as a range (for example, between the action level and the PEL), but must reflect exposures that would occur if the employee were not using a respirator.

When an exposure assessment reveals exposures above the PEL, the written notification must also describe the corrective action the employer is taking to reduce employee exposures to or below the PEL. Corrective actions include engineering controls. However, if engineering controls are not feasible or the employer needs more than 5 days to identify the right engineering controls, respiratory protection is the corrective action that would be described in the written notification.

Observation of Monitoring. The employer must let affected employees or their designated representatives observe any air monitoring of employee exposure to respirable crystalline silica. When observation of monitoring requires entry into an area where use of protective clothing or equipment, such as a respirator, is required, the employer must provide the observer with that protective clothing or equipment. The employer must provide the protective clothing and equipment at no cost, and make sure that the observer uses such clothing or equipment.

However, if the observer does not need to enter an area requiring the use of protective clothing or equipment in order to effectively observe monitoring (for example, if monitoring can be viewed from outside the hazardous areas), no protective clothing or equipment would be needed.

Methods of Compliance

Employers following alternative exposure control methods must comply with the methods of compliance requirements of the standard. The methods of compliance section of the standard requires employers to protect employees following the hierarchy of controls, which relies on engineering and work practice controls for reducing exposures and allows for respirator use, in addition to those controls, only when feasible engineering controls cannot reduce exposures to acceptable levels. The methods of compliance section also cross-references other OSHA standards that apply to abrasive blasting.

Engineering and Work Practice Controls. Employers must use engineering and work practice controls to reduce and keep employee exposure to respirable crystalline silica to or below the PEL of 50 μg/m^3, unless the employer can demonstrate that such controls are not feasible. If feasible engineering and work practice controls are not able to reduce employee exposures to or below the PEL, employers must still use feasible controls to reduce exposures to the lowest possible level and then use respiratory protection along with those controls.

The main types of engineering controls for silica are wet methods and local exhaust ventilation. Wet methods involve applying water or foam at the point of dust generation to keep dust from getting into the air. An example is an integrated water delivery system on a stationary masonry saw. Local exhaust ventilation removes dust by capturing it at or near the point where it is created. An example is a dust collector for a handheld grinder.

Another engineering control is isolation. Isolation separates employees from the dust source by containing the dust or isolating employees. An example is a properly ventilated cab on heavy equipment.

Work practice controls involve performing a task in a way that reduces the likelihood or levels of exposure. Work practice controls are often used with engineering controls to protect employees. Employees must know the appropriate work practices for maximizing the effectiveness of controls and minimizing exposures. Examples of work practice controls include:

- Inspecting and maintaining controls to prevent or fix malfunctions that would result in increased exposures;
- Making sure that nozzles spray water at the point of dust generation for wet method controls;

- Making sure that hoses are not kinked on a tool used with a dust collector;
- Wetting down silica dust before sweeping it up; and
- Scheduling work so that tasks that involve high exposures are performed when no other employees are in the area.

Reducing exposures through the primary use of engineering and work practice controls is known as the hierarchy of controls, and it is a long-standing OSHA policy. Advantages of engineering controls are that they:

- Control crystalline silica-containing dust particles at the source, thus minimizing exposures to all persons in the surrounding work area;
- Are reliable, predictable, and provide consistent levels of protection to a large number of employees;
- Can be monitored; and
- Are less prone to human error than the use of personal protective equipment.

Under the hierarchy of controls, respirators can be another effective way to protect employees. However, respirators may be less practical or effective than engineering controls for the following reasons:

- They must be selected for each worker, fitted, occasionally refitted, and regularly maintained (including replacing filters and other parts as necessary).
- Employees have to consistently and correctly use properly fitted respirators but may resist wearing them because respirators can be uncomfortable, especially in hot weather.
- Respirators may put a physical strain on employees' bodies, as a result of the respirator's weight and because they increase breathing resistance. Employees with some health conditions cannot wear respirators because the physical strain of wearing the respirator increases their risk of illness, injury, and even death.
- Respirators can create safety concerns because they interfere with workers' ability to hear, see, smell, and communicate.
- Respirators only protect the employees wearing them.

Even when engineering and work practice controls cannot reduce exposure levels to or below the PEL, those controls must be used to reduce exposures as low as possible. This reduction in exposure levels benefits employees by reducing the required protection factor of the respirator, and thus increasing the choices of respirators that can be used. For example, if feasible engineering controls reduce exposures from 50 times to less than 10 times the PEL, employers could provide approved half-mask respirators with an APF of 10 that may be lighter and easier to use compared to full-facepiece respirators.

Abrasive Blasting. In addition to complying with requirements to use engineering controls and work practices according to the hierarchy of controls, construction employers that conduct abrasive blasting operations using crystalline silica-containing blasting agents or conduct abrasive blasting on structures that contain crystalline silica must also comply with other relevant standards, such as the ventilation standard for construction (29 CFR 1926.57), which contains requirements for ventilation and personal protective equipment, including respirators. This is simply a cross-reference to other standards that construction employers must comply with when conducting abrasive blasting.

RESPIRATORY PROTECTION – PARAGRAPH (E) OF THE STANDARD

Employers must provide employees with appropriate respirators where required by the silica standard. The respirators must comply with requirements of the silica standard and with OSHA's Respiratory Protection standard (29 CFR 1910.134).

Employers who follow the specified exposure control methods listed in Table 1 must provide respiratory protection where required by Table 1. Employers who follow alternative exposure control methods must provide respiratory protection:

- Where exposures exceed the PEL during periods necessary to install or implement feasible engineering and work practice controls;
- Where exposures exceed the PEL during tasks, such as some maintenance and repair tasks, for which engineering and work practice controls are not feasible;
- During tasks in which the employer has implemented all feasible engineering and work practice controls but exposures remain above the PEL.

Where respirator use is required, employers must implement a respiratory protection program in accordance with the respiratory protection standard. The respiratory protection program ensures that respirators are properly used in the workplace and are effective in protecting employees. See the *Small Entity Compliance Guide for the Respiratory Protection Standard* for information on the requirements of that standard.

If an employer following the specified exposure control methods fully and properly implements the engineering controls, work practices, and respiratory protection required in Table 1, the employer will be considered to be in compliance with the requirements of the silica standard and the respiratory protection standard for identifying and evaluating respiratory hazards and providing each employee with an appropriate respirator.

Employers following Table 1 must comply with all other requirements of the Respiratory Protection standard.

Voluntary Use of Respirators

Employers may provide respirators at the request of employees or let employees use their own respirators when respirators are not required under the silica standard. See the *Small Entity Compliance Guide for the Respiratory Protection Standard* for information about employer responsibilities when employees voluntarily wear respirators.

HOUSEKEEPING – PARAGRAPH (F) OF THE STANDARD

The respirable crystalline silica standard requires all construction employers covered by the standard, including those who fully and properly implement the control methods specified in Table 1, to avoid certain housekeeping practices. When cleaning up dust that could contribute to employee exposure to respirable crystalline silica, employers must:

- Not allow dry brushing or dry sweeping, unless methods such as wet sweeping and HEPA-filtered vacuuming are not feasible;
- Not allow cleaning of surfaces or clothing with compressed air, unless the compressed air is used together with a ventilation system that effectively captures the dust cloud or no other cleaning method is feasible.

Cleaning methods such as dry sweeping, dry brushing, and use of compressed air can cause respirable crystalline silica dust to get into the air and be inhaled by employees. Therefore, the silica standard limits the use of these cleaning methods to prevent unnecessary exposures to employees. Employers are required to use other cleaning methods such as wet sweeping and HEPA-filtered vacuums, whenever feasible, because such methods reduce employee exposures by preventing silica-containing dust from getting into the air.

Feasibility of Cleaning Methods

In a very limited number of cases, cleaning methods such as wet sweeping or HEPA-filtered vacuums may not be safe or effective. When wet methods or HEPA-filtered vacuuming would not be effective, would cause damage, or would create a hazard in the workplace, the employer is not required to use these cleaning methods. However, even in cases where one of those cleaning methods may not be safe or effective, employers could often use another acceptable method for cleaning. For example, if it is not feasible to wet sweep a wood floor because water would damage the wood or cause mold growth, a HEPA-filtered vacuum could be used for cleaning. Therefore, situations in which no acceptable cleaning methods can be used are expected to be very rare.

In those rare cases where the employer needs to use cleaning methods such as dry sweeping, dry brushing, or compressed air, the employer must be able to show why cleaning methods that decrease employee exposures are not feasible.

When Employers Must Follow Housekeeping Practices

The housekeeping requirements in the silica standard apply only where cleaning “could contribute to employee exposure to respirable crystalline silica”. This phrase clarifies that employers have to follow the housekeeping requirements of the silica standard only where employees could be exposed to the very small (respirable) crystalline silica particles created by high-energy tasks such as drilling, cutting, grinding, or crushing crystalline-silica-containing materials. Employers are not required to follow these housekeeping requirements when cleaning ordinary soil, large debris, and non-silica-containing materials, such as sawdust.

WRITTEN EXPOSURE CONTROL PLAN – PARAGRAPH (G) OF THE STANDARD

All employers covered by the standard, including employers who fully and properly implement the specified exposure controls in Table 1, must develop and implement a written exposure control plan. Written exposure control plans describe workplace exposures and ways to reduce those exposures, such as engineering controls, work practices, housekeeping methods, and restricting access to areas where high exposures occur. The plans improve employee protections by making sure that employers identify all exposures and controls to prevent overexposures. Such plans are also useful for letting employees know what kind of protections they should expect to see on the job.

What Must be Included in a Written Exposure Control Plan

Below is a list of what the employer must include in each section of the written exposure control plan, with general examples of the types of information that could be included and sample entries for the use of a stationary masonry saws for cutting bricks.

The plan must include a description of workplace tasks involving exposures to respirable crystalline silica. Employers must list all tasks that employees perform that could expose them to respirable crystalline silica dust. This section could also describe the equipment used and factors that affect exposures, such as types of silica-containing materials handled in those tasks (concrete or tile), weather conditions (wind or humidity), soil types (clay versus rock), and if tasks are done outdoors versus indoors or in enclosed locations.

Example: Cutting bricks using a stationary masonry saw outdoors.

The plan must include a description of engineering controls, work practices, and respiratory protection used to limit employee exposure to respirable crystalline silica for each task. For each task that employees perform, employers must describe types of controls used, like a dust collector with manufacturer's recommended air flow and a filter with 99 percent efficiency, effective work practices, as in checking that water nozzles are not plugged, and if required, appropriate respiratory protection, like a respirator with an APF of 10. Employers could also describe signs that controls are not working effectively, such as an increase in visible dust or no water being delivered to the saw blade.

This section of the written exposure control plan is especially important for construction employers who use controls in Table 1, because they are not required to measure exposures to make sure that controls are working. Therefore, including information such as manufacturer's instructions for operating and maintaining tools to decrease dust, when possible, demonstrates that the employer has a complete understanding of those instructions and is using them to control dust. Describing those instructions in the written exposure control plans also lets employees know what the employer needs to do to protect them.

Example: When cutting bricks using a stationary masonry saw, Table 1 will be fully and properly implemented, including using a saw with an integrated water delivery system that delivers a steady stream of water to the cutting blade. The saw operator will make sure that enough water for the saw is available before starting to cut, and that a steady stream of water can be seen while cutting. The operator will change water, when needed, to maintain flow of water to the blade.

Use the stationary masonry saw in accordance with manufacturer's instructions to minimize the release of visible dust. Inspect dust controls daily to make sure they are functioning properly. Stop work and adjust controls if you see an increase in visible dust.

Respiratory protection is not required.

The plan must include a description of the housekeeping methods used to limit employee exposure to respirable crystalline silica. While employees are cleaning, dust can become airborne and expose them to silica. In this part of the written exposure control plan, employers must list acceptable cleaning methods that will be used to prevent employees from being exposed and any protections that are needed if certain cleaning methods have to be used.

The *Housekeeping* section of the standard requires that when cleaning up dust that can contribute to employee exposures to respirable crystalline silica, employers must:

- Not allow cleaning by dry brushing and sweeping, unless methods such as wet sweeping and HEPA-filtered vacuuming are not feasible;
- Not allow cleaning of surfaces or clothing with compressed air, unless the compressed air is used together with a ventilation system that effectively captures the dust cloud or no other cleaning method is feasible.

This section of the written plan would include cleaning methods that are acceptable (*e.g.*, wet sweeping), cleaning methods that are unacceptable because acceptable cleaning methods are feasible (*e.g.*, dry sweeping), and special instructions (*e.g.*, use local exhaust ventilation if compressed air must be used). Hygiene-related subjects, such as not using compressed air to clean clothing, could also be addressed in this section of the written exposure control plan.

Example: Slurry generated by the saw will be cleaned up before it dries using a wet vacuum. When emptying the vacuum, the slurry will be transferred into a plastic bag and placed inside a container for disposal. The container will be sealed to prevent the release of dust back into the work space.

Never sweep or use compressed air on dried slurry. If slurry dries, immediately wet it down and clean it up with the wet vacuum.

The plan must include a description of the procedures used to restrict access to work areas, when necessary, to limit the number of employees exposed to respirable crystalline silica and the levels to which they are exposed, including exposures generated by other employers or self-employed workers. This section of the plan must describe how the employer restricts access to prevent exposures, such as:

- Scheduling certain tasks when others are not around,
- Telling employees to stay out of areas where dust is generated,
- Moving employees to an area where they are not exposed to dust, or
- Posting warning signs.

Employers following the alternative exposure control methods approach must restrict access where an exposure assessment shows that exposures are above the PEL. When following Table 1, employers must restrict access when employees are engaged in tasks that require respirator use under Table 1. For example, if an employer following Table 1 has an employee who is jackhammering for more than four hours and is therefore wearing a respirator, the employer or the competent person must make sure that an employee directing traffic (not engaged in the task), is positioned away and upwind from the employee who is jackhammering.

The employer or competent person must also restrict access, when needed, for exposures generated by another employer or self-employed person. Such a situation might occur if the other employer of self-employed person is conducting a task that generates clearly visible dust.

Example: When the controls on a stationary masonry saw are fully and properly implemented, access does not need to be restricted to decrease other employees' exposure to respirable crystalline silica.

The competent person can use traffic cones or barrier tape to restrict access if needed for other reasons such as safety concerns.

Yearly Review of Written Exposure Control Plans

The respirable crystalline silica standard requires employers to review and evaluate the effectiveness of the written exposure control plan at least once a year and update it as necessary. A yearly review is needed to make sure that all information in the plan is up-to-date. For example, the employer might have bought a new type of equipment or asked employees to conduct a new task involving exposure, and that information needs to be described in the written plan.

Availability of the Written Exposure Control Plan

Employers must allow the written exposure control plan to be viewed or copied by each employee covered by the standard, their designated representative, and representatives from OSHA or NIOSH, upon request. Making the written exposure control plan available to employees and their designated representatives empowers and protects employees by letting them and their representatives know the silica hazards the employer identified and controls for those hazards. This allows employees and representatives to question employers if controls are not fully and properly implemented or maintained. Likewise, making written exposure control plans readily available to OSHA or NIOSH allows them to verify that employee protections are effective. If OSHA inspects a workplace, the OSHA Compliance Safety and Health Officer will ask to see the employer's written exposure control plan.

Sample Written Exposure Control Plans

To help employers develop written exposure control plans, a sample plan is included below. This sample shows an easy-to-use format that can be changed to address the specific tasks performed by each employee. The sample plan meets the requirements of the standard and contains the level of detail that OSHA considers useful for employers in helping them protect their employees. As the sample shows, the plan can contain useful information without being long or complicated.

The Center for Construction Research and Training (CPWR) has a tool to help employers develop written exposure control plans that is available at www.silica-safe.org. Unions, trade associations or professional groups may offer sample written exposure control plans or other assistance to employers, which might be helpful, especially if written exposure control plans are tailored to a particular type of construction work performed. Although such general guidance may be helpful, employers must make sure that any plan they use is tailored to address all the information required by the standard and all tasks, tools, and controls used by the employer.

Some sample plans might call for more information than is required by the silica standard (for example, information about exposure assessments, medical surveillance, and training). Employers can include this information in the plan if it is useful to them, but they are not required to do so under the silica standard.

Employers can also develop a comprehensive plan that includes all equipment, materials, tasks, and conditions for the jobs they perform. Doing so will greatly reduce the need to update the written plan for each new job or jobsite for the many construction employers who use the same equipment to perform the same tasks at many locations.

Sample Written Exposure Control Plan

Company:
John Doe Renovators

Person Completing the Plan, Title:
John Doe, Owner

Description of Task:
Demolishing concrete and tile floors inside homes or public buildings using a jackhammer.

Control Description
Controls:

- Use jackhammer equipped with the appropriate, commercially available shroud and a vacuum dust collection system with the flow rate recommended by the jackhammer manufacturer, a filter that is at least 99 percent efficient, and a filter cleaning mechanism.
- Use a portable fan to exhaust air and prevent the buildup of dust.

Work practices:

- Check shrouds and hoses to make sure they are not damaged before starting work.
- Make sure the hoses do not become kinked or bent while working.
- Use switch on vacuum to activate filter cleaning at the frequency recommended by the manufacturer.
- Replace vacuum bags as needed to prevent overfilling.
- Use the jackhammer and vacuum controls according to manufacturer's instructions for reducing the release of visible dust.
- If visible dust increases, check controls and adjust as needed.

Respiratory protection:

- Use respirator with APF of 10 the entire time the task is being performed.
- See the written respiratory protection program for information on selection, training and fit testing requirements, in addition to proper use instructions for respirators (for example, being clean shaven when using a respirator that seals against the face).

Housekeeping:

- Dust containing silica on work surfaces and equipment must be cleaned up using wet methods or a HEPA-filtered vacuum.
- Do not use compressed air or dry sweeping for removing dust and debris containing silica from work surfaces.
- Dispose of used vacuum bags in a container and keep the container sealed.

Procedures Used to Restrict Access to Work Areas:
Schedule the work so that only employees who are engaged in the task (the jackhammer operator and employees helping the operator) are in the area.

Competent Person Requirements

The employer must designate a competent person to frequently and regularly inspect job sites, materials, and equipment to implement the written exposure control plan. A competent person is someone who:

- Can identify existing and foreseeable respirable crystalline silica hazards;
- Is authorized to promptly eliminate or minimize silica hazards; and
- Has the knowledge and ability to implement the written exposure control plan.

The employer can designate any of his or her employees to be a competent person if the employee is qualified, including the employee who does the work on a jobsite. For example, employees who go to jobsites alone can be designated a competent person if they know how to properly implement controls on the tools they use, can recognize if the controls are not working, and can correct the non-working control.

The standard does not require specific training for a competent person. The employer is responsible for determining what training is necessary to provide the knowledge and ability for his or her competent person to implement the written exposure control plan.

The training will depend on the types of work done, and in some cases, successfully completing training required under the silica standard and OSHA's Hazard Communication standard will be enough. In other cases, additional training may be needed. For example, a competent person at a small residential construction company might only need training on controls for power tools that they do not typically use to do their own tasks, so that they could help other employees with questions about or problems with dust controls on those tools. In contrast, a competent person for heavy equipment tasks may require more specialized training in heavy equipment inspection or in recognizing different soil types to determine if exposures might be a concern.

MEDICAL SURVEILLANCE – PARAGRAPH (H) OF THE STANDARD

Medical surveillance is intended to: (1) identify respirable crystalline silica-related diseases so that employees with those diseases can take actions to protect their health; (2) determine if an employee has any condition, such as a lung disease, that might make him or her more sensitive to respirable crystalline silica exposure; and (3) determine the employee's fitness to use respirators.

The standard specifies which employees must be offered medical surveillance, when and how often the examinations must offered, and the tests that make up medical examinations. The standard also specifies the information that the employer must give to the physician or other licensed health care professional (PLHCP) who conducts the examinations and the information that the employer must ensure that the PLHCP provides to the employee and employer.

All medical examinations and procedures required by the standard must be performed by a PLHCP. Medical surveillance must be provided at no cost to employees, and at a reasonable time and place. If getting the medical examination requires the employee to travel away from the worksite, the employer is required to cover the cost of travel. The employer must also pay employees for time spent traveling and taking medical examinations.

Which Employees Must be Offered Medical Surveillance

Employers must make an initial or periodic medical examination available to employees who will be required by the silica standard to wear a respirator for 30 or more days per year in the upcoming year (the next 365 days). If the employee is required to wear a respirator at any time during a day, that counts as one day of respirator use.

An employer will be able to estimate how often respirator use will be required by the standard in the upcoming year based on the types of tasks that the employee will perform, as well as how long and how often those tasks are performed. Respirator use with past employers does not count toward the 30-day threshold.

When unexpected circumstances result in employees being required to wear respirators more frequently than first expected, employers must make medical surveillance available as soon as it becomes apparent that the employee will be required by the silica standard to wear a respirator for 30 or more days in the upcoming year.

Frequency of Medical Examinations

Employers must offer medical examinations:

- Within 30 days of initial assignment (the day the employee starts working in a job/task in which he or she will be required by the silica standard to wear a respirator for 30 or more days per year), unless the employee has had an examination that meets the requirements of the silica standard within the last three years.
- Every three years from the employee's last examination that met the requirements of the silica standard, or more frequently if recommended by the PLHCP, if the employee will continue to perform tasks that require respirator use under the silica standard for 30 or more days per year.

A PLHCP might recommend more frequent medical examinations based on factors such as high exposure levels or a medical finding such as an X-ray suggesting silicosis.

Employers must make sure that employees receive a dated copy of the PLHCP's written medical opinion for the employer, and the employee can present that opinion to a new employer as proof of a current medical examination. Employers can determine when they must offer an employee the next periodic medical examination based on the examination date on the written medical opinion.

Medical Evaluation Requirements under the Respiratory Protection Standard

Employees who are required to wear respirators must receive medical evaluations required by the respiratory protection standard before they are fit tested for a respirator or wear a respirator in the workplace. The medical evaluation for the respiratory protection standard can be combined with the medical examination for silica, and employers could have the PLHCP conduct both the evaluation for respirator use and examination for silica at the same time. They could also have employees evaluated for respirator use before they wear a respirator and then offer the silica examination later, according to the required time limits of the silica standard.

Also note that under the respiratory protection standard, employers are required to provide another medical evaluation if employees report medical signs or symptoms related to the ability to wear a respirator.

(see 29 CFR 1910.134, Respiratory Protection, and OSHA's *Small Entity Compliance Guide for the Respiratory Protection Standard*, Publication #3384).

Tests that Must be Included in the Examination

An initial medical examination provided under the silica standard must consist of:

- A medical and work history that focuses on: past, present, and anticipated exposure to respirable crystalline silica, dust, and other agents affecting the respiratory system; any history of respiratory system dysfunction, including signs and symptoms of respiratory disease (for example, shortness of breath, cough, wheezing); history of tuberculosis; and smoking status and history;
- A physical examination that focuses on the respiratory system;
- A digital or film chest X-ray interpreted according to the International Labour Office (ILO) International Classification of Radiographs of Pneumoconioses by a National Institute for Occupational Safety and Health (NIOSH)-certified B Reader (this involves a certified physician reading the X-ray according to certain procedures to determine if it shows signs of diseases such as silicosis);
- A lung function (spirometry) test that includes forced vital capacity (the total amount of air that is forcefully blown out after taking a full breath), forced expiratory volume in one second (the amount of air forcefully blown out in the first second), and FEV_1/FVC ratio (the speed of air that is forcefully blown out), administered by a spirometry technician with a current certificate from a NIOSH-approved spirometry course;
- Testing for latent tuberculosis infection;
- Any other tests deemed appropriate (medically necessary and related to respirable crystalline silica exposure) by the PLHCP.

Periodic examinations include all these tests, with the exception of testing for latent tuberculosis, which is required only for the initial examination.

Employees who must be offered medical surveillance are at risk of developing respirable crystalline silica-related diseases, and the required tests are the minimum tests needed to look for those diseases. More tests may also be needed to address an employee's medical complaint or a finding related to respirable crystalline silica exposure, such as abnormal lung function. The standard gives the PLHCP the flexibility to order additional tests he or she deems appropriate. Employers must make those tests ordered by the PLHCP available to the employee.

Information the Employer Must Provide to the PLHCP

The employer must ensure that the examining PLHCP has a copy of the standard and must provide the PLHCP with:

- A description of the employee's past, current, and future duties as they relate to respirable crystalline silica exposure;
- The employee's past, current, and future levels of exposure to respirable crystalline silica (if the employer does not have information on the employee's past or current exposure level because they are following Table 1 and are not required to measure exposures, the employer can indicate if the employee is likely exposed at or above the PEL, based on required respirator use under Table 1);
- A description of any personal protective equipment used, or to be used, by the employee, including when and for how long the employee has used or will use that equipment; and
- Information from records of employment-related medical examinations previously provided to the employee and currently within the control of the employer.

The PLHCP needs this information to evaluate the employee's health in relation to assigned duties and fitness to use personal protective equipment, such as respirators. The information provided to the PLHCP includes only that within the control of the employer; the employer is not required to obtain information from past employers.

