**Chapter 40 Dust Explosion and Fire Prevention**

40.1 Application

Equipment, processes, and operations that involve the manufacture, processing, blending, repackaging, or handling of combustible particulate solids or combustible dusts regardless of concentration or particle size shall be installed and maintained in accordance with this chapter.

40.1.1

All facilities and operations that manufacture, process, blend, convey, repackage, generate, or handle combustible dusts or combustible particulate solids shall be in compliance with NFPA 652 and, as applicable, NFPA 61, NFPA 69, NFPA 85, NFPA 120, NFPA 484, NFPA 654, NFPA 655, and NFPA 664.

40.2 Permits

Permits, where required, shall comply with Section 1.12.

40.3 Retroactivity

This chapter shall be applied retroactively to new and existing facilities and processes. [652:8.1]

40.3.1

Existing facilities shall perform a dust hazards analysis (DHA) in accordance with Section 40.5.

40.4\* General

The procedures and training in this chapter shall be delivered in a language that the participants can understand. [652:8.2]

40.5 Dust Hazards Analysis (DHA)

40.5.1\* General Requirements

40.5.1.1\* Retroactivity

The requirements of this section shall be applied retroactively in accordance with 40.5.1.1.1 and 40.5.1.1.2. [652:7.1.1]

40.5.1.1.1

A DHA shall be completed for all new processes and facility compartments. [652:7.1.1.1]

40.5.1.1.2\*

For existing processes and facility compartments, a DHA shall be completed by September 7, 2020. [652:7.1.1.2]

40.5.1.1.3

The owner/operator shall demonstrate reasonable progress each year in completing DHAs prior to the deadline set in 40.5.1.1.2. [652:7.1.1.3]

40.5.1.2

The owner/operator of a facility where materials determined to be combustible or explosible in accordance with Chapter 5 of NFPA 652 are present in an enclosure shall be responsible to ensure a DHA is completed in accordance with the requirements of this section. [652:7.1.2]

40.5.1.3

The absence of previous incidents shall not be used as the basis for not performing a DHA. [652:7.1.3]

40.5.1.4

The DHA shall be reviewed and updated at least every 5 years. [652:7.1.4]

40.5.2 Criteria

40.5.2.1\* Overview

The DHA shall evaluate the fire, deflagration, and explosion hazards and provide recommendations to manage the hazards in accordance with Section 4.2 of NFPA 652. [652:7.2.1]

40.5.2.2\* Qualifications

The DHA shall be performed or led by a qualified person. [652:7.2.2]

40.5.2.3 Documentation

The results of the DHA review shall be documented, including any necessary action items requiring change to the process materials, physical process, process operations, or facilities associated with the process. [652:7.2.3]

40.5.3 Methodology

40.5.3.1 General

The DHA shall include the following:

Identification and evaluation of the process or facility areas where fire, flash fire, and explosion hazards exist

Where such a hazard exists, identification and evaluation of specific fire and deflagration scenarios shall include the following:

Identification of safe operating ranges

\* Identification of the safeguards that are in place to manage fire, deflagration, and explosion events

Recommendation of additional safeguards where warranted, including a plan for implementation

[652:7.3.1]

40.5.3.2 Material Evaluation

40.5.3.2.1

The DHA shall be based on data obtained in accordance with Chapter 5 of NFPA 652 for material that is representative of the dust present. [652:7.3.2.1]

40.5.3.3 Process Systems

40.5.3.3.1\*

Each part of the process system where combustible dust is present or where combustible particulate solids could cause combustible dust to be present shall be evaluated, and the evaluation shall address the following:

Potential intended and unintended combustible dust transport between parts of the process system

Potential fugitive combustible dust emissions into a building or building compartments

Potential deflagration propagation between parts of the process system

[652:7.3.3.1]

40.5.3.3.2

Each part of the process that contains a combustible particulate solid and that can potentially include both of the following conditions shall be considered a fire hazard and shall be documented as such:

Oxidizing atmosphere

Credible ignition source

[652:7.3.3.2]

40.5.3.3.3\*

Each part of the process that contains a sufficient quantity of combustible dust to propagate a deflagration and that can potentially include all the following conditions shall be considered a dust deflagration hazard and shall be documented as such:

Oxidizing atmosphere

Credible ignition source

Credible suspension mechanism

[652:7.3.3.3]

40.5.3.4 Building or Building Compartments

40.5.3.4.1

Each building or building compartment where combustible dust is present shall be evaluated. [652:7.3.4.1]

40.5.3.4.1.1

Where multiple buildings or building compartments present essentially the same hazard, a single evaluation shall be permitted to be conducted as representative of all similar buildings or building compartments. [652:7.3.4.1.1]