The PLHCP's Written Medical Report for the Employee

The employer must ensure that the PLHCP explains the results of the medical examination to the employee and gives the employee a written medical report within 30 days of each medical examination performed. Only the employee receives the written medical report, and the employer does not receive a copy of this report. The report must contain:

- A description of the medical examination results, including any medical condition(s) that would place the employee at increased risk of material impairment of health from exposure to respirable crystalline silica (any health condition that might make the employee more sensitive to exposure). The report must also describe any medical conditions that require further evaluation or treatment;
- Any recommended limitations on the employee's use of respirators;
- Any recommended limitations on respirable crystalline silica exposure; and
- A statement that the employee should be examined by a specialist if the B-reader classifies the chest X-ray provided under the silica standard as 1/0 or higher (X-ray evidence of silicosis in employees exposed to respirable crystalline silica), or if the PLHCP otherwise recommends referral to a specialist.

The PLHCP's Written Medical Opinion for the Employer

The employer must get a written medical opinion from the PLHCP within 30 days of the medical examination. The written opinion must contain only the following information:

- The date of the examination;
- A statement that the examination has met the requirements of the silica standard; and
- Any recommended limitations on the employee's use of respirators.

If the employee gives written authorization, the written medical opinion to the employer must also contain one or both of the following:

- Any recommended limitations on the employee's exposure to respirable crystalline silica;
- A statement that the employee should be examined by a specialist if the B reader classifies the chest X-ray provided under the silica standard as 1/0 or higher (X-ray evidence of silicosis in employees exposed to respirable crystalline silica), or if the PLHCP otherwise recommends referral to a specialist.

The purpose of the employee written authorization requirement is to enhance employee privacy and encourage employees to participate in medical surveillance by minimizing fears about retaliation or discrimination based on medical findings.

Employers must make sure that each employee receives a copy of the written medical opinion within 30 days of each medical examination. The PLHCP can give a copy of the opinion directly to the employee, so long as the time deadline is met. As indicated above, employees can show this opinion to future employers as proof that medical surveillance requirements under the silica standard are current.

Sample Medical Forms in Appendix B of the Standard

Appendix B contains guidelines for PLHCPs and blank sample forms for the medical report for the employee, the medical opinion for the employer, and an authorization form to allow limitations on respirable crystalline silica exposure or recommendations for a specialist examination to be reported to the employer. Employers must make sure that PLHCPs who will conduct medical examinations required by the silica standard have a copy of the standard, including Appendix B. The purpose of Appendix B is to give PLHCPs medical information and guidance to help them conduct medical examinations that meet the requirements of the silica standard.

Examples of completed forms are included in this guide. Sample Form 1 is a sample of the written medical report that the PLHCP provides to the employee. The employer does not receive a copy of the written medical report. Sample Form 2 is a sample of the written medical opinion that the PLHCP provides to the employer. The PLHCP indicates the type of examination and recommendations on use of a respirator. If the employee signs the written authorization (Sample Form 3) allowing the PLHCP to release further information to the employer, the PLHCP must include any recommend limitations on exposure to respirable crystalline silica and/or any referral to a specialist.

Sample Form 1: Written Medical Report for Employee

EMPLOYEE NAME: Joe Smith **DATE OF EXAMINATION**: June 1, 2017

TYPE OF EXAMINATION:
[x] Initial examination [ ] Periodic examination [ ] Specialist examination
[ ] Other: ____

RESULTS OF MEDICAL EXAMINATION:

Physical Examination –	[x] Normal	[ ] Abnormal (see below)	[ ] Not performed
Chest X-Ray –	[x] Normal	[ ] Abnormal (see below)	[ ] Not performed
Breathing Test (Spirometry) –	[ ] Normal	[x] Abnormal (see below)	[ ] Not performed
Test for Tuberculosis –	[x] Normal	[ ] Abnormal (see below)	[ ] Not performed
Other:____________________	[ ] Normal	[ ] Abnormal (see below)	[ ] Not performed

Results reported as abnormal: Breathing test (Spirometry) shows an obstructive pattern.
____

[x] Your health may be at increased risk from exposure to respirable crystalline silica due to the following:
Continued unprotected exposure to respirable crystalline silica may further damage your lungs.

RECOMMENDATIONS:
[ ] No limitations on respirator use
[x] Recommended limitations on use of respirator: A powered air purifying respirator (PAPR) is the only type of respirator you can safely wear. A PAPR will give you higher protection from silica exposure and will decrease strain on your heart and lungs.
[x] Recommended limitations on exposure to respirable crystalline silica: Ideally, you may want to consider a position that doesn't involve exposure to substances hazardous to your lungs, such as respirable crystalline silica. If that is not possible, be sure to always wear a respirator when needed to protect your lungs.

Dates for recommended limitations, if applicable: Indefinitely unless otherwise indicated by a specialist.

[x] I recommend that you be examined by a Board Certified Specialist in Pulmonary Disease or Occupational Medicine

[x] Other recommendations*: See your personal physician about the mole on your neck
____

Your next periodic examination for silica exposure should be in: [ ] 3 years [x] Other: 1 year, June 1, 2018

Examining Provider: Dr. Jones Date: June 1, 2017
(signature)
Provider Name: Dr. Jones Health Clinic
Office Address: 1111 Main Street, Washington, DC Office Phone: 123-456-7890

*These findings may not be related to respirable crystalline silica exposure or may not be work-related, and therefore may not be covered by the employer. These findings may necessitate follow-up and treatment by your personal physician.

Respirable Crystalline Silica standard (§ 1910.1053 or 1926.1153)

Sample Form 2: Written Medical Opinion for Employer

EMPLOYER: John Doe Renovations

EMPLOYEE NAME: Joe Smith **DATE OF EXAMINATION:** June 1, 2017

TYPE OF EXAMINATION:
[x] Initial examination [ ] Periodic examination [ ] Specialist examination
[ ] Other: ____________________

USE OF RESPIRATOR:
[ ] No limitations on respirator use
[x] Recommended limitations on use of respirator: A powered air purifying respirator (PAPR) is the only type of respirator Mr. Smith can safely wear.

Dates for recommended limitations, if applicable: Indefinitely, unless otherwise recommended by specialist

---

The employee has provided written authorization for disclosure of the following to the employer (if applicable):

[x] This employee should be examined by an American Board Certified Specialist in Pulmonary Disease or Occupational Medicine
[ ] Recommended limitations on exposure to respirable crystalline silica:____________________

Dates for exposure limitations noted above: ______________ to ______________
MM/DD/YYYY MM/DD/YYYY

NEXT PERIODIC EVALUATION: [ ] 3 years [x] Other: 1 year, June 1, 2018

Examining Provider: Dr. Jones Date: June 1, 2017
(signature)
Provider Name: Dr. Jones Health Clinic Provider's specialty: None, general practitioner

Office Address: 1111 Main Street, Washington, DC Office Phone: 123-456-7890

[x] I attest that the results have been explained to the employee.

The following is required to be checked by the Physician or other Licensed Health Care Professional (PLHCP):
[x] I attest that this medical examination has met the requirements of the medical surveillance section of the OSHA Respirable Crystalline Silica standard (§ 1910.1053(h) or 1926.1153(h)).

Sample Form 3: Authorization for Crystalline Silica Opinion to Employer

This medical examination for exposure to crystalline silica could reveal a medical condition that results in recommendations for (1) limitations on respirator use, (2) limitations on exposure to crystalline silica, or (3) examination by a specialist in pulmonary disease or occupational medicine. Recommended limitations on respirator use will be included in the written opinion to the employer. If you want your employer to know about limitations on crystalline silica exposure or recommendations for a specialist examination, you will need to give authorization for the written opinion to the employer to include one or both of those recommendations.

I hereby authorize the opinion to the employer to contain the following information, if relevant (please check all that apply):

- [ ] Recommendations for limitations on crystalline silica exposure
- [x] Recommendation for a specialist examination

OR

- [ ] I do not authorize the opinion to the employer to contain anything other than recommended limitations on respirator use.

Please read and initial:

_X_ I understand that if I do not authorize my employer to receive the recommendation for specialist examination, the employer will not be responsible for arranging and covering costs of a specialist examination under the OSHA standard for respirable crystalline silica.

__Joe Smith__
Name (printed)

__Joe Smith____________________
Signature

__June 1, 2017________________
Date

Additional Examinations by a Specialist

The employer must make the specialist examination available within 30 days of receiving the written medical opinion that includes the PLHCP's recommendation for a specialist examination. The specialists must be either an American Board Certified Specialist in Pulmonary Disease or an American Board Certified Specialist in Occupational Medicine.

The employer must ensure the specialist:

- Receives the same information that the employer is required to provide the PLHCP (*see* above);
- Explains the results of the medical examination to the employee and provides each employee with a written medical report within 30 days of the examination; and
- Provides the employer a written medical opinion within 30 days of the examination.

The specialist's written medical report to the employee must contain the following information:

- A description of the medical examination results, including any medical condition(s) that may make an employee more sensitive to respirable crystalline silica exposure and any medical conditions that require further evaluation or treatment;
- Any recommended limitations on the employee's use of respirators; and
- Any recommended limitations on respirable crystalline silica exposure.

The specialist's written medical opinion for the employer must include only the following:

- The date of the examination; and
- Any recommended limitations on the employee's use of respirators.

If the employee gives written authorization, the written opinion to the employer must also contain any recommended limitations on the employee's exposure to respirable crystalline silica.

COMMUNICATION OF HAZARDS – PARAGRAPH (I) OF THE STANDARD

Employers must train and inform employees covered by the silica standard about respirable crystalline silica hazards and the methods the employer uses to limit their exposures to those hazards. Employers must cover the cost of training and must pay employees for the time spent in training.

OSHA's Hazard Communication Standard

Employers must also comply with OSHA's Hazard Communication standard (HCS) (29 CFR 1910.1200). HCS requires employers to inform employees about hazardous chemicals in the workplace, such as respirable crystalline silica, through their written hazard communication programs. Written hazard communication programs must describe how requirements for container labels, safety data sheets (SDSs), and employee training will be met. As part of their hazard communication program for respirable crystalline silica, employers must address at least these health hazards: cancer, lung effects, immune system effects, and kidney effects.

Under the HCS, employers must:

- Inform employees about the general requirements of HCS, as well as where and how they can view the written hazard communication program, lists of hazardous chemicals, and SDSs.
- Train employees on how the presence or release of hazardous chemicals in the work area is detected; in the case of respirable crystalline silica, this could include methods the employer uses to measure exposures, such as air sampling or objective data. If employers are using Table 1, they can train employees to recognize that an increase in visible dust is a sign that a control may not be working properly.
- Train employees on the details of the workplace-specific hazard communication program developed by the employer, such as container labels, the workplace labeling system, SDSs (including the order in which the information is presented), and how employees can get and use hazard information.

See OSHA's *HAZARD COMMUNICATION: Small Entity Compliance Guide for Employers that Use Hazardous Chemicals [OSHA Publication #3695]* for more information on preparing a written hazard communication program and employer requirements for labeling, SDSs, and training.

Training Topics

The employer must ensure that employees trained under the silica standard can demonstrate knowledge and understanding of at least:

1. Health hazards associated with respirable crystalline silica exposure. For respirable crystalline silica, the health hazards include: cancer, lung effects, immune system effects, and kidney effects.
2. Specific workplace tasks that could expose employees to respirable crystalline silica. Examples include those listed in Table 1, such as using a stationary masonry saw to cut crystalline silica-containing materials.
3. Specific measures the employer is implementing to protect employees from respirable crystalline silica exposure, including engineering controls, work practices, and respirators to be used.

This training must be specific for the task that each employee performs. For example, employees who operate tools with built-in controls, such as saws with integrated water delivery systems, would need to demonstrate knowledge and understanding of:

- The full and proper use of the controls on those tools; and
- Signs that controls may not be functioning properly.

Laborers who do not operate equipment but are engaged in a task by helping the tool operator would only need to demonstrate knowledge and understanding of:

- The general types of controls used in the workplace, such as water or vacuum controls and how to recognize if those controls are not working properly; and
- Work practices they perform as part of helping the tool operator, such as appropriate clean-up of respirable crystalline silica dust accumulations.

4. The contents of the respirable crystalline silica standard. This would involve a description of the standard's requirements.

5. The identity of the competent person designated by the employer. This could be as simple as announcing who the competent person is at the beginning of a work shift.

6. The purpose and a description of the medical surveillance program required under the standard. Topics that employers could communicate to their employees as part of this training include:

- That employers must offer medical examinations to employees who are required to wear a respirator under the silica standard for 30 or more days a year;
- That employers must offer medical examinations at no cost to the employee, including additional silica-related tests or specialist examinations recommended by the physician or other licensed health care professional;
- The types of tests included in the medical examinations;
- Symptoms associated with respirable crystalline silica-related diseases;
- Information that must be included in the written medical report to the employee versus the written medical opinion for the employer;
- Information that must not be included in written medical opinion to the employer without written authorization from the employee (recommendations for limitations on exposures to silica and for specialist referrals);
- The importance of keeping a copy of the written medical opinion to the employer as proof of a current medical examination to avoid unnecessary testing; and
- That employers cannot retaliate or discriminate against employees for participating in medical surveillance.

The employer is not required to provide all required training if an employee is already able to demonstrate knowledge and understanding of training topics such as health hazards, the contents of the silica standard, or medical surveillance requirements. However, some site-specific or employer-specific training is always necessary, such as training on specific tasks that could result in exposures in that workplace, specific controls or work practices that the employer is using, and the identity of the competent person.

When Employees Must be Trained

Employees must be trained at the time they are assigned to a position involving exposure to respirable crystalline silica.

Additional training must be provided as often as necessary to ensure that employees know and understand respirable crystalline silica hazards and the protections available in their workplace. Examples of when additional training would be required include:

- When the employer asks an employee to perform a task that is new to that employee;
- When the employer introduces new protections (for example, an employer who was having employees use a handheld grinder with wet method controls decides to have employees use a handheld grinder with a dust collection system); or
- When an employee is working in a manner that suggests he or she has forgotten what was learned in training.

Training Methods

The silica standard does not require the employer to use any particular method for training employees. Employers could use hands-on training, videotapes, slide presentations, classroom instruction, informal discussions during safety meetings, written materials, or any combination of these methods to train employees.

In order for employees to demonstrate knowledge and understanding of the training subjects, training must be done in a manner and language that employees understand. This may mean, for example, providing materials, instruction, or assistance in Spanish rather than English for Spanish-speaking employees who do not understand English, and using methods other than printed reading materials if the employee is not able to read.

To ensure that employees understand the material presented during training, it is critical that trainees have the opportunity to ask questions and receive answers if they do not fully understand the material that is presented to them. When videotape presentations or computer-based programs are used, this requirement may be met by having a qualified trainer available to address questions after the presentation, or providing a telephone hotline so that trainees will have direct access to a qualified trainer.

Employers can determine if employees know and understand the training topics through discussion of the required training subjects, written tests, or oral quizzes.

Making a Copy of the Standard Available

Employers must make a copy of the respirable crystalline silica standard available at no cost to each employee covered by the standard. This could simply involve allowing employees to view a printed or electronic copy in a reasonable location.

RECORDKEEPING – PARAGRAPH (J) OF THE STANDARD

Records can demonstrate employer compliance with the standard, and can assist in diagnosing and identifying workplace-related illnesses. Therefore, employers are required to make and keep accurate records of air monitoring data and objective data used to assess employee exposures to respirable crystalline silica under the standard, as well as records of medical surveillance provided under the standard.

Air Monitoring Data

Employers must make and keep an accurate record of all air monitoring performed to comply with the standard. The record must indicate:

- The date of the measurement for each sample taken;
- The task monitored;
- Sampling and analytical methods used;
- The number, duration, and results of samples taken;
- The identity of the laboratory that performed the analysis;
- The type of personal protective equipment used (*e.g.*, type of respirators worn); and
- The name, social security number, and job classification of all employees represented by the monitoring, indicating which employees were actually monitored.

Objective Data

When an employer relies on objective data to comply with the silica standard, the employer must make and keep an accurate record of the objective data. The record must include at least:

- The crystalline silica-containing material in question;
- The source of the objective data;
- The testing protocol and results of testing;
- A description of the process, task, or activity on which the objective data were based; and
- Any other data relevant to the process, task, activity, material, or exposures on which the objective data are based.

Medical Surveillance

The employer must make and keep an accurate record for each employee provided medical surveillance under the standard. The record must include the following information about the employee:

- Name and social security number;
- A copy of the PLHCPs' and specialists' written opinions; and
- A copy of the information that the employer is required to provide to the PLHCPs and specialists (*i.e.*, a description of the employee's former, current, and anticipated duties as they relate to crystalline silica exposure; a description of the employee's former, current, and anticipated respirable crystalline silica exposure levels; a description of the personal protective equipment used by the employee; and information from previous employment-related medical examinations that is currently within the control of the employer).

Keeping and Making Medical Records Available

Exposure and medical records must be kept and made available to employees, their representatives, and OSHA in accordance with OSHA's access to employee exposure and medical records regulation.

OSHA's Access to Employee Exposure and Medical Records Regulation

A separate OSHA regulation (29 CFR 1910.1020, Access to Employee Exposure and Medical Records) addresses requirements for maintaining exposure and medical records. In general, exposure records (including air monitoring and objective data) must be kept for at least 30 years, and medical records must be kept for at least the duration of employment plus 30 years. It is necessary to keep these records for extended periods because silica-related diseases such as cancer often cannot be detected until several decades after exposure. However, if an employee works for an employer for less than one year, the employer does not have to keep the medical records after employment ends, as long as the employer gives those records to the employee.

DATES – PARAGRAPH (K) OF THE STANDARD

Construction employers must comply with all requirements of the standard by September 23, 2017 (delayed from June 23, 2017), except the requirement to use laboratories that analyze respirable crystalline silica samples according to the procedures in Appendix A, which will be enforced beginning on June 23, 2018. That means that as of September 23, 2017, employers must either fully and properly implement Table 1 requirements or implement alternative exposure control measures, and comply with requirements for respiratory protection, housekeeping, medical surveillance, hazard communication and training, and recordkeeping. Prior to September 23, 2017, the previous PEL (a formula that is approximately equivalent to 250 μg/m^3 of respirable crystalline silica as an 8-hour TWA) remains in effect.

Take steps now to ensure the requirements can be met by the compliance dates.

1. Implement specified exposure control methods in Table 1.
2. Complete exposure assessments needed to select appropriate engineering controls and respiratory protection for tasks not in Table 1.
3. Set up respiratory protection programs where required.
4. Get appropriate equipment, controls, and respirators.
5. Arrange for medical surveillance.
6. Take actions such as the following to meet all other requirements:
    a. Determine appropriate housekeeping methods.
    b. Prepare a written exposure control plan.
    c. Set up a training program.
    d. Set up a recordkeeping system.

APPENDIX I: OSHA RESPIRABLE CRYSTALLINE SILICA STANDARD FOR CONSTRUCTION

§1926.1153 Respirable crystalline silica.

(a) *Scope and application*. This section applies to all occupational exposures to respirable crystalline silica in construction work, except where employee exposure will remain below 25 micrograms per cubic meter of air (25 μg/m^3) as an 8-hour time-weighted average (TWA) under any foreseeable conditions.

(b) *Definitions*. For the purposes of this section the following definitions apply:

Action level means a concentration of airborne respirable crystalline silica of 25 μg/m^3, calculated as an 8-hour TWA.

Assistant Secretary means the Assistant Secretary of Labor for Occupational Safety and Health, U.S. Department of Labor, or designee.

Director means the Director of the National Institute for Occupational Safety and Health (NIOSH), U.S. Department of Health and Human Services, or designee.

Competent person means an individual who is capable of identifying existing and foreseeable respirable crystalline silica hazards in the workplace and who has authorization to take prompt corrective measures to eliminate or minimize them. The competent person must have the knowledge and ability necessary to fulfill the responsibilities set forth in paragraph (g) of this section.

Employee exposure means the exposure to airborne respirable crystalline silica that would occur if the employee were not using a respirator.

High-efficiency particulate air [HEPA] filter means a filter that is at least 99.97 percent efficient in removing mono-dispersed particles of 0.3 micrometers in diameter.

Objective data means information, such as air monitoring data from industry-wide surveys or calculations based on the composition of a substance, demonstrating employee exposure to respirable crystalline silica associated with a particular product or material or a specific process, task, or activity. The data must reflect workplace conditions closely resembling or with a higher exposure potential than the processes, types of material, control methods, work practices, and environmental conditions in the employer's current operations.

Physician or other licensed health care professional [PLHCP] means an individual whose legally permitted scope of practice (*i.e.*, license, registration, or certification) allows him or her to independently provide or be delegated the responsibility to provide some or all of the particular health care services required by paragraph (h) of this section.

Respirable crystalline silica means quartz, cristobalite, and/or tridymite contained in airborne particles that are determined to be respirable by a sampling device designed to meet the characteristics for respirable-particle-size-selective samplers specified in the International Organization for Standardization (ISO) 7708:1995: Air Quality – Particle Size Fraction Definitions for Health-Related Sampling.

Specialist means an American Board Certified Specialist in Pulmonary Disease or an American Board Certified Specialist in Occupational Medicine.

This section means this respirable crystalline silica standard, 29 CFR 1926.1153.

(c) Specified exposure control methods. (1) For each employee engaged in a task identified on Table 1, the employer shall fully and properly implement the engineering controls, work practices, and respiratory protection specified for the task in Table 1, unless the employer assesses and limits the exposure of the employee to respirable crystalline silica in accordance with paragraph (d) of this section.

TABLE 1: Specified Exposure Control Methods When Working with Materials Containing Crystalline Silica

Equipment/Task	Engineering and Work Practice Control Methods	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 hours/shift	> 4 hours/shift
(i) Stationary masonry saws	Use saw equipped with integrated water delivery system that continuously feeds water to the blade. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.	None	None
(ii) Handheld power saws (any blade diameter)	Use saw equipped with integrated water delivery system that continuously feeds water to the blade. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. • When used outdoors. • When used indoors or in an enclosed area.	 None APF 10	 APF 10 APF 10
(iii) Handheld power saws for cutting fiber-cement board (with blade diameter of 8 inches or less)	For tasks performed outdoors only: Use saw equipped with commercially available dust collection system. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. Dust collector must provide the air flow recommended by the tool manufacturer, or greater, and have a filter with 99% or greater efficiency.	None	None

TABLE 1: Specified Exposure Control Methods When Working with Materials Containing Crystalline Silica

Equipment/Task	Engineering and Work Practice Control Methods	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 hours/shift	> 4 hours/shift
(iv) Walk-behind saws	Use saw equipped with integrated water delivery system that continuously feeds water to the blade. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. • When used outdoors. • When used indoors or in an enclosed area.	None APF 10	None APF 10
(v) Drivable saws	For tasks performed outdoors only: Use saw equipped with integrated water delivery system that continuously feeds water to the blade. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.	None	None
(vi) Rig-mounted core saws or drills	Use tool equipped with integrated water delivery system that supplies water to cutting surface. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.	None	None
(vii) Handheld and stand-mounted drills (including impact and rotary hammer drills)	Use drill equipped with commercially available shroud or cowling with dust collection system. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. Dust collector must provide the air flow recommended by the tool manufacturer, or greater, and have a filter with 99% or greater efficiency and a filter-cleaning mechanism. Use a HEPA-filtered vacuum when cleaning holes.	None	None

TABLE 1: Specified Exposure Control Methods When Working with Materials Containing Crystalline Silica

Equipment/Task	Engineering and Work Practice Control Methods	Required Respiratory Protection and Minimum Assigned Protection Factor (APF) ≤ 4 hours/shift	Required Respiratory Protection and Minimum Assigned Protection Factor (APF) > 4 hours/shift
(viii) Dowel drilling rigs for concrete	For tasks performed outdoors only: Use shroud around drill bit with a dust collection system. Dust collector must have a filter with 99% or greater efficiency and a filter-cleaning mechanism. Use a HEPA-filtered vacuum when cleaning holes.	APF 10	APF 10
(ix) Vehicle-mounted drilling rigs for rock and concrete	Use dust collection system with close capture hood or shroud around drill bit with a low-flow water spray to wet the dust at the discharge point from the dust collector.	None	None
	OR		
	Operate from within an enclosed cab and use water for dust suppression on drill bit.	None	None
(x) Jackhammers and handheld powered chipping tools	Use tool with water delivery system that supplies a continuous stream or spray of water at the point of impact.		
	• When used outdoors.	None	APF 10
	• When used indoors or in an enclosed area.	APF 10	APF 10
	OR		
	Use tool equipped with commercially available shroud and dust collection system. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. Dust collector must provide the air flow recommended by the tool manufacturer, or greater, and have a filter with 99% or greater efficiency and a filter-cleaning mechanism.		
	• When used outdoors.	None	APF 10
	• When used indoors or in an enclosed area.	APF 10	APF 10

TABLE 1: Specified Exposure Control Methods When Working with Materials Containing Crystalline Silica

Equipment/Task	Engineering and Work Practice Control Methods	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 hours/shift	> 4 hours/shift
(xi) Handheld grinders for mortar removal (i.e., tuckpointing)	Use grinder equipped with commercially available shroud and dust collection system. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. Dust collector must provide 25 cubic feet per minute (cfm) or greater of airflow per inch of wheel diameter and have a filter with 99% or greater efficiency and a cyclonic pre-separator or filter-cleaning mechanism.	APF 10	APF 25
(xii) Handheld grinders for uses other than mortar removal	For tasks performed outdoors only: Use grinder equipped with integrated water delivery system that continuously feeds water to the grinding surface. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.	None	None
	OR		
	Use grinder equipped with commercially available shroud and dust collection system. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. Dust collector must provide 25 cubic feet per minute (cfm) or greater of airflow per inch of wheel diameter and have a filter with 99% or greater efficiency and a cyclonic pre-separator or filter-cleaning mechanism.		
	• When used outdoors.	None	None
	• When used indoors or in an enclosed area.	None	APF 10

TABLE 1: Specified Exposure Control Methods When Working with Materials Containing Crystalline Silica

Equipment/Task	Engineering and Work Practice Control Methods	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 hours/shift	> 4 hours/shift
(xiii) Walk-behind milling machines and floor grinders	Use machine equipped with integrated water delivery system that continuously feeds water to the cutting surface. Operate and maintain tool in accordance with manufacturer’s instructions to minimize dust emissions.	None	None
	OR		
	Use machine equipped with dust collection system recommended by the manufacturer. Operate and maintain tool in accordance with manufacturer’s instructions to minimize dust emissions. Dust collector must provide the air flow recommended by the manufacturer, or greater, and have a filter with 99% or greater efficiency and a filter-cleaning mechanism. When used indoors or in an enclosed area, use a HEPA-filtered vacuum to remove loose dust in between passes.	None	None
(xiv) Small drivable milling machines (less than half-lane)	Use a machine equipped with supplemental water sprays designed to suppress dust. Water must be combined with a surfactant. Operate and maintain machine to minimize dust emissions.	None	None

TABLE 1: Specified Exposure Control Methods When Working with Materials Containing Crystalline Silica

Equipment/Task	Engineering and Work Practice Control Methods	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 hours/shift	> 4 hours/shift
(xv) Large drivable milling machines (half-lane and larger)	For cuts of any depth on asphalt only:		
	Use machine equipped with exhaust ventilation on drum enclosure and supplemental water sprays designed to suppress dust.	None	None
	Operate and maintain machine to minimize dust emissions.		
	For cuts of four inches in depth or less on any substrate:		
	Use machine equipped with exhaust ventilation on drum enclosure and supplemental water sprays designed to suppress dust.	None	None
	Operate and maintain machine to minimize dust emissions.		
	OR		
	Use a machine equipped with supplemental water spray designed to suppress dust. Water must be combined with a surfactant.	None	None
	Operate and maintain machine to minimize dust emissions.		
(xvi) Crushing machines	Use equipment designed to deliver water spray or mist for dust suppression at crusher and other points where dust is generated (e.g., hoppers, conveyers, sieves/sizing or vibrating components, and discharge points).	None	None
	Operate and maintain machine in accordance with manufacturer's instructions to minimize dust emissions.		
	Use a ventilated booth that provides fresh, climate-controlled air to the operator, or a remote control station.		

TABLE 1: Specified Exposure Control Methods When Working with Materials Containing Crystalline Silica

Equipment/Task	Engineering and Work Practice Control Methods	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 hours/shift	> 4 hours/shift
(xvii) Heavy equipment and utility vehicles used to abrade or fracture silica-containing materials (e.g., hoe-ramming, rock ripping) or used during demolition activities involving silica-containing materials	Operate equipment from within an enclosed cab. When employees outside of the cab are engaged in the task, apply water and/or dust suppressants as necessary to minimize dust emissions.	None None	None None
(xviii) Heavy equipment and utility vehicles for tasks such as grading and excavating but not including: demolishing, abrading, or fracturing silica-containing materials	Apply water and/or dust suppressants as necessary to minimize dust emissions. OR When the equipment operator is the only employee engaged in the task, operate equipment from within an enclosed cab.	None None	None None

(2) When implementing the control measures specified in Table 1, each employer shall:

(i) For tasks performed indoors or in enclosed areas, provide a means of exhaust as needed to minimize the accumulation of visible airborne dust;

(ii) For tasks performed using wet methods, apply water at flow rates sufficient to minimize release of visible dust;

(iii) For measures implemented that include an enclosed cab or booth, ensure that the enclosed cab or booth:

(A) Is maintained as free as practicable from settled dust;

(B) Has door seals and closing mechanisms that work properly;

(C) Has gaskets and seals that are in good condition and working properly;

(D) Is under positive pressure maintained through continuous delivery of fresh air;

(E) Has intake air that is filtered through a filter that is 95% efficient in the 0.3-10.0 μm range (*e.g.*, MERV-16 or better); and

(F) Has heating and cooling capabilities.

(3) Where an employee performs more than one task on Table 1 during the course of a shift, and the total duration of all tasks combined is more than four hours, the required respiratory protection for each task is the respiratory protection specified for more than four hours per shift. If the total duration of all tasks on Table 1 combined is less than four hours, the required respiratory protection for each task is the respiratory protection specified for less than four hours per shift.

(d) *Alternative exposure control methods.* For tasks not listed in Table 1, or where the employer does not fully and properly implement the engineering controls, work practices, and respiratory protection described in Table 1:

(1) *Permissible exposure limit (PEL)*. The employer shall ensure that no employee is exposed to an airborne concentration of respirable crystalline silica in excess of 50 μg/m^3, calculated as an 8-hour TWA.

(2) *Exposure assessment*—(i) *General*. The employer shall assess the exposure of each employee who is or may reasonably be expected to be exposed to respirable crystalline silica at or above the action level in accordance with either the performance option in paragraph (d)(2)(ii) or the scheduled monitoring option in paragraph (d)(2)(iii) of this section.

(ii) *Performance option*. The employer shall assess the 8-hour TWA exposure for each employee on the basis of any combination of air monitoring data or objective data sufficient to accurately characterize employee exposures to respirable crystalline silica.

(iii) *Scheduled monitoring option*. (A) The employer shall perform initial monitoring to assess the 8-hour TWA exposure for each employee on the basis of one or more personal breathing zone air samples that reflect the exposures of employees on each shift, for each job classification, in each work area. Where several employees perform the same tasks on the same shift and in the same work area, the employer may sample a representative fraction of these employees in order to meet this requirement. In representative sampling, the employer shall sample the employee(s) who are expected to have the highest exposure to respirable crystalline silica.

(B) If initial monitoring indicates that employee exposures are below the action level, the employer may discontinue monitoring for those employees whose exposures are represented by such monitoring.

(C) Where the most recent exposure monitoring indicates that employee exposures are at or above the action level but at or below the PEL, the employer shall repeat such monitoring within six months of the most recent monitoring.

(D) Where the most recent exposure monitoring indicates that employee exposures are above the PEL, the employer shall repeat such monitoring within three months of the most recent monitoring.

(E) Where the most recent (non-initial) exposure monitoring indicates that employee exposures are below the action level, the employer shall repeat such monitoring within six months of the most recent monitoring until two consecutive measurements, taken seven or more days apart, are below the action level, at which time the employer may discontinue monitoring for those employees whose exposures are represented by such monitoring, except as otherwise provided in paragraph (d)(2)(iv) of this section.

(iv) *Reassessment of exposures*. The employer shall reassess exposures whenever a change in the production, process, control equipment, personnel, or work practices may reasonably be expected to result in new or additional exposures at or above the action level, or when the employer has any reason to believe that new or additional exposures at or above the action level have occurred.

(v) *Methods of sample analysis*. The employer shall ensure that all samples taken to satisfy the monitoring requirements of paragraph (d)(2) of this section are evaluated by a laboratory that analyzes air samples for respirable crystalline silica in accordance with the procedures in Appendix A to this section.

(vi) *Employee notification of assessment results*. (A) Within five working days after completing an exposure assessment in accordance with paragraph (d)(2) of this section, the employer shall individually notify each affected employee in writing of the results of that assessment or post the results in an appropriate location accessible to all affected employees.

(B) Whenever an exposure assessment indicates that employee exposure is above the PEL, the employer shall describe in the written notification the corrective action being taken to reduce employee exposure to or below the PEL.

(vii) *Observation of monitoring*. (A) Where air monitoring is performed to comply with the requirements of this section, the employer shall provide affected employees or their designated representatives an opportunity to observe any monitoring of employee exposure to respirable crystalline silica.

(B) When observation of monitoring requires entry into an area where the use of protective clothing or equipment is required for any workplace hazard, the employer shall provide the observer with protective clothing and equipment at no cost and shall ensure that the observer uses such clothing and equipment.

(3) *Methods of compliance*—(i) *Engineering and work practice controls*. The employer shall use engineering and work practice controls to reduce and maintain employee exposure to respirable crystalline silica to or below the PEL, unless the employer can demonstrate that such controls are not feasible. Wherever such feasible engineering and work practice controls are not sufficient to reduce employee exposure to or below the PEL, the employer shall nonetheless use them to reduce employee exposure to the lowest feasible level and shall supplement them with the use of respiratory protection that complies with the requirements of paragraph (e) of this section.

(ii) *Abrasive blasting*. In addition to the requirements of paragraph (d)(3)(i) of this section, the employer shall comply with other OSHA standards, when applicable, such as 29 CFR 1926.57 (Ventilation), where abrasive blasting is conducted using crystalline silica-containing blasting agents, or where abrasive blasting is conducted on substrates that contain crystalline silica.

(e) *Respiratory protection*—(1) General. Where respiratory protection is required by this section, the employer must provide each employee an appropriate respirator that complies with the requirements of this paragraph and 29 CFR 1910.134. Respiratory protection is required:

(i) Where specified by Table 1 of paragraph (c) of this section; or

(ii) For tasks not listed in Table 1, or where the employer does not fully and properly implement the engineering controls, work practices, and respiratory protection described in Table 1:

(A) Where exposures exceed the PEL during periods necessary to install or implement feasible engineering and work practice controls;

(B) Where exposures exceed the PEL during tasks, such as certain maintenance and repair tasks, for which engineering and work practice controls are not feasible; and

(C) During tasks for which an employer has implemented all feasible engineering and work practice controls and such controls are not sufficient to reduce exposures to or below the PEL.

(2) *Respiratory protection program*. Where respirator use is required by this section, the employer shall institute a respiratory protection program in accordance with 29 CFR 1910.134.

(3) *Specified exposure control methods*. For the tasks listed in Table 1 in paragraph (c) of this section, if the employer fully and properly implements the engineering controls, work practices, and respiratory protection described in Table 1, the employer shall be considered to be in compliance with paragraph (e)(1) of this section and the requirements for selection of respirators in 29 CFR 1910.134(d)(1)(iii) and (d)(3) with regard to exposure to respirable crystalline silica.

(f) *Housekeeping*. (1) The employer shall not allow dry sweeping or dry brushing where such activity could contribute to employee exposure to respirable crystalline silica unless wet sweeping, HEPA-filtered vacuuming or other methods that minimize the likelihood of exposure are not feasible.

(2) The employer shall not allow compressed air to be used to clean clothing or surfaces where such activity could contribute to employee exposure to respirable crystalline silica unless:

(i) The compressed air is used in conjunction with a ventilation system that effectively captures the dust cloud created by the compressed air; or

(ii) No alternative method is feasible.

(g) *Written exposure control plan*. (1) The employer shall establish and implement a written exposure control plan that contains at least the following elements:

(i) A description of the tasks in the workplace that involve exposure to respirable crystalline silica;

(ii) A description of the engineering controls, work practices, and respiratory protection used to limit employee exposure to respirable crystalline silica for each task;

(iii) A description of the housekeeping measures used to limit employee exposure to respirable crystalline silica; and

(iv) A description of the procedures used to restrict access to work areas, when necessary, to minimize the number of employees exposed to respirable crystalline silica and their level of exposure, including exposures generated by other employers or sole proprietors.

(2) The employer shall review and evaluate the effectiveness of the written exposure control plan at least annually and update it as necessary.

(3) The employer shall make the written exposure control plan readily available for examination and copying, upon request, to each employee covered by this section, their designated representatives, the Assistant Secretary and the Director.

(4) The employer shall designate a competent person to make frequent and regular inspections of job sites, materials, and equipment to implement the written exposure control plan.

(h) *Medical surveillance*—(1) *General*. (i) The employer shall make medical surveillance available at no cost to the employee, and at a reasonable time and place, for each employee who will be required under this section to use a respirator for 30 or more days per year.

(ii) The employer shall ensure that all medical examinations and procedures required by this section are performed by a PLHCP as defined in paragraph (b) of this section.

(2) *Initial examination*. The employer shall make available an initial (baseline) medical examination within 30 days after initial assignment, unless the employee has received a medical examination that meets the requirements of this section within the last three years. The examination shall consist of:

(i) A medical and work history, with emphasis on: past, present, and anticipated exposure to respirable crystalline silica, dust, and other agents affecting the respiratory system; any history of respiratory system dysfunction, including signs and symptoms of respiratory disease (*e.g.*, shortness of breath, cough, wheezing); history of tuberculosis; and smoking status and history;

(ii) A physical examination with special emphasis on the respiratory system;

(iii) A chest X-ray (a single posteroanterior radiographic projection or radiograph of the chest at full inspiration recorded on either film (no less than 14 x 17 inches and no more than 16 x 17 inches) or digital radiography systems), interpreted and classified according to the International Labour Office (ILO) International Classification of Radiographs of Pneumoconioses by a NIOSH-certified B Reader;

(iv) A pulmonary function test to include forced vital capacity (FVC) and forced expiratory volume in one second (FEV_1) and FEV_1/FVC ratio, administered by a spirometry technician with a current certificate from a NIOSH-approved spirometry course;

(v) Testing for latent tuberculosis infection; and

(vi) Any other tests deemed appropriate by the PLHCP.

(3) *Periodic examinations*. The employer shall make available medical examinations that include the procedures described in paragraph (h)(2) of this section (except paragraph (h)(2)(v)) at least every three years, or more frequently if recommended by the PLHCP.

(4) *Information provided to the PLHCP*. The employer shall ensure that the examining PLHCP has a copy of this standard, and shall provide the PLHCP with the following information:

(i) A description of the employee's former, current, and anticipated duties as they relate to the employee's occupational exposure to respirable crystalline silica;

(ii) The employee's former, current, and anticipated levels of occupational exposure to respirable crystalline silica;

(iii) A description of any personal protective equipment used or to be used by the employee, including when and for how long the employee has used or will use that equipment; and

(iv) Information from records of employment-related medical examinations previously provided to the employee and currently within the control of the employer.

(5) *PLHCP's written medical report for the employee*. The employer shall ensure that the PLHCP explains to the employee the results of the medical examination and provides each employee with a written medical report within 30 days of each medical examination performed. The written report shall contain:

(i) A statement indicating the results of the medical examination, including any medical condition(s) that would place the employee at increased risk of material impairment to health from exposure to respirable crystalline silica and any medical conditions that require further evaluation or treatment;

(ii) Any recommended limitations on the employee's use of respirators;

(iii) Any recommended limitations on the employee's exposure to respirable crystalline silica; and

(iv) A statement that the employee should be examined by a specialist (pursuant to paragraph (h)(7) of this section) if the chest X-ray provided in accordance with this section is classified as 1/0 or higher by the B Reader, or if referral to a specialist is otherwise deemed appropriate by the PLHCP.

(6) *PLHCP's written medical opinion for the employer*. (i) The employer shall obtain a written medical opinion from the PLHCP within 30 days of the medical examination. The written opinion shall contain only the following:

(A) The date of the examination;

(B) A statement that the examination has met the requirements of this section; and

(C) Any recommended limitations on the employee's use of respirators.

(ii) If the employee provides written authorization, the written opinion shall also contain either or both of the following:

(A) Any recommended limitations on the employee's exposure to respirable crystalline silica;

(B) A statement that the employee should be examined by a specialist (pursuant to paragraph (h)(7) of this section) if the chest X-ray provided in accordance with this section is classified as 1/0 or higher by the B Reader, or if referral to a specialist is otherwise deemed appropriate by the PLHCP.

(iii) The employer shall ensure that each employee receives a copy of the written medical opinion described in paragraph (h)(6)(i) and (ii) of this section within 30 days of each medical examination performed.

(7) *Additional examinations*. (i) If the PLHCP's written medical opinion indicates that an employee should be examined by a specialist, the employer shall make available a medical examination by a specialist within 30 days after receiving the PLHCP's written opinion.

(ii) The employer shall ensure that the examining specialist is provided with all of the information that the employer is obligated to provide to the PLHCP in accordance with paragraph (h)(4) of this section.

(iii) The employer shall ensure that the specialist explains to the employee the results of the medical examination and provides each employee with a written medical report within 30 days of the examination. The written report shall meet the requirements of paragraph (h)(5) (except paragraph (h)(5)(iv)) of this section.

(iv) The employer shall obtain a written opinion from the specialist within 30 days of the medical examination. The written opinion shall meet the requirements of paragraph (h)(6) (except paragraph (h)(6)(i)(B) and (ii)(B)) of this section.

(i) *Communication of respirable crystalline silica hazards to employees—(1) Hazard communication*. The employer shall include respirable crystalline silica in the program established to comply with the hazard communication standard (HCS) (29 CFR 1910.1200). The employer shall ensure that each employee has access to labels on containers of crystalline silica and safety data sheets, and is trained in accordance with the provisions of HCS and paragraph (i)(2) of this section. The employer shall ensure that at least the following hazards are addressed: Cancer, lung effects, immune system effects, and kidney effects.

(2) *Employee information and training*. (i) The employer shall ensure that each employee covered by this section can demonstrate knowledge and understanding of at least the following:

(A) The health hazards associated with exposure to respirable crystalline silica;

(B) Specific tasks in the workplace that could result in exposure to respirable crystalline silica;

(C) Specific measures the employer has implemented to protect employees from exposure to respirable crystalline silica, including engineering controls, work practices, and respirators to be used;

(D) The contents of this section;

(E) The identity of the competent person designated by the employer in accordance with paragraph (g)(4) of this section; and

(F) The purpose and a description of the medical surveillance program required by paragraph (h) of this section.

(ii) The employer shall make a copy of this section readily available without cost to each employee covered by this section.

(j) *Recordkeeping*—(1) Air monitoring data. (i) The employer shall make and maintain an accurate record of all exposure measurements taken to assess employee exposure to respirable crystalline silica, as prescribed in paragraph (d)(2) of this section.

(ii) This record shall include at least the following information:

(A) The date of measurement for each sample taken;

(B) The task monitored;

(C) Sampling and analytical methods used;

(D) Number, duration, and results of samples taken;

(E) Identity of the laboratory that performed the analysis;

(F) Type of personal protective equipment, such as respirators, worn by the employees monitored; and

(G) Name, social security number, and job classification of all employees represented by the monitoring, indicating which employees were actually monitored.

(iii) The employer shall ensure that exposure records are maintained and made available in accordance with 29 CFR 1910.1020.

(2) *Objective data*. (i) The employer shall make and maintain an accurate record of all objective data relied upon to comply with the requirements of this section.

(ii) This record shall include at least the following information:

(A) The crystalline silica-containing material in question;

(B) The source of the objective data;

(C) The testing protocol and results of testing;

(D) A description of the process, task, or activity on which the objective data were based; and

(E) Other data relevant to the process, task, activity, material, or exposures on which the objective data were based.

(iii) The employer shall ensure that objective data are maintained and made available in accordance with 29 CFR 1910.1020.

(3) *Medical surveillance*. (i) The employer shall make and maintain an accurate record for each employee covered by medical surveillance under paragraph (h) of this section.

(ii) The record shall include the following information about the employee:

(A) Name and social security number;

(B) A copy of the PLHCPs' and specialists' written medical opinions; and

(C) A copy of the information provided to the PLHCPs and specialists.

(iii) The employer shall ensure that medical records are maintained and made available in accordance with 29 CFR 1910.1020.

(k) *Dates*. (1) This section shall become effective June 23, 2016.

(2) All obligations of this section, except requirements for methods of sample analysis in paragraph (d)(2)(v), shall commence June 23, 2017.

(3) Requirements for methods of sample analysis in paragraph (d)(2)(v) of this section commence June 23, 2018.

Appendix A to § 1926.1153 – Methods of Sample Analysis.

This appendix specifies the procedures for analyzing air samples for respirable crystalline silica, as well as the quality control procedures that employers must ensure that laboratories use when performing an analysis required under 29 CFR 1926.1153 (d)(2)(v). Employers must ensure that such a laboratory:

1. Evaluates all samples using the procedures specified in one of the following analytical methods: OSHA ID-142; NMAM 7500; NMAM 7602; NMAM 7603; MSHA P-2; or MSHA P-7;

2. Is accredited to ANS/ISO/IEC Standard 17025:2005 with respect to crystalline silica analyses by a body that is compliant with ISO/IEC Standard 17011:2004 for implementation of quality assessment programs;

3. Uses the most current National Institute of Standards and Technology (NIST) or NIST traceable standards for instrument calibration or instrument calibration verification;

4. Implements an internal quality control (QC) program that evaluates analytical uncertainty and provides employers with estimates of sampling and analytical error;

5. Characterizes the sample material by identifying polymorphs of respirable crystalline silica present, identifies the presence of any interfering compounds that might affect the analysis, and makes any corrections necessary in order to obtain accurate sample analysis; and

6. Analyzes quantitatively for crystalline silica only after confirming that the sample matrix is free of uncorrectable analytical interferences, corrects for analytical interferences, and uses a method that meets the following performance specifications:

6.1 Each day that samples are analyzed, performs instrument calibration checks with standards that bracket the sample concentrations;

6.2 Uses five or more calibration standard levels to prepare calibration curves and ensures that standards are distributed through the calibration range in a manner that accurately reflects the underlying calibration curve; and

6.3 Optimizes methods and instruments to obtain a quantitative limit of detection that represents a value no higher than 25 percent of the PEL based on sample air volume.

Appendix B to § 1926.1153 – Medical Surveillance Guidelines.

Introduction

The purpose of this Appendix is to provide medical information and recommendations to aid physicians and other licensed health care professionals (PLHCPs) regarding compliance with the medical surveillance provisions of the respirable crystalline silica standard (29 CFR 1926.1153). Appendix B is for informational and guidance purposes only and none of the statements in Appendix B should be construed as imposing a mandatory requirement on employers that is not otherwise imposed by the standard.

Medical screening and surveillance allow for early identification of exposure-related health effects in individual employee and groups of employees, so that actions can be taken to both avoid further exposure and prevent or address adverse health outcomes. Silica-related diseases can be fatal, encompass a variety of target organs, and may have public health consequences when considering the increased risk of a latent tuberculosis (TB) infection becoming active. Thus, medical surveillance of silica-exposed employees requires that PLHCPs have a thorough knowledge of silica-related health effects.

This Appendix is divided into seven sections. Section 1 reviews silica-related diseases, medical responses, and public health responses. Section 2 outlines the components of the medical surveillance program for employees exposed to silica. Section 3 describes the roles and responsibilities of the PLHCP implementing the program and of other medical specialists and public health professionals. Section 4 provides a discussion of considerations, including confidentiality. Section 5 provides a list of additional resources and Section 6 lists references. Section 7 provides sample forms for the written medical report for the employee, the written medical opinion for the employer and the written authorization.

1. Recognition of Silica-related Diseases.

1.1. Overview. The term "silica" refers specifically to the compound silicon dioxide (SiO_2). Silica is a major component of sand, rock, and mineral ores. Exposure to fine (respirable size) particles of crystalline forms of silica is associated with adverse health effects, such as silicosis, lung cancer, chronic obstructive pulmonary disease (COPD), and activation of latent TB infections. Exposure to respirable crystalline silica can occur in industry settings such as foundries, abrasive blasting operations, paint manufacturing, glass and concrete product manufacturing, brick making, china and pottery manufacturing, manufacturing of plumbing fixtures, and many construction activities including highway repair, masonry, concrete work, rock drilling, and tuck-pointing. New uses of silica continue to emerge. These include countertop manufacturing, finishing, and installation (Kramer et al. 2012; OSHA 2015) and hydraulic fracturing in the oil and gas industry (OSHA 2012).

Silicosis is an irreversible, often disabling, and sometimes fatal fibrotic lung disease. Progression of silicosis can occur despite removal from further exposure. Diagnosis of silicosis requires a history of exposure to silica and radiologic findings characteristic of silica exposure. Three different presentations of silicosis (chronic, accelerated, and acute) have been defined. Accelerated and acute silicosis are much less common than chronic silicosis. However, it is critical to recognize all cases of accelerated and acute silicosis because these are life-threatening illnesses and because they are caused by substantial overexposures to respirable crystalline silica. Although any case of silicosis indicates a breakdown in prevention, a case of acute or accelerated silicosis implies current high exposure and a very marked breakdown in prevention.

In addition to silicosis, employees exposed to respirable crystalline silica, especially those with accelerated or acute silicosis, are at increased risks of contracting active TB and other infections (ATS 1997; Rees and Murray 2007). Exposure to respirable crystalline silica also increases an employee's risk of developing lung cancer, and the higher the cumulative exposure, the higher the risk (Steenland et al. 2001; Steenland and Ward 2014). Symptoms for these diseases and other respirable crystalline silica-related diseases are discussed below.

1.2. Chronic Silicosis. Chronic silicosis is the most common presentation of silicosis and usually occurs after at least 10 years of exposure to respirable crystalline silica. The clinical presentation of chronic silicosis is:

1.2.1. Symptoms - shortness of breath and cough, although employees may not notice any symptoms early in the disease. Constitutional symptoms, such as fever, loss of appetite and fatigue, may indicate other diseases associated with silica exposure, such as TB infection or lung cancer. Employees with these symptoms should immediately receive further evaluation and treatment.

1.2.2. Physical Examination - may be normal or disclose dry rales or rhonchi on lung auscultation.

1.2.3. Spirometry - may be normal or may show only a mild restrictive or obstructive pattern.

1.2.4. Chest X-ray - classic findings are small, rounded opacities in the upper lung fields bilaterally. However, small irregular opacities and opacities in other lung areas can also occur. Rarely, "eggshell calcifications" in the hilar and mediastinal lymph nodes are seen.

1.2.5. Clinical Course - chronic silicosis in most cases is a slowly progressive disease. Under the respirable crystalline silica standard, the PLHCP is to recommend that employees with a 1/0 category X-ray be referred to an American Board Certified Specialist in Pulmonary Disease or Occupational Medicine. The PLHCP and/or Specialist should counsel employees regarding work practices and personal habits that could affect employees' respiratory health.

1.3. Accelerated Silicosis. Accelerated silicosis generally occurs within 5-10 years of exposure and results from high levels of exposure to respirable crystalline silica. The clinical presentation of accelerated silicosis is:

1.3.1. Symptoms - shortness of breath, cough, and sometimes sputum production. Employees with exposure to respirable crystalline silica, and especially those with accelerated silicosis, are at high risk for activation of TB infections, atypical mycobacterial infections, and fungal superinfections. Constitutional symptoms, such as fever, weight loss, hemoptysis (coughing up blood), and fatigue may herald one of these infections or the onset of lung cancer.

1.3.2. Physical Examination - rales, rhonchi, or other abnormal lung findings in relation to illnesses present. Clubbing of the digits, signs of heart failure, and cor pulmonale may be present in severe lung disease.

1.3.3. Spirometry - restrictive or mixed restrictive/obstructive pattern.

1.3.4. Chest X-ray - small rounded and/ or irregular opacities bilaterally. Large opacities and lung abscesses may indicate infections, lung cancer, or progression to complicated silicosis, also termed progressive massive fibrosis.

1.3.5. Clinical Course - accelerated silicosis has a rapid, severe course. Under the respirable crystalline silica standard, the PLHCP can recommend referral to a Board Certified Specialist in either Pulmonary Disease or Occupational Medicine, as deemed appropriate, and referral to a Specialist is recommended whenever the diagnosis of accelerated silicosis is being considered.

1.4. Acute Silicosis. Acute silicosis is a rare disease caused by inhalation of extremely high levels of respirable crystalline silica particles. The pathology is similar to alveolar proteinosis with lipoproteinaceous material accumulating in the alveoli. Acute silicosis develops rapidly, often, within a few months to less than 2 years of exposure, and is almost always fatal. The clinical presentation of acute silicosis is as follows:

1.4.1. Symptoms - sudden, progressive, and severe shortness of breath. Constitutional symptoms are frequently present and include fever, weight loss, fatigue, productive cough, hemoptysis (coughing up blood), and pleuritic chest pain.

1.4.2. Physical Examination - dyspnea at rest, cyanosis, decreased breath sounds, inspiratory rales, clubbing of the digits, and fever.

1.4.3. Spirometry - restrictive or mixed restrictive/obstructive pattern.

1.4.4. Chest X-ray - diffuse haziness of the lungs bilaterally early in the disease. As the disease progresses, the "ground glass" appearance of interstitial fibrosis will appear.

1.4.5. Clinical Course - employees with acute silicosis are at especially high risk of TB activation, nontuberculous mycobacterial infections, and fungal superinfections. Acute silicosis is immediately life-threatening. The employee should be urgently referred to a Board Certified Specialist in Pulmonary Disease or Occupational Medicine for evaluation and treatment. Although any case of silicosis indicates a breakdown in prevention, a case of acute or accelerated silicosis implies a profoundly high level of silica exposure and may mean that other employees are currently exposed to dangerous levels of silica.

1.5. COPD. COPD, including chronic bronchitis and emphysema, has been documented in silica-exposed employees, including those who do not develop silicosis. Periodic spirometry tests are performed to evaluate each employee for progressive changes consistent with the development of COPD. In addition to evaluating spirometry results of individual employees over time, PLHCPs may want to be aware of general trends in spirometry results for groups of employees from the same workplace to identify possible problems that might exist at that workplace. (See Section 2 of this Appendix on Medical Surveillance for further discussion.) Heart disease may develop secondary to lung diseases such as COPD. A recent study by Liu et al. 2014 noted a significant exposure-response trend between cumulative silica exposure and heart disease deaths, primarily due to pulmonary heart disease, such as cor pulmonale.

1.6. Renal and Immune System. Silica exposure has been associated with several types of kidney disease, including glomerulonephritis, nephrotic syndrome, and end stage renal disease requiring dialysis. Silica exposure has also been associated with other autoimmune conditions, including progressive systemic sclerosis, systemic lupus erythematosus, and rheumatoid arthritis. Studies note an association between employees with silicosis and serologic markers for autoimmune diseases, including antinuclear antibodies, rheumatoid factor, and immune complexes (Jalloul and Banks 2007; Shtraichman et al. 2015).

1.7. TB and Other Infections. Silica-exposed employees with latent TB are 3 to 30 times more likely to develop active pulmonary TB infection (ATS 1997; Rees and Murray 2007). Although respirable crystalline silica exposure does not cause TB infection, individuals with latent TB infection are at increased risk for activation of disease if they have higher levels of respirable crystalline silica exposure, greater profusion of radiographic abnormalities, or a diagnosis of silicosis. Demographic characteristics, such as immigration from some countries, are associated with increased rates of latent TB infection. PLHCPs can review the latest Centers for Disease Control and Prevention (CDC) information on TB incidence rates and high risk populations online (See Section 5 of this Appendix). Additionally, silica-exposed employees are at increased risk for contracting nontuberculous mycobacterial infections, including Mycobacterium avium-intracellulare and Mycobacterium kansaii.

1.8. Lung Cancer. The National Toxicology Program has listed respirable crystalline silica as a known human carcinogen since 2000 (NTP 2014). The International Agency for Research on Cancer (2012) has also classified silica as Group 1 (carcinogenic to humans). Several studies have indicated that the risk of lung cancer from exposure to respirable crystalline silica and smoking is greater than additive (Brown 2009; Liu et al. 2013). Employees should be counseled on smoking cessation.

2. Medical Surveillance.

PLHCPs who manage silica medical surveillance programs should have a thorough understanding of the many silica-related diseases and health effects outlined in Section 1 of this Appendix. At each clinical encounter, the PLHCP should consider silica-related health outcomes, with particular vigilance for acute and accelerated silicosis. In this Section, the required components of medical surveillance under the respirable crystalline silica standard are reviewed, along with additional guidance and recommendations for PLHCPs performing medical surveillance examinations for silica-exposed employees.

2.1. History.

2.1.1. The respirable crystalline silica standard requires the following: A medical and work history, with emphasis on: past, present, and anticipated exposure to respirable crystalline silica, dust, and other agents affecting the respiratory system; any history of respiratory system dysfunction, including signs and symptoms of respiratory disease (*e.g.*, shortness of breath, cough, wheezing); history of TB; and smoking status and history.

2.1.2. Further, the employer must provide the PLHCP with the following information:

2.1.2.1. A description of the employee's former, current, and anticipated duties as they relate to the employee's occupational exposure to respirable crystalline silica;

2.1.2.2. The employee's former, current, and anticipated levels of occupational exposure to respirable crystalline silica;

2.1.2.3. A description of any personal protective equipment used or to be used by the employee, including when and for how long the employee has used or will use that equipment; and

2.1.2.4. Information from records of employment-related medical examinations previously provided to the employee and currently within the control of the employer.

2.1.3. Additional guidance and recommendations: A history is particularly important both in the initial evaluation and in periodic examinations. Information on past and current medical conditions (particularly a history of kidney disease, cardiac disease, connective tissue disease, and other immune diseases), medications, hospitalizations and surgeries may uncover health risks, such as immune suppression, that could put an employee at increased health risk from exposure to silica. This information is important when counseling the employee on risks and safe work practices related to silica exposure.

2.2. Physical Examination.

2.2.1. The respirable crystalline silica standard requires the following: A physical examination, with special emphasis on the respiratory system. The physical examination must be performed at the initial examination and every three years thereafter.

2.2.2. Additional guidance and recommendations: Elements of the physical examination that can assist the PHLCP include: an examination of the cardiac system, an extremity examination (for clubbing, cyanosis, edema, or joint abnormalities), and an examination of other pertinent organ systems identified during the history.

2.3. TB Testing.

2.3.1. The respirable crystalline silica standard requires the following: Baseline testing for TB on initial examination.

2.3.2. Additional guidance and recommendations:

2.3.2.1. Current CDC guidelines (See Section 5 of this Appendix) should be followed for the application and interpretation of Tuberculin skin tests (TST). The interpretation and documentation of TST reactions should be performed within 48 to 72 hours of administration by trained PLHCPs.

2.3.2.2. PLHCPs may use alternative TB tests, such as interferon-release assays (IGRAs), if sensitivity and specificity are comparable to TST (Mazurek et al. 2010; Slater et al. 2013). PLHCPs can consult the current CDC guidelines for acceptable tests for latent TB infection.

2.3.2.3. The silica standard allows the PLHCP to order additional tests or test at a greater frequency than required by the standard, if deemed appropriate. Therefore, PLHCPs might perform periodic (*e.g.*, annual) TB testing as appropriate, based on employees' risk factors. For example, according to the American Thoracic Society (ATS), the diagnosis of silicosis or exposure to silica for 25 years or more are indications for annual TB testing (ATS 1997). PLHCPs should consult the current CDC guidance on risk factors for TB (See Section 5 of this Appendix).

2.3.2.4. Employees with positive TB tests and those with indeterminate test results should be referred to the appropriate agency or specialist, depending on the test results and clinical picture. Agencies, such as local public health departments, or specialists, such as a pulmonary or infectious disease specialist, may be the appropriate referral. Active TB is a nationally notifiable disease. PLHCPs should be aware of the reporting requirements for their region. All States have TB Control Offices that can be contacted for further information. (See Section 5 of this Appendix for links to CDC's TB resources and State TB Control Offices.)

2.3.2.5. The following public health principles are key to TB control in the U.S. (ATS-CDC-IDSA 2005):

(1) Prompt detection and reporting of persons who have contracted active TB;

(2) Prevention of TB spread to close contacts of active TB cases;

(3) Prevention of active TB in people with latent TB through targeted testing and treatment; and

(4) Identification of settings at high risk for TB transmission so that appropriate infection-control measures can be implemented.

2.4. Pulmonary Function Testing.

2.4.1. The respirable crystalline silica standard requires the following: Pulmonary function testing must be performed on the initial examination and every three years thereafter. The required pulmonary function test is spirometry and must include forced vital capacity (FVC), forced expiratory volume in one second (FEV_1), and FEV_1/FVC ratio. Testing must be administered by a spirometry technician with a current certificate from a National Institute for Occupational Health and Safety (NIOSH)-approved spirometry course.

2.4.2. Additional guidance and recommendations: Spirometry provides information about individual respiratory status and can be used to track an employee's respiratory status over time or as a surveillance tool to follow individual and group respiratory function. For quality results, the ATS and the American College of Occupational and Environmental Medicine (ACOEM) recommend use of the third National Health and Nutrition Examination Survey (NHANES III) values, and ATS publishes recommendations for spirometry equipment (Miller et al. 2005; Townsend 2011; Redlich et al. 2014). OSHA's publication, Spirometry Testing in Occupational Health Programs: Best Practices for Healthcare Professionals, provides helpful guidance (See Section 5 of this Appendix). Abnormal spirometry results may warrant further clinical evaluation and possible recommendations for limitations on the employee's exposure to respirable crystalline silica.

2.5. Chest X-ray.

2.5.1. The respirable crystalline silica standard requires the following: A single posteroanterior (PA) radiographic projection or radiograph of the chest at full inspiration recorded on either film (no less than 14 x 17 inches and no more than 16 x 17 inches) or digital radiography systems. A chest X-ray must be performed on the initial examination and every three years thereafter. The chest X-ray must be interpreted and classified according to the International Labour Office (ILO) International Classification of Radiographs of Pneumoconioses by a NIOSH-certified B Reader.

Chest radiography is necessary to diagnose silicosis, monitor the progression of silicosis, and identify associated conditions such as TB. If the B reading indicates small opacities in a profusion of 1/0 or higher, the employee is to receive a recommendation for referral to a Board Certified Specialist in Pulmonary Disease or Occupational Medicine.

2.5.2. Additional guidance and recommendations: Medical imaging has largely transitioned from conventional film-based radiography to digital radiography systems. The ILO Guidelines for the Classification of Pneumoconioses has historically provided film-based chest radiography as a referent standard for comparison to individual exams. However, in 2011, the ILO revised the guidelines to include a digital set of referent standards that were derived from the prior film-based standards. To assist in assuring that digitally-acquired radiographs are at least as safe and effective as film radiographs, NIOSH has prepared guidelines, based upon accepted contemporary professional recommendations (See Section 5 of this Appendix). Current research from Laney et al. 2011 and Halldin et al. 2014 validate the use of the ILO digital referent images. Both studies conclude that the results of pneumoconiosis classification using digital references are comparable to film-based ILO classifications. Current ILO guidance on radiography for pneumoconioses and B-reading should be reviewed by the PLHCP periodically, as needed, on the ILO or NIOSH websites (See Section 5 of this Appendix).

2.6. Other Testing. Under the respirable crystalline silica standards, the PLHCP has the option of ordering additional testing he or she deems appropriate. Additional tests can be ordered on a case-by-case basis depending on individual signs or symptoms and clinical judgment. For example, if an employee reports a history of abnormal kidney function tests, the PLHCP may want to order a baseline renal function tests (*e.g.*, serum creatinine and urinalysis). As indicated above, the PLHCP may order annual TB testing for silica-exposed employees who are at high risk of developing active TB infections. Additional tests that PLHCPs may order based on findings of medical examinations include, but is not limited to, chest computerized tomography (CT) scan for lung cancer or COPD, testing for immunologic diseases, and cardiac testing for pulmonary-related heart disease, such as cor pulmonale.

3. Roles and Responsibilities.

3.1. PLHCP. The PLHCP designation refers to "an individual whose legally permitted scope of practice (*i.e.*, license, registration, or certification) allows him or her to independently provide or be delegated the responsibility to provide some or all of the particular health care services required" by the respirable crystalline silica standard. The legally permitted scope of practice for the PLHCP is determined by each State. PLHCPs who perform clinical services for a silica medical surveillance program should have a thorough knowledge of respirable crystalline silica-related diseases and symptoms. Suspected cases of silicosis, advanced COPD, or other respiratory conditions causing impairment should be promptly referred to a Board Certified Specialist in Pulmonary Disease or Occupational Medicine.

Once the medical surveillance examination is completed, the employer must ensure that the PLHCP explains to the employee the results of the medical examination and provides the employee with a written medical report within 30 days of the examination. The written medical report must contain a statement indicating the results of the medical examination, including any medical condition(s) that would place the employee at increased risk of material impairment to health from exposure to respirable crystalline silica and any medical conditions that require further evaluation or treatment. In addition, the PLHCP's written medical report must include any recommended limitations on the employee's use of respirators, any recommended limitations on the employee's exposure to respirable crystalline silica, and a statement that the employee should be examined by a Board Certified Specialist in Pulmonary Disease or Occupational medicine if the chest X-ray is classified as 1/0 or higher by the B Reader, or if referral to a Specialist is otherwise deemed appropriate by the PLHCP.

The PLHCP should discuss all findings and test results and any recommendations regarding the employee's health, worksite safety and health practices, and medical referrals for further evaluation, if indicated. In addition, it is suggested that the PLHCP offer to provide the employee with a complete copy of their examination and test results, as some employees may want this information for their own records or to provide to their personal physician or a future PLHCP. Employees are entitled to access their medical records.

Under the respirable crystalline silica standard, the employer must ensure that the PLHCP provides the employer with a written medical opinion within 30 days of the employee examination, and that the employee also gets a copy of the written medical opinion for the employer within 30 days. The PLHCP may choose to directly provide the employee a copy of the written medical opinion. This can be particularly helpful to employees, such as construction employees, who may change employers frequently. The written medical opinion can be used by the employee as proof of up-to-date medical surveillance. The following lists the elements of the written medical report for the employee and written medical opinion for the employer. (Sample forms for the written medical report for the employee, the written medical opinion for the employer, and the written authorization are provided in Section 7 of this Appendix.)

3.1.1. The written medical report for the employee must include the following information:

3.1.1.1. A statement indicating the results of the medical examination, including any medical condition(s) that would place the employee at increased risk of material impairment to health from exposure to respirable crystalline silica and any medical conditions that require further evaluation or treatment;

3.1.1.2. Any recommended limitations upon the employee's use of a respirator;

3.1.1.3. Any recommended limitations on the employee's exposure to respirable crystalline silica; and

3.1.1.4. A statement that the employee should be examined by a Board Certified Specialist in Pulmonary Disease or Occupational Medicine, where the standard requires or where the PLHCP has determined such a referral is necessary. The standard requires referral to a Board Certified Specialist in Pulmonary Disease or Occupational Medicine for a chest X-ray B reading indicating small opacities in a profusion of 1/0 or higher, or if the PHLCP determines that referral to a Specialist is necessary for other silica-related findings.

3.1.2. The PLHCP's written medical opinion for the employer must include only the following information:

3.1.2.1. The date of the examination;

3.1.2.2. A statement that the examination has met the requirements of this section; and

3.1.2.3. Any recommended limitations on the employee's use of respirators.

3.1.2.4. If the employee provides the PLHCP with written authorization, the written opinion for the employer shall also contain either or both of the following:

(1) Any recommended limitations on the employee's exposure to respirable crystalline silica; and

(2) A statement that the employee should be examined by a Board Certified Specialist in Pulmonary Disease or Occupational Medicine if the chest X-ray provided in accordance with this section is classified as 1/0 or higher by the B Reader, or if referral to a Specialist is otherwise deemed appropriate.

3.1.2.5. In addition to the above referral for abnormal chest X-ray, the PLHCP may refer an employee to a Board Certified Specialist in Pulmonary Disease or Occupational Medicine for other findings of concern during the medical surveillance examination if these findings are potentially related to silica exposure.

3.1.2.6. Although the respirable crystalline silica standard requires the employer to ensure that the PLHCP explains the results of the medical examination to the employee, the standard does not mandate how this should be done. The written medical opinion for the employer could contain a statement that the PLHCP has explained the results of the medical examination to the employee.

3.2. Medical Specialists. The silica standard requires that all employees with chest X-ray B readings of 1/0 or higher be referred to a Board Certified Specialist in Pulmonary Disease or Occupational Medicine. If the employee has given written authorization for the employer to be informed, then the employer shall make available a medical examination by a Specialist within 30 days after receiving the PLHCP's written medical opinion.

3.2.1. The employer must provide the following information to the Board Certified Specialist in Pulmonary Disease or Occupational Medicine:

3.2.1.1. A description of the employee's former, current, and anticipated duties as they relate to the employee's occupational exposure to respirable crystalline silica;

3.2.1.2. The employee's former, current, and anticipated levels of occupational exposure to respirable crystalline silica;

3.2.1.3. A description of any personal protective equipment used or to be used by the employee, including when and for how long the employee has used or will use that equipment; and

3.2.1.4. Information from records of employment-related medical examinations previously provided to the employee and currently within the control of the employer.

3.2.2. The PLHCP should make certain that, with written authorization from the employee, the Board Certified Specialist in Pulmonary Disease or Occupational Medicine has any other pertinent medical and occupational information necessary for the specialist's evaluation of the employee's condition.

3.2.3. Once the Board Certified Specialist in Pulmonary Disease or Occupational Medicine has evaluated the employee, the employer must ensure that the Specialist explains to the employee the results of the medical examination and provides the employee with a written medical report within 30 days of the examination. The employer must also ensure that the Specialist provides the employer with a written medical opinion within 30 days of the employee examination. (Sample forms for the written medical report for the employee, the written medical opinion for the employer and the written authorization are provided in Section 7 of this Appendix.)

3.2.4. The Specialist's written medical report for the employee must include the following information:

3.2.4.1. A statement indicating the results of the medical examination, including any medical condition(s) that would place the employee at increased risk of material impairment to health from exposure to respirable crystalline silica and any medical conditions that require further evaluation or treatment;

3.2.4.2. Any recommended limitations upon the employee's use of a respirator; and

3.2.4.3. Any recommended limitations on the employee's exposure to respirable crystalline silica.

3.2.5. The Specialist's written medical opinion for the employer must include the following information:

3.2.5.1. The date of the examination; and

3.2.5.2. Any recommended limitations on the employee's use of respirators.

3.2.5.3. If the employee provides the Board Certified Specialist in Pulmonary Disease or Occupational Medicine with written authorization, the written medical opinion for the employer shall also contain any recommended limitations on the employee's exposure to respirable crystalline silica.

3.2.5.4. Although the respirable crystalline silica standard requires the employer to ensure that the Board Certified Specialist in Pulmonary Disease or Occupational Medicine explains the results of the medical examination to the employee, the standard does not mandate how this should be done. The written medical opinion for the employer could contain a statement that the Specialist has explained the results of the medical examination to the employee.

3.2.6. After evaluating the employee, the Board Certified Specialist in Pulmonary Disease or Occupational Medicine should provide feedback to the PLHCP as appropriate, depending on the reason for the referral. OSHA believes that because the PLHCP has the primary relationship with the employer and employee, the Specialist may want to communicate his or her findings to the PLHCP and have the PLHCP simply update the original medical report for the employee and medical opinion for the employer. This is permitted under the standard, so long as all requirements and time deadlines are met.

3.3. Public Health Professionals. PLHCPs might refer employees or consult with public health professionals as a result of silica medical surveillance. For instance, if individual cases of active TB are identified, public health professionals from state or local health departments may assist in diagnosis and treatment of individual cases and may evaluate other potentially affected persons, including coworkers. Because silica-exposed employees are at increased risk of progression from latent to active TB, treatment of latent infection is recommended. The diagnosis of active TB, acute or accelerated silicosis, or other silica-related diseases and infections should serve as sentinel events suggesting high levels of exposure to silica and may require consultation with the appropriate public health agencies to investigate potentially similarly exposed coworkers to assess for disease clusters. These agencies include local or state health departments or OSHA. In addition, NIOSH can provide assistance upon request through their Health Hazard Evaluation program. (See Section 5 of this Appendix)

4. Confidentiality and Other Considerations.

The information that is provided from the PLHCP to the employee and employer under the medical surveillance section of OSHA's respirable crystalline silica standard differs from that of medical surveillance requirements in previous OSHA standards. The standard requires two separate written communications, a written medical report for the employee and a written medical opinion for the employer. The confidentiality requirements for the written medical opinion are more stringent than in past standards. For example, the information the PLHCP can (and must) include in his or her written medical opinion for the employer is limited to: the date of the examination, a statement that the examination has met the requirements of this section, and any recommended limitations on the employee's use of respirators. If the employee provides written authorization for the disclosure of any limitations on the employee's exposure to respirable crystalline silica, then the PLHCP can (and must) include that information in the written medical opinion for the employer as well. Likewise, with the employee's written authorization, the PLHCP can (and must) disclose the PLHCP's referral recommendation (if any) as part of the written medical opinion for the employer. However, the opinion to the employer must not include information regarding recommended limitations on the employee's exposure to respirable crystalline silica or any referral recommendations without the employee's written authorization.

The standard also places limitations on the information that the Board Certified Specialist in Pulmonary Disease or Occupational Medicine can provide to the employer without the employee's written authorization. The Specialist's written medical opinion for the employer, like the PLHCP's opinion, is limited to (and must contain): the date of the examination and any recommended limitations on the employee's use of respirators. If the employee provides written authorization, the written medical opinion can (and must) also contain any limitations on the employee's exposure to respirable crystalline silica.

The PLHCP should discuss the implication of signing or not signing the authorization with the employee (in a manner and language that he or she understands) so that the employee can make an informed decision regarding the written authorization and its consequences. The discussion should include the risk of ongoing silica exposure, personal risk factors, risk of disease progression, and possible health and economic consequences. For instance, written authorization is required for a PLHCP to advise an employer that an employee should be referred to a Board Certified Specialist in Pulmonary Disease or Occupational Medicine for evaluation of an abnormal chest X-ray (B-reading 1/0 or greater). If an employee does not sign an authorization, then the employer will not know and cannot facilitate the referral to a Specialist and is not required to pay for the Specialist's examination. In the rare case where an employee is diagnosed with acute or accelerated silicosis, co-workers are likely to be at significant risk of developing those diseases as a result of inadequate controls in the workplace. In this case, the PLHCP and/or Specialist should explain this concern to the affected employee and make a determined effort to obtain written authorization from the employee so that the PLHCP and/or Specialist can contact the employer.

Finally, without written authorization from the employee, the PLHCP and/or Board Certified Specialist in Pulmonary Disease or Occupational Medicine cannot provide feedback to an employer regarding control of workplace silica exposure, at least in relation to an individual employee. However, the regulation does not prohibit a PLHCP and/or Specialist from providing an employer with general recommendations regarding exposure controls and prevention programs in relation to silica exposure and silica-related illnesses, based on the information that the PLHCP receives from the employer such as employees' duties and exposure levels. Recommendations may include increased frequency of medical surveillance examinations, additional medical surveillance components, engineering and work practice controls, exposure monitoring and personal protective equipment. For instance, more frequent medical surveillance examinations may be a recommendation to employers for employees who do abrasive blasting with silica because of the high exposures associated with that operation.

ACOEM's Code of Ethics and discussion is a good resource to guide PLHCPs regarding the issues discussed in this section (See Section 5 of this Appendix).

5. Resources.

5.1. American College of Occupational and Environmental Medicine (ACOEM):

ACOEM Code of Ethics. Accessed at: http://www.acoem.org/codeofconduct.aspx

Raymond, L.W. and Wintermeyer, S. (2006) ACOEM evidenced-based statement on medical surveillance of silica-exposed workers: medical surveillance of workers exposed to crystalline silica. J Occup Environ Med, 48, 95-101.

5.2. Center for Disease Control and Prevention (CDC)

Tuberculosis webpage: http://www.cdc.gov/tb/default.htm

State TB Control Offices web page: http://www.cdc.gov/tb/links/tboffices.htm

Tuberculosis Laws and Policies webpage: http://www.cdc.gov/tb/programs/laws/default.htm

CDC. (2013). Latent Tuberculosis Infection: A Guide for Primary Health Care Providers. Accessed at: http://www.cdc.gov/tb/publications/ltbi/pdf/targetedltbi.pdf

5.3. International Labour Organization

International Labour Office (ILO). (2011) Guidelines for the use of the ILO International Classification of Radiographs of Pneumoconioses, Revised edition 2011. Occupational Safety and Health Series No. 22: http://www.ilo.org/safework/info/publications/WCMS_168260/lang--en/index.htm

5.4. National Institute of Occupational Safety and Health (NIOSH)

NIOSH B Reader Program webpage. (Information on interpretation of X-rays for silicosis and a list of certified B-readers). Accessed at: http://www.cdc.gov/niosh/topics/chestradiography/breader-info.html

NIOSH Guideline (2011). Application of Digital Radiography for the Detection and Classification of Pneumoconiosis. NIOSH publication number 2011-198. Accessed at: http://www.cdc.gov/niosh/docs/2011-198/

NIOSH Hazard Review (2002), Health Effects of Occupational Exposure to Respirable Crystalline Silica. NIOSH publication number 2002-129: Accessed at http://www.cdc.gov/niosh/docs/2002-129

NIOSH Health Hazard Evaluations Programs. (Information on the NIOSH Health Hazard Evaluation (HHE) program, how to request an HHE and how to look up an HHE report). Accessed at: http://www.cdc.gov/niosh/hhe

5.5. National Industrial Sand Association:

Occupational Health Program for Exposure to Crystalline Silica in the Industrial Sand Industry. National Industrial Sand Association, 2nd ed. 2010. Can be ordered at: http://www.sand.org/silica-occupational-health-program

5.6. Occupational Safety and Health Administration (OSHA)

Contacting OSHA: http://www.osha.gov/html/Feed_Back.html

OSHA's Clinicians webpage. (OSHA resources, regulations and links to help clinicians navigate OSHA's web site and aid clinicians in caring for workers.) Accessed at: http://www.osha.gov/dts/oom/clinicians

OSHA's Safety and Health Topics webpage on Silica. Accessed at: http://www.osha.gov/dsg/topics/silicacrystalline

OSHA (2013). Spirometry Testing in Occupational Health Programs: Best Practices for Healthcare Professionals. (OSHA 3637-03 2013). Accessed at: http://www.osha.gov/Publications/OSHA3637.pdf

OSHA/NIOSH (2011). Spirometry: OSHA/NIOSH Spirometry InfoSheet (OSHA 3415-1-11). (Provides guidance to employers). Accessed at http://www.osha.gov/Publications/osha3415.pdf

OSHA/NIOSH (2011) Spirometry: OSHA/NIOSH Spirometry Worker Info. (OSHA 3418-3-11). Accessed at http://www.osha.gov/Publications/osha3418.pdf

5.7. Other

Steenland, K. and Ward E. (2014). Silica: A lung carcinogen. CA Cancer J Clin, 64, 63-69. (This article reviews not only silica and lung cancer but also all the known silica-related health effects. Further, the authors provide guidance to clinicians on medical surveillance of silica-exposed workers and worker counselling on safety practices to minimize silica exposure.)

6. References.

American Thoracic Society (ATS). Medical Section of the American Lung Association (1997). Adverse effects of crystalline silica exposure. Am J Respir Crit Care Med, 155, 761-765.

American Thoracic Society (ATS), Centers for Disease Control (CDC), Infectious Diseases Society of America (IDSA) (2005). Controlling Tuberculosis in the United States. Morbidity and Mortality Weekly Report (MMWR), 54(RR12), 1-81. Accessed at: http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5412a1.htm

Brown, T. (2009). Silica exposure, smoking, silicosis and lung cancer – complex interactions. Occupational Medicine, 59, 89-95.

Halldin, C. N., Petsonk, E. L., and Laney, A. S. (2014). Validation of the International Labour Office digitized standard images for recognition and classification of radiographs of pneumoconiosis. Acad Radiol, 21,305-311.

International Agency for Research on Cancer. (2012). Monographs on the evaluation of carcinogenic risks to humans: Arsenic, Metals, Fibers, and Dusts Silica Dust, Crystalline, in the Form of Quartz or Cristobalite. A Review of Human Carcinogens. Volume 100 C. Geneva, Switzerland: World Health Organization.

Jalloul, A. S. and Banks D. E. (2007). Chapter 23. The health effects of silica exposure. In: Rom, W. N. and Markowitz, S. B. (Eds). Environmental and Occupational Medicine, 4th edition. Lippincott, Williams and Wilkins, Philadelphia, 365-387.

Kramer, M. R., Blanc, P. D., Fireman, E., Amital, A., Guber, A., Rahman, N. A., and Shitrit, D. (2012). Artifical stone silicosis: disease resurgence among artificial stone workers. Chest, 142, 419-424.

Laney, A. S., Petsonk, E. L., and Attfield, M. D. (2011). Intramodality and intermodality comparisons of storage phosphor computed radiography and conventional film-screen radiography in the recognition of small pneumonconiotic opacities. Chest, 140, 1574-1580.

Liu, Y., Steenland, K., Rong, Y., Hnizdo, E., Huang, X., Zhang, H., Shi, T., Sun, Y., Wu, T., and Chen, W. (2013). Exposure-response analysis and risk assessment for lung cancer in relationship to silica exposure: a 44-year cohort study of 34,018 workers. Am J Epi, 178,1424-1433.

Liu, Y., Rong, Y., Steenland, K., Christiani, D. C., Huang, X., Wu, T., and Chen, W. (2014). Long-term exposure to crystalline silica and risk of heart disease mortality. Epidemiology, 25, 689-696.

Mazurek, G. H., Jereb, J., Vernon, A., LoBue, P., Goldberg, S., Castro, K. (2010). Updated guidelines for using interferon gamma release assays to detect Mycobacterium tuberculosis infection – United States. Morbidity and Mortality Weekly Report (MMWR), 59(RR05), 1-25.

Miller, M. R., Hankinson, J., Brusasco, V., Burgos, F., Casaburi, R., Coates, A., Crapo, R., Enright, P., van der Grinten, C. P., Gustafsson, P., Jensen, R., Johnson, D. C., MacIntyre, N., McKay, R., Navajas, D., Pedersen, O. F., Pellegrino, R., Viegi, G., and Wanger, J. (2005).

American Thoracic Society/European Respiratory Society (ATS/ERS) Task Force: Standardisation of Spirometry. Eur Respir J, 26, 319-338.

National Toxicology Program (NTP) (2014). Report on Carcinogens, Thirteenth Edition. Silica, Crystalline (respirable Size). Research Triangle Park, NC: U.S. Department of Health and Human Services, Public Health Service. http://ntp.niehs.nih.gov/ntp/roc/content/profiles/silica.pdf

Occupational Safety and Health Administration/National Institute for Occupational Safety and Health (OSHA/NIOSH) (2012). Hazard Alert. Worker exposure to silica during hydraulic fracturing.

Occupational Safety and Health Administration/National Institute for Occupational Safety and Health (OSHA/NIOSH) (2015). Hazard alert. Worker exposure to silica during countertop manufacturing, finishing, and installation. (OSHA- HA-3768-2015).

Redlich, C. A., Tarlo, S. M., Hankinson, J. L., Townsend, M. C, Eschenbacher, W. L., Von Essen, S. G., Sigsgaard, T., Weissman, D. N. (2014). Official American Thoracic Society technical standards: spirometry in the occupational setting. Am J Respir Crit Care Med; 189, 984-994.

Rees, D. and Murray, J. (2007). Silica, silicosis and tuberculosis. Int J Tuberc Lung Dis, 11(5), 474-484.

Shtraichman, O., Blanc, P. D., Ollech, J. E., Fridel, L., Fuks, L., Fireman, E., and Kramer, M. R. (2015). Outbreak of autoimmune disease in silicosis linked to artificial stone. Occup Med, 65, 444-450.

Slater, M. L., Welland, G., Pai, M., Parsonnet, J., and Banaei, N. (2013). Challenges with QuantiFERON-TB gold assay for large-scale, routine screening of U.S. healthcare workers. Am J Respir Crit Care Med, 188,1005-1010.

Steenland, K., Mannetje, A., Boffetta, P., Stayner, L., Attfield, M., Chen, J., Dosemeci, M., DeKlerk, N., Hnizdo, E., Koskela, R., and Checkoway, H. (2001). International Agency for Research on Cancer. Pooled exposure-response analyses and risk assessment for lung cancer in 10 cohorts of silica-exposed workers: an IARC multicentre study. Cancer Causes Control,12(9):773-84.

Steenland, K. and Ward E. (2014). Silica: A lung carcinogen. CA Cancer J Clin, 64, 63-69.

Townsend, M. C. ACOEM Guidance Statement. (2011). Spirometry in the occupational health setting – 2011 Update. J Occup Environ Med, 53, 569-584.

7. Sample Forms.

Three sample forms are provided. The first is a sample written medical report for the employee. The second is a sample written medical opinion for the employer. And the third is a sample written authorization form that employees sign to clarify what information the employee is authorizing to be released to the employer.

WRITTEN MEDICAL REPORT FOR EMPLOYEE

EMPLOYEE NAME: ____________________________________ **DATE OF EXAMINATION**: _______________

TYPE OF EXAMINATION:
[ ] Initial examination [ ] Periodic examination [ ] Specialist examination
[ ] Other: ____

RESULTS OF MEDICAL EXAMINATION:

Physical Examination –	[ ] Normal	[ ] Abnormal (see below)	[ ] Not performed
Chest X-Ray –	[ ] Normal	[ ] Abnormal (see below)	[ ] Not performed
Breathing Test (Spirometry) –	[ ] Normal	[ ] Abnormal (see below)	[ ] Not performed
Test for Tuberculosis –	[ ] Normal	[ ] Abnormal (see below)	[ ] Not performed
Other:___________________	[ ] Normal	[ ] Abnormal (see below)	[ ] Not performed

Results reported as abnormal: ____
____

[ ] Your health may be at increased risk from exposure to respirable crystalline silica due to the following:
____

RECOMMENDATIONS:
[ ] No limitations on respirator use
[ ] Recommended limitations on use of respirator: ____
[ ] Recommended limitations on exposure to respirable crystalline silica: ___________________________
____

Dates for recommended limitations, if applicable: _______________ to _____________
MM/DD/YYYY MM/DD/YYYY

[ ] I recommend that you be examined by a Board Certified Specialist in Pulmonary Disease or Occupational Medicine

[ ] Other recommendations*:
____
____

Your next periodic examination for silica exposure should be in: [ ] 3 years [ ] Other: ___________________
MM/DD/YYYY

Examining Provider: ____ Date: _____________________
(signature)

Provider Name: ____
Office Address: ____ Office Phone: ___________________

*These findings may not be related to respirable crystalline silica exposure or may not be work-related, and therefore may not be covered by the employer. These findings may necessitate follow-up and treatment by your personal physician.

Respirable Crystalline Silica standard (§ 1910.1053 or 1926.1153)

WRITTEN MEDICAL OPINION FOR EMPLOYER

EMPLOYER: ____

EMPLOYEE NAME: _______________________________________ **DATE OF EXAMINATION:** _______________

TYPE OF EXAMINATION:
[ ] Initial examination [ ] Periodic examination [ ] Specialist examination
[ ] Other: ____

USE OF RESPIRATOR:
[ ] No limitations on respirator use
[ ] Recommended limitations on use of respirator:____

Dates for recommended limitations, if applicable: _______________ to _______________
MM/DD/YYYY MM/DD/YYYY

The employee has provided written authorization for disclosure of the following to the employer (if applicable):

[ ] This employee should be examined by an American Board Certified Specialist in Pulmonary Disease or Occupational Medicine
[ ] Recommended limitations on exposure to respirable crystalline silica:_______________________________
____

Dates for exposure limitations noted above: _______________ to _______________
MM/DD/YYYY MM/DD/YYYY

NEXT PERIODIC EVALUATION: [ ] 3 years [ ] Other: _______________
MM/DD/YYYY

Examining Provider: _______________________________________ Date: ___________
(signature)

Provider Name: ____ Provider's specialty:_______________________

Office Address: ____ Office Phone: _______________

[ ] I attest that the results have been explained to the employee.

The following is required to be checked by the Physician or other Licensed Health Care Professional (PLHCP):
[ ] I attest that this medical examination has met the requirements of the medical surveillance section of the OSHA Respirable Crystalline Silica standard (§ 1910.1053(h) or 1926.1153(h)).

AUTHORIZATION FOR CRYSTALLINE SILICA OPINION TO EMPLOYER

This medical examination for exposure to crystalline silica could reveal a medical condition that results in recommendations for (1) limitations on respirator use, (2) limitations on exposure to crystalline silica, or (3) examination by a specialist in pulmonary disease or occupational medicine. Recommended limitations on respirator use will be included in the written opinion to the employer. If you want your employer to know about limitations on crystalline silica exposure or recommendations for a specialist examination, you will need to give authorization for the written opinion to the employer to include one or both of those recommendations.

I hereby authorize the opinion to the employer to contain the following information, if relevant (please check all that apply):

☐ Recommendations for limitations on crystalline silica exposure

☐ Recommendation for a specialist examination

OR

☐ I do not authorize the opinion to the employer to contain anything other than recommended limitations on respirator use.

Please read and initial:

___ I understand that if I do not authorize my employer to receive the recommendation for specialist examination, the employer will not be responsible for arranging and covering costs of a specialist examination.

____
Name (printed)

________________________________ ________________________________
Signature Date

WORKERS' RIGHTS

Under federal law, workers are entitled to working conditions that do not pose a risk of serious harm.

For more information on how to assure a safe and healthful workplace, see OSHA's Workers page.

OSHA ASSISTANCE, SERVICES AND PROGRAMS

OSHA has a great deal of information to assist employers in complying with their responsibilities under OSHA law. Several OSHA programs and services can help employers identify and correct job hazards, as well as improve their safety and health program.

Establishing a Safety and Health Program

Safety and health programs are systems that can substantially reduce the number and severity of workplace injuries and illnesses, while reducing costs to employers.

Visit www.osha.gov/shpguidelines for more information.

Compliance Assistance Specialists

OSHA Compliance assistance specialists can provide information to employers and workers about OSHA standards, short educational programs on specific hazards or OSHA rights and responsibilities, and information on additional compliance assistance resources.

Visit www.osha.gov/dcsp/compliance_assistance/cas.html or call 1-800-321-OSHA (6742) to contact your local OSHA office.

Free On-site Safety and Health Consultation Services for Small Business

OSHA's On-site Consultation Program offers free and confidential advice to small and medium-sized businesses in all states, with priority given to high-hazard worksites. On-site consultation services are separate from enforcement and do not result in penalties or citations.

For more information or to find the local On-site Consultation office in your state, visit www.osha.gov/consultation, or call 1-800-321-OSHA (6742).

Under the consultation program, certain exemplary employers may request participation in OSHA's **Safety and Health Achievement Recognition Program (SHARP)**. Worksites that receive SHARP recognition are exempt from programmed inspections during the period that the SHARP certification is valid.

Cooperative Programs

OSHA offers cooperative programs under which businesses, labor groups and other organizations can work cooperatively with OSHA. To find out more about any of the following programs, visit www.osha.gov/cooperativeprograms.

Strategic Partnerships and Alliances

The OSHA Strategic Partnerships (OSP) provide the opportunity for OSHA to partner with employers, workers, professional or trade associations, labor organizations, and/or other interested stakeholders. Through the Alliance Program, OSHA works with groups to develop compliance assistance tools and resources to share with workers and employers, and educate workers and employers about their rights and responsibilities.

Voluntary Protection Programs (VPP)

The VPP recognize employers and workers in private industry and federal agencies who have implemented effective safety and health management programs and maintain injury and illness rates below the national average for their respective industries.

Occupational Safety and Health Training Courses

The OSHA Training Institute partners with 27 OSHA Training Institute Education Centers at 42 locations throughout the United States to deliver courses on OSHA standards and occupational safety and health topics to thousands of students a year. For more information on training courses, visit www.osha.gov/otiec.

OSHA Educational Materials

OSHA has many types of educational materials to assist employers and workers in finding and preventing workplace hazards.

All OSHA publications are free at www.osha.gov/publications and www.osha.gov/ebooks. You can also call 1-800-321-OSHA (6742) to order publications.

Employers and safety and health professionals can sign-up for *QuickTakes*, OSHA's free, twice-monthly online newsletter with the latest news about OSHA initiatives and products to assist in finding and preventing workplace hazards. To sign up visit www.osha.gov/quicktakes.

OSHA REGIONAL OFFICES

Region I
Boston Regional Office
(CT*, ME*, MA, NH, RI, VT*)
JFK Federal Building, Room E340
Boston, MA 02203
(617) 565-9860 (617) 565-9827 Fax

Region II
New York Regional Office
(NJ*, NY*, PR*, VI*)
201 Varick Street, Room 670
New York, NY 10014
(212) 337-2378 (212) 337-2371 Fax

Region III
Philadelphia Regional Office
(DE, DC, MD*, PA, VA*, WV)
The Curtis Center
170 S. Independence Mall West
Suite 740 West
Philadelphia, PA 19106-3309
(215) 861-4900 (215) 861-4904 Fax

Region IV
Atlanta Regional Office
(AL, FL, GA, KY*, MS, NC*, SC*, TN*)
61 Forsyth Street, SW, Room 6T50
Atlanta, GA 30303
(678) 237-0400 (678) 237-0447 Fax

Region V
Chicago Regional Office
(IL*, IN*, MI*, MN*, OH, WI)
230 South Dearborn Street
Room 3244
Chicago, IL 60604
(312) 353-2220 (312) 353-7774 Fax

Region VI
Dallas Regional Office
(AR, LA, NM*, OK, TX)
525 Griffin Street, Room 602
Dallas, TX 75202
(972) 850-4145 (972) 850-4149 Fax
(972) 850-4150 FSO Fax

Region VII
Kansas City Regional Office
(IA*, KS, MO, NE)
Two Pershing Square Building
2300 Main Street, Suite 1010
Kansas City, MO 64108-2416
(816) 283-8745 (816) 283-0547 Fax

Region VIII
Denver Regional Office
(CO, MT, ND, SD, UT*, WY*)
Cesar Chavez Memorial Building
1244 Speer Boulevard, Suite 551
Denver, CO 80204
(720) 264-6550 (720) 264-6585 Fax

Region IX
San Francisco Regional Office
(AZ*, CA*, HI*, NV*, and American Samoa, Guam and the Northern Mariana Islands)
90 7th Street, Suite 18100
San Francisco, CA 94103
(415) 625-2547 (415) 625-2534 Fax

Region X
Seattle Regional Office
(AK*, ID, OR*, WA*)
300 Fifth Avenue, Suite 1280
Seattle, WA 98104
(206) 757-6700 (206) 757-6705 Fax

*These states and territories operate their own OSHA-approved job safety and health plans and cover state and local government employees as well as private sector employees. The Connecticut, Illinois, Maine, New Jersey, New York and Virgin Islands programs cover public employees only. (Private sector workers in these states are covered by Federal OSHA). States with approved programs must have standards that are identical to, or at least as effective as, the Federal OSHA standards.

Note: To get contact information for OSHA area offices, OSHA-approved state plans and OSHA consultation projects, please visit us online at www.osha.gov or call us at 1-800-321-OSHA (6742).

HOW TO CONTACT OSHA

For questions or to get information or advice, to report an emergency, fatality, inpatient hospitalization, amputation, or loss of an eye, or to file a confidential complaint, contact your nearest OSHA office, visit www.osha.gov or call OSHA at 1-800-321-OSHA (6742), TTY 1-877-889-5627.

For assistance, contact us.
We are OSHA. We can help.

OSHA®
www.osha.gov

U.S. Department of Labor

For more information:

Occupational
Safety and Health
Administration

www.osha.gov (800) 321-OSHA (6742)

OSHA® FactSheet

Confined Spaces in Residential Construction

OSHA has developed a standard for Confined Spaces in Construction (29 CFR 1926 Subpart AA) that applies to spaces such as attics, basements, and crawl spaces. This Fact Sheet, developed after consultation with the National Association of Home Builders (NAHB), and a detailed Frequently Asked Questions (FAQs) document, clarify some of the standard's provisions and their application to residential construction work.

OSHA has developed a construction standard for Confined Spaces (29 CFR 1926 Subpart AA) — that applies to any space that meets the following three criteria:

- Is large enough for a worker to enter it;
- Has limited or restricted means of entry or exit; and
- Is not designed for continuous occupancy.

A confined space that contains certain hazardous conditions may be considered a ***permit-required*** confined space under the standard. ***Permit-required*** confined spaces can be immediately dangerous to workers' lives if not properly identified, evaluated, tested and controlled. A ***permit-required*** confined space means a confined space that has one or more of the following characteristics:

- Contains or has the potential to contain a hazardous atmosphere;
- Contains a material that has the potential for engulfing an entrant;
- Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section;
- Contains any other recognized serious safety or health hazard.

How Employers Can Determine if Confined Spaces or Permit-required Confined Spaces Exist

Before beginning work on a residential homebuilding project, each employer must ensure that a competent person identifies all confined spaces in which one or more employees it directs may work, and identifies each space that is a permit-required confined space. The competent person does not have to physically examine each attic, basement or crawl space, provided that the competent person can reliably determine whether the spaces with the same or similar configuration contain a hazard or potential hazard that would require the permit-space classification. The initial evaluation may be done using existing experience and knowledge of the space by the competent person and does not need to be documented. For example, a competent person responsible for inspecting new homes being built to identical specifications with the same materials need not physically inspect each attic separately to determine if it is a permit-required confined space.

How Common Spaces in Residential Construction are Impacted by the Standard

Spaces in a residential home may be considered confined spaces or permit-required confined spaces during the construction or remodeling process. However, the vast majority of the standard's requirements only apply to ***permit-required*** confined spaces, and attics, basements, and crawl spaces in a residential home — three common spaces – will not typically trigger these requirements.

Attics: In many instances, an attic will not be considered a confined space because there is not limited or restricted means for entry and exit. For example, an attic that can be accessed via pull down stairs that resemble the structure of a stationary stairway and do not require an employee to ascend /descend hand-over-hand would not be considered a confined space if there are no impediments to egress.

Attics that are determined to be confined spaces would generally not be ***permit-required*** confined spaces because they typically do not contain the types of hazards or potential hazards that make a confined space a permit-required confined space (those that could impair an entrant's ability to exist the space without assistance).

However, extreme heat in an attic can be considered a serious physical hazard such that the attic could be considered permit-required confined space. OSHA has not quantified how hot it must be to trigger the permit-required confined spaces requirements. However, heat that is extreme enough to cause heat exhaustion (e.g., dizziness, headaches, severe sweating, cramps) may impede an entrant's ability to exit the attic without assistance and would make a confined space permit-required.

Basements: Basements in a residential home that are designed for continuous occupancy by a homeowner are not considered confined spaces under the standard, provided the basement is configured as designed (e.g., has permanent stairs, a walk-out entry/exit, or an egress window installed).

Crawl Spaces: Crawl spaces in a residential home will not typically trigger the majority of the requirements of the standard unless they contain a physical hazard such as an exposed active electric wire.

For Employers

Regardless of the area, the competent person needs to pay particular attention to acute health hazards that may be present when assessing confined spaces, such as toxic (carbon monoxide), flammable, or explosive atmospheres. Safety Data Sheets (SDSs) must be maintained and reviewed to fully assess potential hazards prior to worker entry into a confined space to determine whether it is a permit-required space.

Employers' obligations under the standard will depend, in part, on what "type" of employer they are. However, most of the obligations in the standard apply to ***entry*** employers.

Host employer: The employer who owns or manages the property where the construction work is taking place.

Controlling contractor: The employer who has overall responsibility for construction at the worksite (note that if the controlling contractor owns or manages the property, then it is both a controlling employer and a host employer).

Entry employer (Sub Contractor): Any employer who decides that an employee it directs will enter a ***permit-required*** confined space.

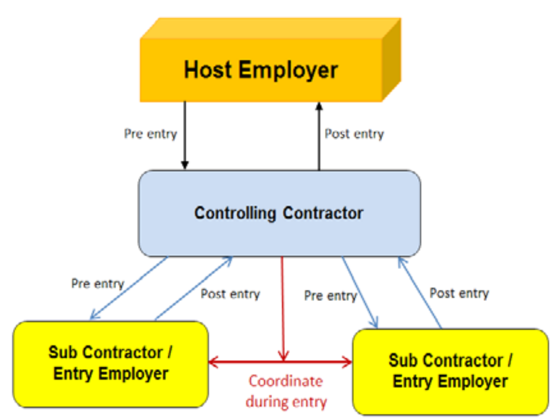
The standard makes the controlling contractor the primary point of contact for information about permit-required confined spaces at the work site. The controlling contractor passes information it has about permit-required confined spaces at the work site on to the employers whose workers will enter the spaces (entry employers).

Likewise, entry employers must give the controlling contractor information about their entry program and hazards they encounter in the space, and the controlling contractor passes that information on to other entry employers. The controlling contractor is also responsible for making sure that employers outside a space know not to create hazards in the space, and that workers from different entry employers working in a space at the same time do not create hazards for each other.

Host/Controlling Employer Obligations

Before entry operations begin, a host employer with the following information must provide it to the controlling contractor:

- Location of each known permit-required confined space;
- Hazards or potential hazards in each space or the reason it is a permit-required confined space; and
- Any precautions that the host employer or any previous controlling contractor/entry employer implemented for the protection of workers in the permit-required confined space.



Note: The above diagram shows the information flow and coordination between these employers

The multi-employer communication requirements only apply to host employers with employees who work at the worksite, regardless of when those workers are at the site and only apply to ***permit-required*** confined spaces. In addition, beyond this duties discussed above, host employers and controlling contractors are not responsible for compliance with the ***permit-required*** confined space program provisions of the standard if they have no reason to anticipate that the employees they direct will enter a permit-required confined space.

Entry Employer Obligations

Inform employees: If a workplace contains a permit-required confined space, the entry employer must inform workers in the vicinity of each space of the location and danger posed by that space. This can be done by posting and positioning warning signs at each possible point of entry, or by other equally effective means. The employer must also either take steps to prevent its employees from entering that space or ensure that entry only occurs through a permit program or as otherwise allowed by the standard (alternative entry procedures).

Personal Protective Equipment: Entry employers allowing an employee to enter a permit space must attempt to eliminate or isolate the hazards in the space. When engineering and work-practice controls do not adequately protect employees, they must assess the space to determine what personal protective equipment (PPE) is needed to protect workers. Entry employers must provide workers with the required PPE and proper training on its use and about any related hazards before the work starts.

Training: The standard requires employers to ensure that their workers know about the existence and location of, and dangers posed by, each permit-required confined space, and that they may not enter such spaces without authorization. Entry employers must train workers involved in permit-required confined space operations so that they can perform their duties safely and understand the hazards in permit spaces and the methods used to isolate, control or protect workers. Workers not authorized to perform entry rescues must be trained on the dangers of attempting such rescues.

Written permit-required confined space entry program: The permit-required confined space program must establish a system for preparing, using, and canceling entry permits, which are written or printed documents that allow and control entry into permit spaces.

Rescue: Entry employers must ensure that properly trained rescue and emergency services are available before entry into permit-required confined spaces. For a full discussion of an entry employer's obligations to provide rescue, see OSHA's Fact Sheet entitled: Is 911 your Confined Space Rescue Plan?

Resources

For additional information see OSHA's Confined Spaces in Construction webpage at www.osha.gov/confinedspaces.

How to Contact OSHA

For questions or to get information or advice, to find out how to contact OSHA's free on-site consultation program, order publications, report a fatality or severe injury, or to file a confidential complaint, visit www.osha.gov or call 1-800-321-OSHA (6742).

This fact sheet was developed by OSHA after consultation with NAHB. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: 1-877-889-5627.

For assistance, contact us. We can help. It's confidential.

OSHA® Occupational Safety and Health Administration

www.osha.gov (800) 321-OSHA (6742)

DEPARTMENT OF LABOR · UNITED STATES OF AMERICA

U.S. Department of Labor

DOC FS-3914 06/2017

OSHA® FactSheet

CONTROL SILICA DUST
Breathe Easier

CONTROL OF SILICA DUST IN CONSTRUCTION

Handheld Power Saws Used to Cut Fiber-Cement Board

Using a handheld circular saw to cut fiber-cement board can generate *respirable crystalline silica* dust. When inhaled over time, the small particles of silica can irreversibly damage the lungs. This fact sheet describes dust controls to minimize the amount of airborne dust when using handheld circular saws with a blade diameter of 8 inches or less to cut fiber-cement board as listed in Table 1 of the Respirable Crystalline Silica Standard for Construction, 29 CFR 1926.1153.

Engineering Control Method: Vacuum Dust Collection System

Fiber-cement board is a composite material made from cement, sand, and cellulose fibers. Cutting fiber-cement boards with high speed circular saws generates airborne dust that contains respirable crystalline silica. Specialty saw blades having 4–8 teeth reduce the amount of respirable dust compared to standard masonry blades. Blades with polycrystalline diamond tips are recommended for longer cutting life.

Vacuum Dust Collection System (VDCS)

A commercially-available VDCS can be used to control dust when cutting fiber-cement board outdoors with a handheld power saw equipped with a blade of 8 inches or less.

The VDCS includes:

- A handheld circular saw with a partially enclosed saw blade equipped with either an integrated dust collection port, or a commercially available adapter installed per manufacturer's directions.
- A fiber-cement saw blade less than 8 inches in diameter.
- A vacuum that is recommended by the tool manufacturer with enough air flow to capture dust at the cutting point. Use a vacuum rated at 80 cubic feet per minute or higher for effective capture.
- Filter with a 99 percent or greater efficiency in the vacuum exhaust. HEPA filters may be used but are not required. For longer filter life, use of a disposable filter bag or cyclone pre-filter is recommended.
- A vacuum exhaust hose capable of providing the airflow recommended by the tool manufacturer. A 1.25″ to 2″ diameter vacuum hose is typically adequate.

Photo courtesy of NIOSH

Worker cutting fiber-cement board outdoors using a handheld power saw with a vacuum dust collection system. The dust collection system consists of a saw with a partially enclosed blade, vacuum hose, and dust collector positioned between the saw horses. Note that while this system is effective at controlling dust, some dust is still visible.

A VDCS is most effective when workers are properly trained and use good work practices. Focus on the following areas:

- **Keep** the vacuum hose clear and free of debris, kinks, and tight bends.

- **Turn** the vacuum off and on regularly to reduce dust buildup on the filter, if it is not self-cleaning. For best results, use a vacuum with an actuator switch that allows the vacuum to be powered on and off using the saw.
- **Change** vacuum-collection bags at least as often as the manufacturer recommends.
- **Set up** a regular schedule for maintenance.
- **Avoid** exposure to dust when changing vacuum bags and cleaning or replacing air filters.

Compressed Air. Unless there is a ventilation system that effectively captures the dust cloud, do not use compressed air or blowers to clean surfaces, clothing, or filters because it can increase exposure to silica. Instead, clean only with a HEPA filter-equipped vacuum or by wet methods.

Respiratory Protection

When properly used, a VDCS can effectively control silica dust. Therefore, Table 1 does not require use of respiratory protection when cutting fiber-cement board **outdoors** using a handheld power saw with a blade 8 inches or smaller in diameter. For **indoor** use, or with blades **larger** than 8 inches, Table 1 does not apply and the employers must conduct an exposure assessment and may need to take additional action, including the implementation of a respiratory protection program.

Additional Information

For more information, visit www.osha.gov/silica and see the OSHA Fact Sheet on the Crystalline Silica Rule for Construction, and the Small Entity Compliance Guide for the Respirable Crystalline Silica Standard for Construction.

OSHA can provide compliance assistance through a variety of programs, including technical assistance about effective safety and health programs, workplace consultations, and training and education.

OSHA's On-Site Consultation Program offers free, confidential occupational safety and health services to small and medium-sized businesses in all states and several territories across the country, with priority given to high-hazard worksites. On-Site consultation services are separate from enforcement and do not result in penalties or citations. To locate the OSHA On-Site Consultation Program nearest you, visit www.osha.gov/consultation.

Workers' Rights

Workers have the right to:

- Working conditions that do not pose a risk of serious harm.
- Receive information and training (in a language and vocabulary the worker understands) about workplace hazards, methods to prevent them, and the OSHA standards that apply to their workplace.
- Review records of work-related injuries and illnesses.
- File a complaint asking OSHA to inspect their workplace if they believe there is a serious hazard or that their employer is not following OSHA's rules. OSHA will keep all identities confidential.
- Exercise their rights under the law without retaliation, including reporting an injury or raising health and safety concerns with their employer or OSHA. If a worker has been retaliated against for using their rights, they must file a complaint with OSHA as soon as possible, but no later than 30 days.

For additional information, see OSHA's Workers page.

How to Contact OSHA

Under the Occupational Safety and Health Act of 1970, employers are responsible for providing safe and healthful workplaces for their employees. OSHA's role is to ensure these conditions for America's working men and women by setting and enforcing standards, and providing training, education and assistance. For more information, visit www.osha.gov or call OSHA at 1-800-321-OSHA (6742), TTY 1-877-889-5627.

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

U.S. Department of Labor

OSHA® Occupational Safety and Health Administration

DSG FS-3927 12/2017

OSHA® FactSheet

CONTROL SILICA DUST
Breathe Easier

CONTROL OF SILICA DUST IN CONSTRUCTION

Drivable Saws

Using a drivable saw to cut masonry, concrete, stone, or other silica-containing materials can generate *respirable crystalline silica* dust. When inhaled, the small particles of silica can irreversibly damage the lungs. This fact sheet describes dust controls that can be used to minimize the amount of airborne dust when using drivable saws as listed in Table 1 of the Respirable Crystalline Silica Standard for Construction, 29 CFR 1926.1153.

Engineering Control Method: Water continuously fed to saw blade

Wet Cutting

Wet cutting is an effective method to reduce exposure to silica dust when outdoors using drivable saws equipped with an integrated water delivery system. This system directs a continuous stream of water onto the blade where it wets the materials being cut and reduces the amount of dust generated. These saws have built-in water tanks, or water is supplied to the saw from a source such as a hose connected to a faucet or portable tank. Water flow rates must be sufficient to minimize the release of visible dust.

Photo courtesy of Husqvarna

A construction worker cutting pavement using a drivable saw with an integrated water delivery system.

The saw must be operated and maintained in accordance with manufacturers' instructions to minimize dust emissions. Focus on the following areas:

- **Check** that hoses are securely connected and are not cracked or broken.
- **Adjust** nozzles so that water goes to the blade and wets the cutting area.
- **Inspect** the saw blade before use to be sure it is in good condition and does not show excessive wear.

Clean up any slurry produced during wet cutting to prevent the slurry from drying and releasing silica dust into the air. Wet slurry can be cleaned up using shovels or a wet vacuum equipped with a HEPA filter.

If employers operate drivable saws indoors or in an enclosed area, they must conduct an exposure assessment and may need to take additional action.

Electrical Safety. Where water is used to control dust, electrical safety is a particular concern. Use ground-fault circuit interrupters (GFCIs) and watertight, sealable electrical connectors for electric tools and equipment on construction sites.

Respiratory Protection

When properly used outdoors, wet methods can effectively control silica dust. Therefore, Table 1 in the silica standard does not require use of respiratory protection when using wet methods for outdoor operation of drivable saws. Table 1 does not apply to drivable saws used indoors or in enclosed areas. Therefore, if drivable saws are operated indoors or in an enclosed area, employers must conduct an exposure assessment and may need to take additional action including the use of respiratory protection.

When respirators are required, employers must put in place a written respiratory protection program in accordance with OSHA's Respiratory Protection standard 29 CFR 1910.134.

Additional Information

For more information, visit www.osha.gov/silica and see the OSHA Fact Sheet on the Crystalline Silica Rule for Construction, and the Small Entity Compliance Guide for the Respirable Crystalline Silica Standard for Construction.

OSHA can provide compliance assistance through a variety of programs, including technical assistance about effective safety and health programs, workplace consultations, and training and education. OSHA's On-Site Consultation Program offers free, confidential occupational safety and health services to small and medium-sized businesses in all states and several territories across the country, with priority given to high-hazard worksites. On-Site consultation services are separate from enforcement and do not result in penalties or citations. To locate the OSHA On-Site Consultation Program nearest you, visit www.osha.gov/consultation.

Workers' Rights

Workers have the right to:

- Working conditions that do not pose a risk of serious harm.
- Receive information and training (in a language and vocabulary the worker understands) about workplace hazards, methods to prevent them, and the OSHA standards that apply to their workplace.
- Review records of work-related injuries and illnesses.
- File a complaint asking OSHA to inspect their workplace if they believe there is a serious hazard or that their employer is not following OSHA's rules. OSHA will keep all identities confidential.
- Exercise their rights under the law without retaliation, including reporting an injury or raising health and safety concerns with their employer or OSHA. If a worker has been retaliated against for using their rights, they must file a complaint with OSHA as soon as possible, but no later than 30 days.

For additional information, see OSHA's Workers page.

How to Contact OSHA

Under the Occupational Safety and Health Act of 1970, employers are responsible for providing safe and healthful workplaces for their employees. OSHA's role is to ensure these conditions for America's working men and women by setting and enforcing standards, and providing training, education and assistance. For more information, visit www.osha.gov or call OSHA at 1-800-321-OSHA (6742), TTY 1-877-889-5627.

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

U.S. Department of Labor

OSHA® **Occupational Safety and Health Administration**

DSG FS-3928 12/2017

OSHA® FactSheet

CONTROL SILICA DUST
Breathe Easier

CONTROL OF SILICA DUST IN CONSTRUCTION

Rig-Mounted Core Saws or Drills

The use of rig-mounted core saws or drills to cut holes in concrete, masonry, or other silica-containing materials can generate *respirable crystalline silica* dust. When inhaled over time, the small particles of silica can irreversibly damage the lungs. This fact sheet describes methods to minimize the amount of airborne dust when using core saws or drills as listed in Table 1 of the Respirable Crystalline Silica Standard for Construction, 29 CFR 1926.1153.

Engineering Control Method: Water applied to cutting surface

Wet Methods

Wet cutting is an effective way to reduce the amount of silica dust when using a rig-mounted core saw or drill. Many types of core saws and drills come equipped with an integrated water delivery system that directs a continuous stream onto the blade/drill bit where it wets the material being drilled and reduces the amount of dust generated. Water flow rates must be sufficient to minimize the release of visible dust.

The rig-mounted core saw or drill must be operated and maintained in accordance with manufacturer's instructions to minimize dust emissions. Focus on the following areas:

- **Check and make sure** that hoses are securely connected and are not cracked or broken.
- **Adjust** nozzles so that water goes to the blade and wets the cutting area.
- **Inspect** the saw blade/drill bit to be sure it is in good condition and does not show excessive wear.

Clean up any slurry produced to prevent the slurry from drying and releasing silica dust into the air. Wet slurry can be cleaned up using, for example, shovels or a wet vacuum equipped with a HEPA filter.

Indoors or in Enclosed Areas

Using wet methods indoors or in an enclosed area may not reliably keep exposure low, so extra ventilation may be needed to reduce visible airborne dust. Extra ventilation can be supplied by using:

- Exhaust trunks
- Portable exhaust fans
- Air ducts
- Other means of mechanical ventilation

Ensure air flow is not impeded by the movements of employees during work, or by the opening or closing of doors and windows. Position the ventilation to move contaminated air away from workers' breathing zones.

Respiratory Protection

When properly used, wet methods can effectively control exposure to silica dust. Therefore, Table 1 does not require use of respiratory protection when operating rig-mounted core saws and drills using wet methods.

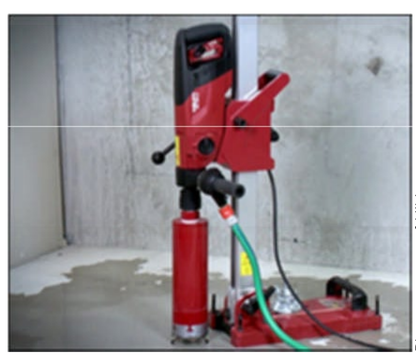


Photo courtesy of Hilti

Example of a core saw with integrated water delivery system.

Electrical Safety. Where water is used to control dust, electrical safety is a particular concern. Use ground-fault circuit interrupters (GFCIs) and watertight, sealable electrical connectors for electric tools and equipment on construction sites.

Vacuum Dust Collection System (VDCS)

For situations in which wet methods are not feasible, some rig-mounted core saws or drills come equipped with a VDCS to capture the dust generated when sawing. When operated with a VDCS instead of wet methods, Table 1 does not apply and therefore the employer must conduct an exposure assessment and may need to take additional actions such as implementing a respiratory protection program.

When respirators are required, employers must put in place a respiratory protection program in accordance with OSHA's Respiratory Protection Standard, 29 CFR 1910.134.

Additional Information

For more information, visit www.osha.gov/silica and see the OSHA Fact Sheet on the Crystalline Silica Rule for Construction, and the Small Entity Compliance Guide for the Respirable Crystalline Silica Standard for Construction.

OSHA can provide compliance assistance through a variety of programs, including technical assistance about effective safety and health programs, workplace consultations, and training and education. OSHA's On-Site Consultation Program offers free, confidential occupational safety and health services to small and medium-sized businesses in all states and several territories across the country, with priority given to high-hazard worksites. On-Site consultation services are separate from enforcement and do not result in penalties or citations. To locate the OSHA On-Site Consultation Program nearest you, visit www.osha.gov/consultation.

Workers' Rights

Workers have the right to:

- Working conditions that do not pose a risk of serious harm.
- Receive information and training (in a language and vocabulary the worker understands) about workplace hazards, methods to prevent them, and the OSHA standards that apply to their workplace.
- Review records of work-related injuries and illnesses.
- File a complaint asking OSHA to inspect their workplace if they believe there is a serious hazard or that their employer is not following OSHA's rules. OSHA will keep all identities confidential.
- Exercise their rights under the law without retaliation, including reporting an injury or raising health and safety concerns with their employer or OSHA. If a worker has been retaliated against for using their rights, they must file a complaint with OSHA as soon as possible, but no later than 30 days.

For additional information, see OSHA's Workers page.

How to Contact OSHA

Under the Occupational Safety and Health Act of 1970, employers are responsible for providing safe and healthful workplaces for their employees. OSHA's role is to ensure these conditions for America's working men and women by setting and enforcing standards, and providing training, education and assistance. For more information, visit www.osha.gov or call OSHA at 1-800-321-OSHA (6742), TTY 1-877-889-5627.

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

U.S. Department of Labor

OSHA® Occupational Safety and Health Administration

DSG FS-3929 12/2017

OSHA® FactSheet

CONTROL SILICA DUST
Breathe Easier

CONTROL OF SILICA DUST IN CONSTRUCTION

Vehicle-Mounted Drilling Rigs for Rock and Concrete

Using drilling rigs mounted on trucks, crawlers, or other vehicles to drill into rock or concrete can generate *respirable crystalline silica* dust. When inhaled, the small particles of silica can irreversibly damage the lungs. This fact sheet describes dust controls that can be used to minimize the amount of airborne dust when using vehicle-mounted drilling rigs for rock and concrete as listed in Table 1 of the Respirable Crystalline Silica Standard for Construction, 29 CFR 1926.1153.

Engineering Control Method: Dust collection systems with water sprays at the discharge point ***OR*** Operator isolation in an enclosed cab with water on drill bit

Dust Collection Systems/Wet Methods

Dust-collecting equipment for vehicle-mounted drills includes a movable duct attached to a close capture hood or shroud around the drill bit, and a flexible rubber skirt that encloses the drill hole opening and captures cuttings that come through the hole.

Dusty air is pulled from inside the shroud through a flexible duct to primary and secondary filter media. The primary filter or dust separator often includes a self-cleaning back-pulse feature that dumps the collected particles to the ground.

Secondary release of particles to the air is minimized by a low-flow water spray at the discharge point. Equipment without these controls can be retrofitted by the manufacturer or a mechanical shop.

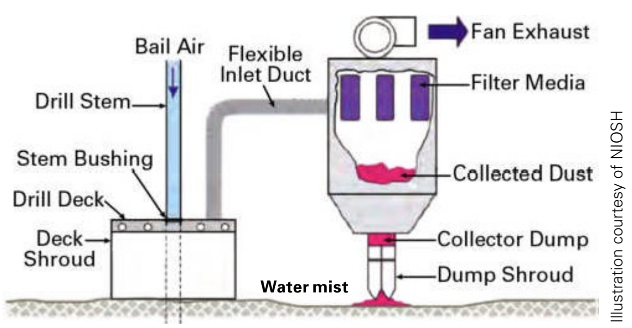


Diagram of dust control systems for rock drills, including deck shrouds for the drill bit and the discharge or dump shroud.

The dust collection systems are most effective when good design and maintenance practices are implemented by skilled and properly trained operators.

- **Deck Shroud Design.** Use a one-piece shroud that fully encloses the area around the drill bit. Repair or replace torn or missing pieces and make sure that gaps are sealed.
- **Adequate Airflow.** The dust collector should be designed to draw more air than the bailing air used to flush out cuttings from the drill hole. The dust collector air volume should be three times the bailing air volume.
- **Water Injection at Dust Collector Exhaust.** Adding small amounts of water into the air discharge duct can significantly reduce the release of silica dust in the dump area. When adding water to the discharge duct, slowly increase the rate until there is no visible dust. Check the duct interior daily and clear dust deposits that may form in it.
- **Fan Exhaust Placement.** Extend the dust collection system exhaust port so that the dusty air releases *away* from workers. Clogged ducts and filters restrict dust collector airflow. Remove dust that collects on filters and in flexible ducts.
- **Fan Maintenance.** Dust can damage the fan motor, blades, and drill bits. Replace worn parts. Check for excessive vibration in fan belts, coupling, and belt alignment, and worn or broken belts, blades, mounting bolts, and bushings. Repair and maintain as needed.
- **Filters.** Replace clogged or damaged air filters and avoid exposure to dust when cleaning or replacing filters.

Operator Isolation/Wet Methods

The alternative to using a dust-collection system is operator isolation in an enclosed cab or booth, along with applying water to the drill bit during cutting to reduce dust.

Drill operators using vehicle-mounted rigs with enclosed cabs can reduce their silica exposure by staying inside the cab during drilling. The cab must:

- Be well-sealed and well-ventilated using positive pressure.
- Have door jambs, window grooves, powerline entries, and other joints that work properly and are tightly sealed.
- Have heating and air conditioning so that operators can keep windows and doors closed.
- Use an intake air filter with a minimum MERV-16 rating (at least 95% in the 0.3-10.0µm range).
- Be kept free from settled dust by regular cleaning and maintenance to prevent dust from become airborne inside the enclosure.

Photo courtesy of NIOSH

Vehicle-mounted drilling rigs with dust collection system around drill bit and low-flow water spray to wet the dust discharged from the dust collector. The enclosed operator's cab is on the right. The dust collection system is on the left.

In wet drilling systems that use forced air (bailing air) to flush cuttings from the hole, water is added to the bailing air at the drill head. Small particles join to form larger particles, thus reducing escaping respirable dust. The proper use of wet methods requires a trained and skilled operator. Too much water can create mud slurry at the bottom of the hole that can trap the bit, coupling, and steel extensions. Too little water will not effectively control escaping dust.

Respiratory Protection

When properly used, dust collection systems and operator isolation can effectively control exposure to silica dust.

Therefore, this Table 1 entry does not require the use of respiratory protection when operating drilling rigs equipped with a dust collection system or from within an enclosed cab.

Additional Information

For more information, visit www.osha.gov/silica and see the OSHA Fact Sheet on the Crystalline Silica Rule for Construction, and the Small Entity Compliance Guide for the Respirable Crystalline Silica Standard for Construction.

OSHA can provide compliance assistance through a variety of programs, including technical assistance about effective safety and health programs, workplace consultations, and training and education. OSHA's On-Site Consultation Program offers free, confidential occupational safety and health services to small and medium-sized businesses in all states and several territories across the country, with priority given to high-hazard worksites. On-Site consultation services are separate from enforcement and do not result in penalties or citations. To locate the OSHA On-Site Consultation Program nearest you, visit www.osha.gov/consultation.

How to Contact OSHA

Under the Occupational Safety and Health Act of 1970, employers are responsible for providing safe and healthful workplaces for their employees. OSHA's role is to ensure these conditions for America's working men and women by setting and enforcing standards, and providing training, education and assistance. For more information, visit www.osha.gov or call OSHA at 1-800-321-OSHA (6742), TTY 1-877-889-5627.

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

U.S. Department of Labor

OSHA® Occupational Safety and Health Administration

DSG FS-3931 12/2017

OSHA® FactSheet

CONTROL SILICA DUST
Breathe Easier

CONTROL OF SILICA DUST IN CONSTRUCTION

Walk-Behind Milling Machines and Floor Grinders

Using walk-behind milling machines and floor grinders on concrete or other silica-containing materials can generate *respirable crystalline silica* dust. When inhaled, the small particles of silica can irreversibly damage the lungs. This fact sheet describes dust controls that can be used to minimize the amount of airborne dust when using walk-behind milling machines and floor grinders as listed in Table 1 of the Respirable Crystalline Silica Standard for Construction, 29 CFR 1926.1153.

Engineering Control Method: Wet methods ***OR*** Vacuum Dust Collection Systems

Two methods for controlling dust when using walk-behind milling machines and floor grinders are: (1) an integrated water delivery system that continuously delivers water to the cutting surface, or (2) a commercially available vacuum dust collection system. In each case the milling machine or grinder must be operated and maintained in accordance with manufacturer's instructions to minimize dust emissions.

Wet Methods

Use of wet methods effectively reduces the amount of silica dust that becomes airborne when milling or grinding silica containing materials because it controls the exposure at its source. The silica standard specifies the use of walk-behind milling machines and floor grinders that are equipped with an integrated water delivery system that continuously delivers water to the cutting surface.

Employers are responsible for keeping equipment in good condition to minimize dust and for training workers on how to use the equipment. Make sure to:

- **Check** that hoses are securely connected and are not cracked or broken.
- **Adjust** nozzles so that water goes to the grinding surface or cut point. Water flow rates must be sufficient to minimize the release of visible dust.
- **Ensure** an adequate supply of water is available.

Clean up any slurry produced to prevent the slurry from drying and releasing silica dust into the air. Wet slurry can be cleaned up using, for example, shovels or a wet vacuum equipped with a HEPA filter.

Worker using water to suppress dust while operating floor grinder.

Electrical Safety. Where water is used to control dust, electrical safety is a particular concern. Use ground-fault circuit interrupters (GFCIs) and watertight, sealable electrical connectors for electric tools and equipment on construction sites.

Vacuum Dust Collection System (VDCS)

Commercially available VDCSs have been shown to reduce silica exposures. The VDCS must include a:

- Hood or shroud that is recommended by the tool manufacturer.
- Vacuum that is recommended by the tool manufacturer with enough suction to capture dust at the cutting point.
- Filter with a 99 percent or greater efficiency in the vacuum exhaust and a filter cleaning mechanism.
- Vacuum exhaust hose capable of providing the airflow recommended by the tool manufacturer. A 1.5" to 2" diameter vacuum exhaust hose is typically adequate.

Photo courtesy of OSHA

Worker milling granite floor indoors with milling machine and vacuum dust collection system (background).

Proper operation should:

- **Keep** the vacuum hose clear and free of debris, kinks and tight bends.
- **Turn** the vacuum off and on regularly to reduce dust buildup on the filter, if it is not self-cleaning.
- **Change** vacuum-collection bags as needed or at least as often as recommended by the manufacturer.
- **Avoid** exposure to dust when changing vacuum bags and cleaning or replacing air filters.
- **Set** a regular schedule for maintenance as recommended by the manufacturer.

Use of Compressed Air: Unless there is a ventilation system that effectively captures the dust cloud, do not use compressed air or blowers to clean surfaces, clothing or filters because it can increase exposure to silica. Instead, clean with a HEPA filter-equipped vacuum or by wet methods.

Respiratory Protection

When properly used, wet methods and a VDCS can effectively control exposure to silica dust. Therefore, Table 1 in the construction standard does not require the use of respiratory protection when operating walk behind milling machines and floor grinders using wet methods or a VDCS.

Indoors or in Enclosed Spaces

When using walk-behind milling machines or floor grinders equipped with a VCDS indoors, or in an enclosed area where dust can build up, a HEPA-filtered vacuum must be used between passes to remove loose dust.

Using wet methods or a VDCS indoors or in an enclosed area may not reliably keep exposure low, so extra ventilation may be needed to reduce visible airborne dust. Extra ventilation can be supplied by using:

- Exhaust trunks
- Portable exhaust fans
- Air ducts
- Other means of mechanical ventilation

Ensure air flow is not impeded by the movements of employees during work, or by the opening or closing of doors and windows. Position the ventilation to move contaminated air away from the workers' breathing zones.

Additional Information

For more information, visit www.osha.gov/silica and see the OSHA Fact Sheet on the Crystalline Silica Rule for Construction, and the Small Entity Compliance Guide for the Respirable Crystalline Silica Standard for Construction.

OSHA can provide compliance assistance through a variety of programs, including technical assistance about effective safety and health programs, workplace consultations, and training and education. OSHA's On-Site Consultation Program offers free, confidential occupational safety and health services to small and medium-sized businesses in all states and several territories across the country, with priority given to high-hazard worksites. On-Site consultation services are separate from enforcement and do not result in penalties or citations. To locate the OSHA On-Site Consultation Program nearest you, visit www.osha.gov/consultation.

Workers' Rights

Workers have the right to:

- Working conditions that do not pose a risk of serious harm.
- Receive information and training (in a language and vocabulary the worker understands) about workplace hazards, methods to prevent them, and the OSHA standards that apply to their workplace.
- Review records of work-related injuries and illnesses.
- File a complaint asking OSHA to inspect their workplace if they believe there is a serious hazard or that their employer is not following OSHA's rules. OSHA will keep all identities confidential.
- Exercise their rights under the law without retaliation, including reporting an injury or raising health and safety concerns with their employer or OSHA. If a worker has been retaliated against for using their rights, they must file a complaint with OSHA as soon as possible, but no later than 30 days.

For additional information, see OSHA's Workers page.

How to Contact OSHA

Under the Occupational Safety and Health Act of 1970, employers are responsible for providing safe and healthful workplaces for their employees. OSHA's role is to ensure these conditions for America's working men and women by setting and enforcing standards, and providing training, education and assistance. For more information, visit www.osha.gov or call OSHA at 1-800-321-OSHA (6742), TTY 1-877-889-5627.

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

U.S. Department of Labor

OSHA® Occupational Safety and Health Administration

DSG FS-3932 12/2017

OSHA® FactSheet

CONTROL SILICA DUST
Breathe Easier

CONTROL OF SILICA DUST IN CONSTRUCTION

Large Drivable Milling Machines (Half Lane and Larger)

Using large drivable milling machines (half lane or more) on asphalt pavement, concrete, and other silica-containing materials can generate *respirable crystalline silica* dust. When inhaled, the small particles of silica can irreversibly damage the lungs. This fact sheet describes dust controls that can be used to minimize the amount of airborne dust when using large drivable milling machines as listed in Table 1 of the Respirable Crystalline Silica Standard for Construction, 29 CFR 1926.1153.

Engineering Control Method: Exhaust ventilation on drum enclosure with water spray ***OR*** Water spray with surfactant (for cuts less than four inches)

Wet methods reduce the amount of silica dust that becomes airborne when using milling machines, because they control exposure at the source. OSHA has determined that it is necessary to supplement water sprays with a dust suppressant additive or with exhaust ventilation. Water amended with a foam additive or surfactant performs better for dust suppression (surfactants are essentially equivalent to dish soap). The soap breaks the surface tension and softens the water, which improves silica dust capture.

Large drivable milling machines can be equipped with a combination of water sprays, exhaust ventilation and surfactants to effectively control silica dust. The exact combination varies with milling depth and substrate material. For cuts of:

- ***Four inches or less in depth on any substrate***, Table 1 includes two options. Employers may use a machine equipped with exhaust ventilation on the drum enclosure and supplemental water sprays designed to suppress dust; OR they may use a machine equipped with supplemental water spray designed to suppress dust. In the second option the water must be combined with a surfactant.
- ***More than four inches on asphalt only,*** Table 1 requires the use of exhaust ventilation on the drum enclosure and supplemental water sprays designed to suppress dust.
- ***More than four inches in depth on substrates other than asphalt*** are not included on Table 1. The control techniques described above can be used to reduce dust exposures, however, the employer must conduct an exposure assessment and may need to take additional actions.

Photo courtesy of NIOSH

Cutting drum with enclosure on large milling machine.

Photo courtesy U.S. Air Force, Beth Holliker

Milling machine milling asphalt road and loading debris into haul truck.

Wet Methods

Large milling machines currently come equipped with water spray systems for dust suppression. The machine must be operated and maintained to minimize dust emissions. Make sure to:

- **Rinse or replace** water filters according to the manufacturers' instructions to ensure they are clean and not clogged.
- **Adjust** the location and orientation of spray nozzles to direct water to the front of the cutter drum, primary (collection) conveyor, secondary (loading) conveyor, discharge pipe, and transfer points.
- **Check** that nozzles are not clogged and spray patterns effectively suppress dust.
- **Conduct** routine inspections to be sure that the system components are working properly.

Exhaust Ventilation

The drum housing and conveyors on the milling machine enclose the cutter drum and conveyor belts. A well-enclosed drum housing and conveyor system can reduce workers' dust exposure. Typical ventilation controls designed to reduce dust emissions from a piece of equipment consist of a hood, fan, ductwork, and dust collector.

Employers are responsible for keeping equipment in good working condition to minimize dust. Employers must also ensure that workers are properly trained on operating the equipment and reducing exposures through good work practices. Focus on the following:

- **Ensure** that the ventilation control has enough velocity to prevent dust from settling and plugging the flow.
- **Check** flashing placement at transfer points and making sure it is in good working condition.
- **Check to ensure** that there are no gaps or leaks around conveyor enclosures and ductwork.
- **Replace** worn cutting teeth.
- **Conduct** routine inspections to be sure that the system components are working properly.

Respiratory Protection

When properly used, wet methods and exhaust ventilation can effectively control exposure to silica dust. Therefore, Table 1 in the silica standard for construction does not require use of respiratory protection when operating large drivable milling machines equipped with the dust controls described in this fact sheet.

Additional Information

For more information, visit www.osha.gov/silica and see the OSHA Fact Sheet on the Crystalline Silica Rule for Construction, and the Small Entity Compliance Guide for the Respirable Crystalline Silica Standard for Construction.

OSHA can provide compliance assistance through a variety of programs, including technical assistance about effective safety and health programs, workplace consultations, and training and education. OSHA's On-Site Consultation Program offers free, confidential occupational safety and health services to small and medium-sized businesses in all states and several territories across the country, with priority given to high-hazard worksites. On-Site consultation services are separate from enforcement and do not result in penalties or citations. To locate the OSHA On-Site Consultation Program nearest you, visit www.osha.gov/consultation.

How to Contact OSHA

Under the Occupational Safety and Health Act of 1970, employers are responsible for providing safe and healthful workplaces for their employees. OSHA's role is to ensure these conditions for America's working men and women by setting and enforcing standards, and providing training, education and assistance. For more information, visit www.osha.gov or call OSHA at 1-800-321-OSHA (6742), TTY 1-877-889-5627.

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

U.S. Department of Labor

Occupational Safety and Health Administration

DSG FS-3934 12/2017

OSHA® FactSheet

CONTROL SILICA DUST
Breathe Easier

CONTROL OF SILICA DUST IN CONSTRUCTION
Crushing Machines

Using crushing machines at construction sites to reduce the size of large rocks, concrete, or construction rubble can generate *respirable crystalline silica* dust. When inhaled, the small particles of silica can irreversibly damage the lungs. This fact sheet describes dust controls that can be used to minimize the amount of airborne dust when using crushing machines as listed in Table 1 of the Respirable Crystalline Silica Standard for Construction 29 CFR 1926.1153.

Engineering Control Method: Wet Methods ***AND*** Operator Isolation

The use of water sprays or mists for dust suppression at the points where dust is generated (e.g., hoppers, conveyers, sieves/sizing or vibrating components, and discharge points) can control dust exposures when operating crushers. In addition, operator isolation through the use of a remote control station or ventilated booth that provides fresh, climate-controlled air to the operator must also be used to control exposure when operating crushers at construction sites.

Photo courtesy of Screen Machine Industries

Crushing machine being loaded with construction debris by an excavator.

Wet Methods

Wet spray methods can greatly reduce the silica exposure levels of operators and laborers who work near crushers, tending the equipment, removing jammed material from hoppers, picking debris out of the material stream, and performing other tasks.

The crusher must be operated and maintained in accordance with the manufacturer's instructions to minimize dust emissions. Make sure to:

- **Locate** nozzles upstream of dust generation points.
- **Position** nozzles to thoroughly wet the material.
- **Ensure** the volume and size of droplets is adequate to sufficiently wet the material (optimal droplet size is between 10 and 150 μm).
- **Ensure** nozzles provide complete water coverage but are not so far that the water is carried away by wind.

Operator Isolation

Operator isolation for crushing machines includes using either an enclosed booth or a remote control station. Operators using crushing machines with enclosed cabs can limit their silica exposure by staying inside the cab during crushing operations. The enclosed cab must:

- Be well-sealed and well-ventilated using positive pressure.
- Have door jambs, window grooves, power-line entries and other joints that work properly and are tightly sealed.
- Have heating and air conditioning so that operators can keep windows and doors closed.
- Use an intake air filter with a minimum MERV-16 rating (at least 95 percent in the 0.3-10.0 μm range).

- Be kept free from settled dust by regular cleaning and maintenance to prevent dust from become airborne inside the enclosed booth.

An alternative method for operator isolation is to use a remote control station located a sufficient distance upwind to limit exposure to silica containing dust.

Respiratory Protection

When properly used, water sprays with either ventilated booths or remote control stations can in most cases effectively limit exposure to airborne dust. Therefore, Table 1 in the silica standard for construction does not require use of respiratory protection when using crushers at construction sites when the machines are equipped with water sprays along with either control booths or remote controls stations.

Additional Information

For more information, visit www.osha.gov/silica and see the OSHA Fact Sheet on the Crystalline Silica Rule for Construction, and the Small Entity Compliance Guide for the Respirable Crystalline Silica Standard for Construction.

OSHA can provide compliance assistance through a variety of programs, including technical assistance about effective safety and health programs, workplace consultations, and training and education. OSHA's On-Site Consultation Program offers free, confidential occupational safety and health services to small and medium-sized businesses in all states and several territories across the country, with priority given to high-hazard worksites. On-Site consultation services are separate from enforcement and do not result in penalties or citations. To locate the OSHA On-Site Consultation Program nearest you, visit www.osha.gov/consultation.

Workers' Rights

Workers have the right to:

- Working conditions that do not pose a risk of serious harm.
- Receive information and training (in a language and vocabulary the worker understands) about workplace hazards, methods to prevent them, and the OSHA standards that apply to their workplace.
- Review records of work-related injuries and illnesses.
- File a complaint asking OSHA to inspect their workplace if they believe there is a serious hazard or that their employer is not following OSHA's rules. OSHA will keep all identities confidential.
- Exercise their rights under the law without retaliation, including reporting an injury or raising health and safety concerns with their employer or OSHA. If a worker has been retaliated against for using their rights, they must file a complaint with OSHA as soon as possible, but no later than 30 days.

For additional information, see OSHA's Workers page.

How to Contact OSHA

Under the Occupational Safety and Health Act of 1970, employers are responsible for providing safe and healthful workplaces for their employees. OSHA's role is to ensure these conditions for America's working men and women by setting and enforcing standards, and providing training, education and assistance. For more information, visit www.osha.gov or call OSHA at 1-800-321-OSHA (6742), TTY 1-877-889-5627.

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

U.S. Department of Labor

OSHA® Occupational Safety and Health Administration

DSG FS-3935 12/2017

OSHA® FactSheet

CONTROL SILICA DUST
Breathe Easier

CONTROL OF SILICA DUST IN CONSTRUCTION

Heavy Equipment and Utility Vehicles Used During Demolition Activities

Using heavy equipment and utility vehicles for tasks such as demolishing, abrading, or fracturing silica-containing materials such as brick, block, and concrete can generate *respirable crystalline silica* dust. When inhaled, the small particles of silica can irreversibly damage the lungs. This fact sheet describes dust controls that can be used to minimize the amount of airborne dust when using heavy equipment or utility vehicles during demolition activities as listed in Table 1 of the Respirable Crystalline Silica Standard for Construction, 29 CFR 1926.1153. A separate fact sheet addresses heavy equipment use for earthmoving tasks such as grading and excavating activities.

Engineering Control Methods: Enclosed cab ***AND*** water sprays and/or dust suppressants if other workers are present

The use of an enclosed cab when operating heavy equipment and utility vehicles during demolition activities, or when fracturing and abrading silica-containing materials, can reduce operator exposures to silica dust. If other workers are present in the area, water and/or dust suppressants must be applied as necessary to minimize visible dust.

Photo courtesy of CPWR

Excavator equipped with an enclosed cab and hoe-ram demolishing a concrete wall.

Operator Isolation

Operators using heavy equipment and utility vehicles must stay inside an enclosed cab with the doors and windows closed while work is in progress. The cab must:

- Be well-sealed and well-ventilated, using positive pressure.
- Have door jambs, window grooves, power line entries and other joints that work properly and are tightly sealed.
- Have heating and air conditioning so that operators can keep windows and doors closed.
- Use an intake air filter with a minimum MERV-16 rating (at least 95 percent efficient in the 0.3–10.0 µm range).
- Be kept free from settled dust by regular cleaning and maintenance to prevent dust from become airborne inside the enclosure.

Modern heavy equipment typically comes equipped with enclosed, filtered cabs that meet the requirements of the silica standard in Table 1. Retrofit equipment is available for older equipment.

Wet Methods

Wet methods for heavy equipment and utility vehicle operators include the use of any method of wet application that will suppress silica dust emissions and be compatible to the task. These include using:

- Tank trucks equipped with hoses and nozzles that spray water or other dust suppressants over large areas to wet the materials disturbed during tasks, including haul roads and job sites in general.
- A worker who assists the operator by applying water or other types of dust suppressants to materials being demolished, abraded, or fractured.
- Large atomized misting devices.
- Spray equipment attached directly to the vehicle.
- Timing the application of the water or other dust suppressants to ensure that the materials are still damp when they are disturbed.

Water must be applied at flow rates sufficient to minimize the release of visible dust. Too much water can create mud slurry that can cause hazards. Too little water will not effectively control dust emissions.

Photo courtesy of BossTek

Atomized misting canons, like the DustBoss unit pictured, are an effective way to suppress silica dust.

Respiratory Protection

When properly used, an enclosed cab and wet methods can effectively reduce exposure to silica dust. Therefore, the silica standard for construction does not require use of respiratory protection when employers comply fully with Table 1 of the standard.

Additional Information

For more information, visit www.osha.gov/silica and see the OSHA Fact Sheet on the Crystalline Silica Rule for Construction, and the Small Entity Compliance Guide for the Respirable Crystalline Silica Standard for Construction.

OSHA can provide compliance assistance through a variety of programs, including technical assistance about effective safety and health programs, workplace consultations, and training and education. OSHA's On-Site Consultation Program offers free, confidential occupational safety and health services to small and medium-sized businesses in all states and several territories across the country, with priority given to high-hazard worksites. On-Site consultation services are separate from enforcement and do not result in penalties or citations. To locate the OSHA On-Site Consultation Program nearest you, visit www.osha.gov/consultation.

How to Contact OSHA

Under the Occupational Safety and Health Act of 1970, employers are responsible for providing safe and healthful workplaces for their employees. OSHA's role is to ensure these conditions for America's working men and women by setting and enforcing standards, and providing training, education and assistance. For more information, visit www.osha.gov or call OSHA at 1-800-321-OSHA (6742), TTY 1-877-889-5627.

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

U.S. Department of Labor

Occupational Safety and Health Administration

DSG FS-3936 12/2017

OSHA FactSheet

CONTROL SILICA DUST
Breathe Easier

CONTROL OF SILICA DUST IN CONSTRUCTION

Heavy Equipment and Utility Vehicles Used for Grading and Excavating Tasks

Using heavy equipment and utility vehicles for earthmoving tasks such as grading and excavating does not in most cases generate hazardous levels of *respirable crystalline silica* dust. However, in dry conditions hazardous exposures can occur. This fact sheet describes methods to minimize the amount of airborne dust when using heavy equipment or utility vehicles for earthmoving tasks such as grading and excavating soil, as listed in Table 1 of the Respirable Crystalline Silica Standard for Construction, 29 CFR 1926.1153. A separate fact sheet covers dust controls for heavy equipment used for abrading, or fracturing silica-containing materials during demolition activities.

Engineering Control Methods: Enclosed cab (when only the operator is exposed) ***OR*** water sprays and/or dust surfactants (a dust suppressant)

The application of water and/or dust suppressants can help to reduce exposure to dust when operating heavy equipment or utility vehicles for tasks such as grading and excavating. If the equipment operator is the only worker engaged in the task, the employer can choose to apply water and/or dust suppressants to minimize dust emissions or can require the operator to stay within an enclosed cab. However, if there are other workers engaged in the task, then water and/or dust suppressants must be applied as needed to minimize their exposure to airborne dust.

Wet Methods

Wet methods for heavy equipment and utility vehicle operators include the use of any method that will suppress dust emissions and be compatible to the job task. These include using:

- Tank trucks equipped with hoses and nozzles that spray water or other dust suppressants over large areas to wet the materials disturbed during earthmoving tasks, including haul roads and job sites in general.
- A worker who assists the operator by applying water or other types of dust suppressants to materials being moved.
- Large atomized misting devices.
- Spray equipment attached directly to the vehicle.
- Nozzles adjusted so that water spray is directed at the work areas where dust suppression is required.
- Timing the application of the water or other dust suppressants to ensure that the materials are still damp when they are disturbed.

Photo courtesy of International Union of Operating Engineers

Backhoe with enclosed cab.

Water must be applied at flow rates sufficient to minimize the release of visible dust. Too much water can create mud slurry that can cause hazards. Too little water will not effectively control dust emissions.

Operator Isolation

When operators rely on enclosed cabs for protection against silica dust, the cab must:

- Be well-sealed and well-ventilated using positive pressure.
- Have door jambs, window grooves, power line entries and other joints that work properly and are tightly sealed.
- Have heating and air conditioning, so that operators can keep windows and doors closed.
- Use an intake air filter with a minimum MERV-16 rating (at least 95 percent efficient in the 0.3-10.0 μm range).
- Be kept free from settled dust by regular cleaning and maintenance to prevent dust from become airborne inside the enclosure.

Modern heavy equipment often comes equipped with enclosed, filtered cabs that meet the requirements of the silica standard in Table 1. Retrofit equipment is available for older equipment.

Respiratory Protection

When properly used, an enclosed cab or wet methods can effectively control airborne silica dust. Therefore, Table 1 in the silica standard for construction does not require the use of respirators when wet methods are used for dust suppression, or for the operator when operating heavy equipment or utility vehicles from within an enclosed cab.

Additional Information

For more information, visit www.osha.gov/silica and see the OSHA Fact Sheet on the Crystalline Silica Rule for Construction, and the Small Entity Compliance Guide for the Respirable Crystalline Silica Standard for Construction.

OSHA can provide compliance assistance through a variety of programs, including technical assistance about effective safety and health programs, workplace consultations, and training and education. OSHA's On-Site Consultation Program offers free, confidential occupational safety and health services to small and medium-sized businesses in all states and several territories across the country, with priority given to high-hazard worksites. On-Site consultation services are separate from enforcement and do not result in penalties or citations. To locate the OSHA On-Site Consultation Program nearest you, visit www.osha.gov/consultation.

How to Contact OSHA

Under the Occupational Safety and Health Act of 1970, employers are responsible for providing safe and healthful workplaces for their employees. OSHA's role is to ensure these conditions for America's working men and women by setting and enforcing standards, and providing training, education and assistance. For more information, visit www.osha.gov or call OSHA at 1-800-321-OSHA (6742), TTY 1-877-889-5627.

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

U.S. Department of Labor

OSHA® Occupational Safety and Health Administration

DSG FS-3937 12/2017

OSHA® FactSheet

Reducing Falls During Residential Construction: Re-Roofing

Re-roofing exposes workers to the hazards of demolition work at heights. With the proper fall protection, the risk of serious falls can be substantially reduced. This fact sheet highlights some of the hazards workers encounter during re-roofing and lists some practical methods employers can use to protect workers who replace roofs. The fall protection methods in this fact sheet may not be suitable in all situations. Employers are responsible for ensuring compliance with applicable OSHA requirements.

Risks During Re-Roofing

Workers replacing roofs risk permanent injury or death from falls while they demolish old roofs and install new roofing material (for example, shingles, tiles, or slate). Even experienced roofers are exposed to unpredictable fall hazards caused by uneven sheathing, sudden gusts of wind, loose roofing materials, and surfaces that become slick when wet. Taking appropriate fall protection measures reduces risks and saves lives.

The employer must provide a training program for each worker who might be exposed to fall hazards. The program must enable each worker to recognize the hazards of falling and train each worker in the procedures to follow to minimize these hazards. For fall protection training requirements, refer to 29 CFR 1926.503. In all cases, employers must evaluate the hazards and take measures to reduce the risk of falls.

> More than one-third of fall deaths in residential construction are caused by falls from roofs.

Safe Roofing Practices: Important Steps

Before beginning the job, focus on identifying fall protection needs. Survey the roof to determine if there are pre-installed anchorages available that can be used. If not, then plan immediately to identify those systems needed to protect workers from falls and have them in place before the workers report to the job.

Reducing Risks: Determining Structural Integrity

Many workers have been injured when the roofs they were working on collapsed from under them. Employers must determine the structural integrity of the roof and take all necessary precautions to protect the workers before the job begins (29 CFR 1926.501(a)(2)). If workers notice signs of structural deterioration (for example, dry rot), a competent person should evaluate the area.

Other considerations for a safe construction site:

- Guard against falls through skylights or other roof openings. Use a guardrail system, a personal fall arrest system (PFAS), or a protective cover that will support two times the weight that may be imposed on it at any one time. For additional information on protecting workers around skylight and other roof openings, refer to 29 CFR 1926.501(b)(4) and 29 CFR 1926.502(i).
- Appropriate footwear is important personal protective equipment on any construction site, but it is critical during roof demolition. A nail or shingle-removal tool injury can cause a worker to lose concentration and fall.
- Workers should be careful of air hoses and power cords for nail guns and other electrical equipment. If a worker steps on one, hoses and cords can slip underfoot and lead to falls.

Staging Material

Loose material and hand-held equipment can create tripping hazards on the roof surface. To minimize exposure to fall hazards, employers can stage materials so that workers on the roof have quick and safe access to them. While handling material on the roof, the worker should hold the material on the side of his or her body that faces the down-sloped edge to prevent being struck by the materials if they are dropped. Material can also be staged so it cannot slide off the roof edge and potentially strike a worker on the ground. Slide guards can help to keep material from sliding off the roof. Establishing a restricted area around the perimeter of the project can also keep workers out of the danger zone where debris, tools or materials may fall to the ground. The area should be posted with signs that warn of the potential hazard.

Protect Workers on the Ground
During the demolition phase, protect workers on the ground from falling debris by controlling how debris leaves the roof. Consider using an all-terrain forklift to elevate a disposal box to the roof level. This method makes cleanup after the job particularly easy.

Using the Right Equipment

Employers must provide roofers fall protection equipment that meets OSHA requirements whenever they work 6 feet or more above a lower level. There are fall protection systems available that can provide roofers the flexibility they need during demolition and roof installation. Some are more efficient than others because, in many cases, the employer can use the same system for both processes. Each phase of roof replacement has different challenges, but the risk of falling remains constant. Contractors may be able to protect their workers using the following equipment:

- Personal fall arrest systems;
- Guardrails; or
- Ladders.

Note: Fall protection requirements for residential construction work performed on ladders are in Subpart X, not in 29 CFR 1926.501(b)(13).

Providing Fall Protection for the Whole Job

Personal fall arrest system: A PFAS is a tool available to roofers during replacement jobs. In fact, a PFAS is the system of choice for many roofers. However, a breakdown in any component of a PFAS could be disastrous for a worker. Always follow the manufacturer's instructions on selecting, installing and using PFAS components correctly. Some PFASs include special elevated anchor assemblies that permit the system to protect workers even when they stand near the anchor locations. Certain anchorage assemblies rotate or offer extension arms to improve mobility and prevent lifelines from contacting the roof surface. This is particularly useful during roof demolition when a line could catch on a nail or debris.

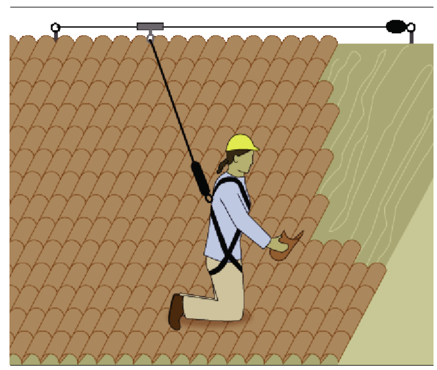
Personal Fall Arrest System (PFAS)

A PFAS is designed to safely stop a fall before the worker strikes a lower level. It includes three major components:

A. An ***anchorage*** to which the other components of the PFAS are rigged.

B. A full body ***harness*** worn by the worker.

C. A connector, such as a ***lanyard or lifeline***, linking the harness to the anchorage. A rip-stitch lanyard, or deceleration device, is typically a part of the system.



Horizontal Lifeline

For more information on the requirements for a PFAS, refer to 29 CFR 1926.502(d).

Remember that workers must use full-body harnesses in fall arrest systems. Body belts can cause serious injury during a fall, and OSHA prohibits their use as part of fall arrest systems.

Horizontal lifeline: An engineered horizontal lifeline system, when used as part of a PFAS, is another way to increase the area in which a worker is protected. Install the system following the manufacturer's instructions and under the supervision of a qualified person. Horizontal lifelines must be designed to maintain a safety factor of at least two (twice the impact load). For requirements for horizontal lifelines, refer to 29 CFR 1926.502(d)(8).

Rope grabs: Instead of attaching themselves to a fixed anchor, workers may be able to use adjustable rope grabs, another available component of a PFAS. This inexpensive and very popular system is the fall protection system of choice for many roofers. Rope grabs allow workers to adjust the length of the lifeline and can be useful when workers are moving about the roof frequently. The anchored ropes can be as long as necessary, making this form of fall protection highly versatile. Roofers who use rope grabs need to constantly take up the slack out of the line. Too much slack could allow a worker to free fall more than six feet off the roof if they slip. Training and monitoring are critical to the safe use of rope grabs.

Rope Grab: Ensure that a stopping mechanism prevents workers using rope grabs from backing down over the roof edge. This mechanism could be an added attachment or a simple knot in the rope.

Fall Restraint: While fall restraint systems are not mentioned in OSHA's fall protection rules, OSHA will accept a properly utilized fall restraint system instead of a personal fall arrest system when the restraint system is rigged so that the worker cannot get to the fall hazard. In effect, (if properly used) the system tethers a worker in a manner that will not allow a fall of any distance. A fall restraint system is comprised of a body belt or body harness, an anchorage, connectors, and other necessary equipment. Other components typically include a lanyard, and may also include a lifeline and other devices.

Always follow the manufacturer's instructions or consult a qualified person to ensure proper installation of anchor points. Fall restraint may be a viable way to provide fall protection in situations in which the employer has concerns about the adequacy of available anchorage points for fall arrest equipment.

Temporary guardrails: Removeable guardrail systems can offer roofers effective protection when installed around the roof perimeter. Always follow the manufacturer's instructions or consult a qualified person, as defined by 29 CFR 1926.32(m), for proper guardrail installation. This person could be the owner, the supervisor, or any other worker who has extensive knowledge, training and experience with fall protection and is able to solve problems relating to fall protection. For requirements for guardrails, refer to 29 CFR 1926.502(b)- Guardrail Systems.

Other considerations: Some employers have found success in eliminating fall hazards by using scaffolds and aerial lifts when site conditions permit their use. Fall protection requirements performed on scaffolds and aerial lifts can be found in 29 CFR 1926 Subpart L – Scaffolds.

Attaching Anchors

OSHA requires that anchors for PFASs be able to hold at least 5,000 pounds of weight per person or maintain a safety factor of at least two (twice the impact load) under the supervision of a qualified person. Always follow the manufacturer's instructions or consult a qualified person when installing anchors to ensure they are strong enough to hold the sudden weight of a falling worker. OSHA believes that anchorages available on the market will meet the strength requirements if they are installed as per the manufacturer's instructions, with the right number of properly sized nails or screws through the roof sheathing and into one or more roof trusses.

When choosing an anchor to use for fall protection, employers have a number of options; for example,

- Peak anchor: At the top of the roof, peak anchors are typically solid, non-moving pieces secured to the trusses underneath.
- Permanent D-rings: Inexpensive D-ring anchors can be attached to the truss frame; they can be left permanently on the roof for future use.

Install an anchor above the area being built: Choose an anchor that is appropriate for the type of roof and anchor location. Depending on the roof design, the best location might be at the peak of the roof, directly over a truss.

Consider leaving anchors in place: Where practical, employers may consider leaving anchors in place. This can make the current job simpler and reduce the burden for roofers in the future.

Written Fall Protection Plans

When working at heights of 6 feet or greater, if the employer does not use ladders, scaffolds, aerial lifts or fall restraint systems and can demonstrate that it is not feasible or would create a greater hazard to use conventional fall protection equipment (guardrails, safety nets or PFAS), the employer must develop a written site-specific fall protection plan in accord with 29 CFR 1926.502(k). The plan must be prepared by a qualified person. This person could be the owner, the supervisor, or any other worker who has extensive knowledge, training and experience with fall protection and is able to solve problems relating to fall protection.

The site-specific fall protection plan must document, for each location, why the use of conventional fall protection equipment is not feasible or will create a greater hazard. The plan must also describe the alternative methods that the employer will use so that workers are protected from falls. Workers and their supervisors must be trained on the proper use of those other fall protection methods.

Conventional fall protection equipment can reduce or eliminate the chances of a fatal fall. Otherwise, a written site-specific fall protection plan ensures that protection continues, even when conventional fall protection methods are determined to not be feasible.

OSHA Standard:

29 CFR 1926 Subpart M – Fall Protection
Available online at
www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10922.

OSHA Residential Fall Protection Web Page:
www.osha.gov/doc/topics/residentialprotection/index.html.

OSHA Compliance Guidance:

Compliance Guidance for Residential Construction – STD 03-11-002 (dated 12/16/2010)
Available online at
www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=DIRECTIVES&p_id=4755.

State Plan Guidance: States with OSHA-approved state plans may have additional requirements for Residential Roofing. For more information on these requirements, please visit:
www.osha.gov/dcsp/osp/statestandards.html.

Help for Employers: OSHA's On-site Consultation Program offers free and confidential advice to small and medium-sized businesses in all states across the country, with priority given to high-hazard worksites. On-site Consultation services are separate from enforcement and do not result in penalties or citations. Consultants from state agencies or universities work with employers to identify workplace hazards, provide advice on compliance with OSHA standards and assist in establishing injury and illness prevention programs. To locate the OSHA Consultation Program nearest you, call 1-800-321-OSHA (6742) or visit www.osha.gov/dcsp/smallbusiness/index.html.

Almost every OSHA area office has a Compliance Assistance Specialist to assist employers in complying with OSHA standards. To find the Compliance Assistance Specialist nearest you, call 1-800-321-OSHA (6742) or visit:
www.osha.gov/html/RAmap.html.

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

For assistance, contact us. We can help. It's confidential.

OSHA® Occupational Safety and Health Administration

U.S. Department of Labor
www.osha.gov (800) 321-OSHA (6742)

DOC FS-3503 1/2012

OSHA® FactSheet

Reducing Falls During Residential Construction: Roof Sheathing

After a roof has been framed, workers can begin installing roof sheathing. Because this work often occurs at great heights, it involves serious fall hazards. This risk makes it important that fall protection systems be used properly during these activities. This fact sheet highlights some of the hazards associated with installing roof sheathing and lists some practical methods that employers may be able to use to protect workers. The fall protection methods in this fact sheet may not be suitable in all situations. Employers are responsible for ensuring compliance with applicable OSHA requirements.

Risks While Installing Roof Sheathing

Workers installing roof sheathing risk permanent injury or death from falls. Even experienced workers are exposed to unpredictable fall hazards caused by uneven sheathing, sudden gusts of wind, loose materials, and surfaces that become slick when wet. Taking appropriate fall protection measures reduces risks and saves lives.

The employer must provide a training program for each worker who might be exposed to fall hazards. The program must enable each worker to recognize the hazards of falling and train each worker in the procedures to follow to minimize these hazards. For fall protection training requirements, refer to 29 CFR 1926.503. In all cases, employers must evaluate the hazards and take measures to reduce the risk of falls.

> More than one-third of fall deaths in residential construction are caused by falls from roofs.

Roof Sheathing Safely: Important Steps

Pre-planning for the use of fall protection equipment can help employers protect workers from falls. Before beginning the job, focus on identifying fall protection needs. Plan ahead and identify those systems needed to protect workers from falls and have them available before sheathing begins.

Reducing Risks

Workers' risk of falling can be greatly reduced if sheathing is installed onto truss sections while the truss sections are on the ground. The truss sections can then be hoisted into place. Peak anchors and lifelines can be pre-installed before the sections are lifted onto the frame. Scaffolds, ladders and lifts can provide workers stable walking/working platforms to stand on to secure the pre-fabricated truss section to the building frame.

When installing roof sheathing in elevated locations, employers should be aware that roof structures generally are unstable until they are properly braced according to industry standards or some sheathing is in place. If conventional fall protection cannot be used due to unstable conditions, employers should consider using ladders, scaffolds or aerial lifts until the first row of sheathing has been installed and until a qualified person, as defined by 29 CFR 1926.32(m), determines that the roof can be used as an anchorage point for a personal fall arrest system. A qualified person can be the owner, the supervisor, or any other worker who has extensive knowledge, training and experience with fall protection and is able to solve problems relating to fall protection.

Personal Fall Arrest System (PFAS): A PFAS is a tool available to workers during roof sheathing jobs. In fact, a PFAS is the system of choice for many workers at heights. However, a breakdown in any component of a PFAS could be disastrous for a worker. Always follow the manufacturer's instructions on selecting, installing and using PFAS components correctly.

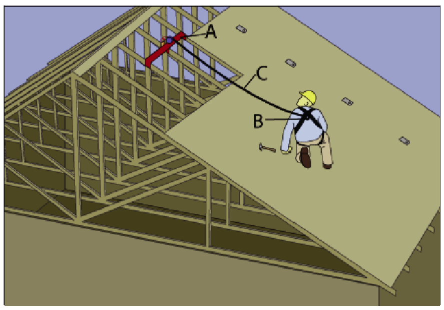
Personal Fall Arrest System (PFAS)

A PFAS is designed to safely stop a fall before the worker strikes a lower level. It includes three major components:

A. An ***anchorage*** to which the other components of the PFAS are rigged.

B. A full body ***harness*** worn by the worker.

C. A connector, such as a ***lanyard or lifeline***, linking the harness to the anchorage. A rip-stitch lanyard, or deceleration device, is typically a part of the system.



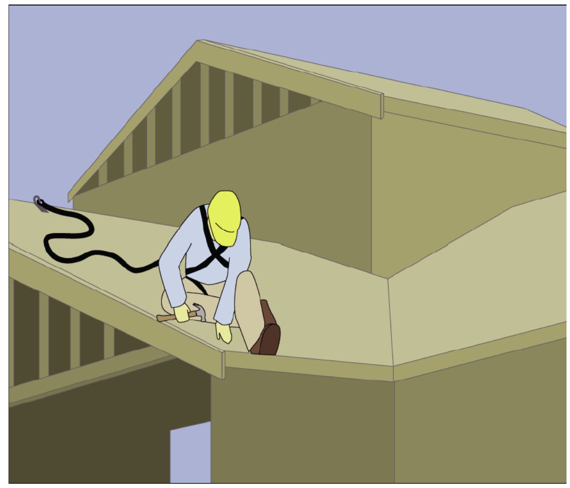
For more information on the requirements for a PFAS, refer to 29 CFR 1926.502(d).

Remember that workers must use full-body harnesses in fall arrest systems. Body belts can cause serious injury during a fall, and OSHA prohibits their use as part of fall arrest systems.

Numerous employers have found that for most roofs, a PFAS can be used once the proper bracing and/or an appropriate amount of sheathing has been established. Anchor points established during truss erection can prove useful during roof sheathing. When placing sheathing on trusses, workers should keep sheathing in front of them as a barrier to protect themselves from falling between truss openings. Once in place, the sheathing can be tacked and nailed down to prevent movement and reduce fall exposures to the inside of the building.

Fall Restraint: While fall restraint systems are not mentioned in OSHA's fall protection rules, OSHA will accept a properly utilized fall restraint system in lieu of a personal fall arrest system when the restraint system is rigged so that the worker cannot get to the fall hazard. In effect, (if properly used) the system tethers a worker in a manner that will not allow a fall of <u>any</u> distance. A fall restraint system is comprised of a body belt or body harness, an anchorage, connectors, and other necessary equipment. Other components typically include a lanyard, and may also include a lifeline and other devices.

Always follow the manufacturer's instructions or consult a qualified person to ensure proper installation of anchor points. Fall restraint may be a viable way to provide fall protection in situations in which the employer has concerns about the adequacy of available anchorage points for fall arrest equipment.



Attaching Anchors

OSHA requires that anchors for PFAS be able to hold at least 5,000 pounds of weight per person, or maintain a safety factor of at least two (twice the impact load) under the supervision of a qualified person. Always follow the anchor manufacturer's instructions or consult a qualified person when installing anchors to ensure they are strong enough to hold the sudden weight of a falling worker. OSHA believes that anchorages available on the market will meet the strength requirements if they are installed as per the manufacturer's instructions, with the right number of properly sized nails or screws through the roof sheathing and into one or more roof trusses.

When choosing an anchor to use for fall protection, employers have a number of options; for example,

- Peak anchor: At the top of the roof, peak anchors are typically solid, non-moving pieces secured to the trusses underneath.
- Permanent D-rings: Inexpensive D-ring anchors are attached to the truss frame; they can be left permanently on the roof for future use.

Spreader: Employers may be able to use engineered spreaders as anchor points. When installed in accord with the manufacturer's instructions, these devices distribute the force of a PFAS across multiple trusses. The roof trusses do not need to be sheathed to use a spreader. These engineered anchorage devices are reusable and can be uninstalled and reinstalled quickly. ***A qualified person should decide if the spreader is suitable for use as an anchor.***

Install an anchor above the area being built: Choose an anchor that is appropriate for the type of roof and anchor location. Depending on the roof design, the best location might be at the peak of the roof, directly over a truss.

Consider leaving anchors in place: Where practical, employers may consider leaving anchors in place. This can make the current job simpler and reduce the burden for roofers in the future.

Scaffolding: Workers installing roof sheathing may be able to use scaffold systems. Bracket scaffolding systems, including top-plate scaffolding systems, can provide workers with stable work platforms. Workers may be able to install the bottom row of roof sheathing while they are standing on these scaffold systems and leaning over the sheathing. Always follow the manufacturer's instructions or consult a qualified person to ensure proper scaffold assembly and use. For requirements on scaffolds, refer to 29 CFR 1926 Subpart L - Scaffolds.

Ladders (A-frame and platform): If the floor below has been established, A-frame and platform ladders can provide stable work platforms for workers who are installing the first row of sheathing on a roof. Always ensure that a ladder has good footing before mounting it. Consult 29 CFR 1926 Subpart X, Ladders for ladder safety requirements.

Safety net systems: In some situations, safety nets can be placed underneath unsheathed trusses to prevent workers from falling between the trusses to the level below. Safety nets must be installed to prevent contact with the surface or structures below them. For requirements for safety nets, refer to 29 CFR 1926.502(c)-Safety Net Systems.

Staging Material

Loose material and hand-held equipment can create tripping hazards on the roof surface. To minimize exposure to fall hazards, employers can stage materials so that workers on the roof have quick and safe access to them. While handling material on the roof, the worker should hold the material on the side of his or her body that faces the down-sloped edge to prevent being struck by the materials if they are dropped. Material can also be staged so it cannot slide off the roof edge and potentially strike a worker on the ground. Slide guards can help to keep material from sliding off the roof. Establishing a restricted area around the perimeter of the project can also keep workers out of the danger zone where debris, tools or materials may fall to the ground. The area should be posted with signs that warn of the potential hazard.

Other considerations: Some employers have found success in eliminating fall hazards by using scaffolds and aerial lifts when site conditions permit their use. Fall protection requirements performed on scaffolds and aerial lifts can be found in Subpart L – Scaffolds.

Written Fall Protection Plans

When working at heights of six feet or greater, if the employer does not use ladders, scaffolds, aerial lifts or fall restraint systems and can demonstrate that it is not feasible or would create a greater hazard to use conventional fall protection equipment (guardrails, safety nets or PFAS), the employer must develop a written site-specific fall protection plan in accord with 29 CFR 1926.502(k). The plan must be prepared by a qualified person. This person could be the owner, the supervisor, or any other worker who has extensive knowledge, training and experience with fall protection and is able to solve problems relating to fall protection.

The site-specific fall protection plan must document, for each location, why the use of conventional fall protection equipment is not feasible or will create a greater hazard. The plan must also describe the alternative methods that the employer will use so that workers are protected from falls. Workers and their supervisors must be trained on the proper use of those other fall protection methods.

Conventional fall protection equipment can reduce or eliminate the chances of a fatal fall. Otherwise, a written site-specific fall protection plan ensures that protection continues, even when conventional fall protection methods are determined to not be feasible.

OSHA Standard:

29 CFR 1926 Subpart M – Fall Protection
Available online at
www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=STANDARDS&p_id=10922.

OSHA Residential Fall Protection Web Page:
www.osha.gov/doc/topics/residentialprotection/index.html.

OSHA Compliance Guidance:

Compliance Guidance for Residential Construction – STD 03-11-002 (dated 12/16/2010)
Available online at
www.osha.gov/pls/oshaweb/owadisp.show_document?p_table=DIRECTIVES&p_id=4755.

State Plan Guidance: States with OSHA-approved state plans may have additional requirements for Residential Roofing. For more information on these requirements, please visit: www.osha.gov/dcsp/osp/statestandards.html.

Help for Employers: OSHA's On-site Consultation Program offers free and confidential advice to small and medium-sized businesses in all states across the country, with priority given to high-hazard worksites. On-site Consultation services are separate from enforcement and do not result in penalties or citations. Consultants from state agencies or universities work with employers to identify workplace hazards, provide advice on compliance with OSHA standards and assist in establishing injury and illness prevention programs. To locate the OSHA Consultation Program nearest you, call 1-800-321-OSHA (6742) or visit www.osha.gov/dcsp/smallbusiness/index.html.

Almost every OSHA area office has a Compliance Assistance Specialist to assist employers in complying with OSHA standards. To find the Compliance Assistance Specialist nearest you, call 1-800-321-OSHA (6742) or visit: www.osha.gov/html/RAmap.html.

This is one in a series of informational fact sheets highlighting OSHA programs, policies or standards. It does not impose any new compliance requirements. For a comprehensive list of compliance requirements of OSHA standards or regulations, refer to Title 29 of the Code of Federal Regulations. This information will be made available to sensory-impaired individuals upon request. The voice phone is (202) 693-1999; teletypewriter (TTY) number: (877) 889-5627.

For assistance, contact us. We can help. It's confidential.

OSHA® Occupational Safety and Health Administration

U.S. Department of Labor
www.osha.gov (800) 321-OSHA (6742)

DOC FS-3501 1/2012

OSHA® FactSheet

Reducing Falls During Residential Construction: Installing Roof Trusses

Every year, residential construction workers experience numerous fatal injuries due to falls. Installing roof trusses presents several challenges for protecting workers from these falls. This fact sheet highlights some of the hazards of truss installation and lists some practical methods that employers can use to protect workers who install trusses.

Risks During Truss Installation

Accidental falls are the leading cause of death for construction workers and installing roof trusses can be particularly dangerous for two reasons: (1) truss construction usually occurs high above the ground and (2) trusses are not stable until they are properly restrained and braced.

Roof trusses are the highest part of a house frame, so residential construction workers installing them can fall and be seriously injured or even killed. Although personal fall arrest systems (PFAS) are the most widely used form of fall protection in residential construction, they might not be suitable when workers begin installing roof truss sections because there may not be a stable place to attach an anchor. Trusses are designed to support weight from the top down. Until trusses are properly restrained and braced, they are weak if pulled from the side (i.e., subjected to lateral force) as can occur when a truss-mounted fall protection system bears the full weight of a falling worker.

PFAS need strong anchor points that can hold the sudden weight of a falling worker. No anchor with a single connection point, such as a strap anchor or a bolt-on anchor, will protect a falling worker who is attached to a single truss.

Other systems, such as scaffolds, lifts and ladders can be used to protect workers until a fully interconnected, multi-truss section has been appropriately braced and secured.

OSHA requires fall protection measures for residential construction activities 6 feet or more above lower levels. As a result, employers must plan ahead to ensure they have the right systems in place, and that all workers are properly trained before the job begins.

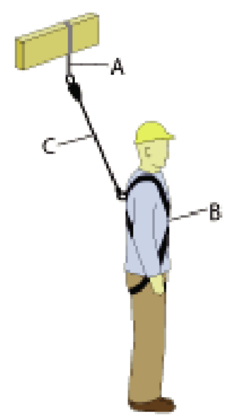
Personal Fall Arrest System (PFAS)

A PFAS is designed to safely stop a fall before the worker strikes a lower level. It includes three major components:

A. An ***anchorage*** to which the other components of the PFAS are rigged.

B. A full body ***harness*** worn by the worker.

C. A connector, such as a ***lanyard or lifeline***, linking the harness to the anchorage. A rip-stitch lanyard, or deceleration device, is typically a part of the system.



For more information on the requirements for a PFAS, refer to 29 CFR 1926.502(d).

Remember that for fall arrest systems, workers must use full-body harnesses. Body belts can cause serious injury during a fall and so OSHA prohibits their use as part of fall arrest systems.