40.5.3.4.1.2

The evaluation shall address potential combustible dust migration between buildings or building compartments. [652:7.3.4.1.2]

40.5.3.4.1.3

The evaluation shall address potential deflagration propagation between buildings or building compartments. [652:7.3.4.1.3]

40.5.3.4.2\*

Each building or building compartment that contains a combustible particulate solid and that can potentially include both of the following conditions shall be considered a fire hazard and shall be documented as such:

Oxidizing atmosphere

Credible ignition source

[652:7.3.4.2]

40.5.3.4.2.1\*

The evaluation of dust deflagration hazard in a building or building compartment shall include a comparison of actual or intended dust accumulation to the threshold housekeeping dust accumulation that would present a potential for flash-fire exposure to personnel or compartment failure due to explosive overpressure. [652:7.3.4.2.1]

40.5.3.4.2.2

Threshold housekeeping dust accumulation levels and nonroutine dust accumulation levels (e.g., from a process upset) shall be in accordance with relevant industry- or commodity-specific NFPA standards. [652:7.3.4.2.2]

40.5.3.4.3

Each building or building compartment that contains a sufficient quantity of combustible dust to propagate a deflagration and that can potentially include all of the following conditions shall be considered a dust deflagration hazard and shall be documented as such:

Oxidizing atmosphere

Credible ignition source

Credible suspension mechanism

[652:7.3.4.3]

40.6 Operating Procedures and Practices

40.6.1\*

The owner/operator shall establish written procedures for operating its facility and equipment to prevent or mitigate fires, deflagrations, and explosions from combustible particulate solids. [652:8.3.1]

40.6.2\*

The owner/operator shall establish safe work practices to address hazards associated with maintenance and servicing operations. [652:8.3.2]

40.6.2.1

The safe work practices shall apply to employees and contractors. [652:8.3.2.1]

40.6.3

A periodic walk-through review of operating areas shall be conducted, on a schedule established by the owner/operator per the requirement in 40.10.3, to verify that operating procedures and safe work practices are being followed. [652:8.3.3]

40.7 Housekeeping

40.7.1 General

40.7.2\* Methodology

40.7.2.1 Procedure

40.7.2.1.1\*

Housekeeping procedures shall be documented. [652:8.4.2.1.1]

40.7.2.1.2\*

The methods used for cleaning surfaces shall be selected on the basis of reducing the potential for creating a combustible dust cloud. [652:8.4.2.1.2]

40.7.2.1.3

Cleaning methods to be used shall be based on the characteristics of the material and quantity of material present. [652:8.4.2.1.3]

40.7.2.2 Vacuum Cleaning Method

40.7.2.2.1\* Portable Vacuum Cleaners

40.7.2.2.1.1

Portable vacuum cleaners with a dirty side volume greater than 8 ft3 shall comply with 9.7.3 and 9.7.4 of NFPA 652. [652:8.4.2.2.1.1]

40.7.2.2.1.2\*

When metal particles, dusts, or powders are being cleaned NFPA 484 shall be the reference source for proper use and limitations of both dry and wet portable vacuum cleaners. [652: 8.4.2.2.1.2]

40.7.2.2.1.3\*

The operation of portable vacuum cleaning devices shall be subject to a dust hazard analysis to ensure that the risk to personnel and facility operations from deflagrations is minimized. [652:8.4.2.2.1.3]

40.7.2.2.1.4

Hoses and vacuum tools shall be appropriate for use and be static dissipative or conductive. [652:8.4.2.2.1.4]

40.7.2.2.1.5

Portable vacuum cleaners shall not be used on processes generating hot embers or sparks. [652:8.4.2.2.1.5]

40.7.2.2.1.6\*

For portable vacuum cleaners used with combustible dusts having a minimum ignition energy less than 30 mJ, the path to ground shall be verified prior to use after each movement or new connection, or both. [652:8.4.2.2.1.6]

40.7.2.2.1.7\*

Portable vacuum cleaners that meet the following minimum requirements shall be permitted to be used to collect combustible particulate solids in unclassified (nonhazardous) areas:

Materials of construction shall comply with 9.4.7.1 of NFPA 652.

Hoses shall be conductive or static dissipative.

All conductive components, including wands and attachments, shall be bonded and grounded.

The fan or blower shall be on the clean side of the primary filtration media or wet separation chamber.

Electrical motors shall not be located on the dirty side of the primary filtration media or wet separation chamber unless listed for Class II, Division 1 locations.

\* Where liquids or wet materials are picked up by the vacuum cleaner, paper filter elements shall not be used.

Vacuum cleaners used for metal dusts shall meet the requirements of NFPA 484.

[652:8.4.2.2.1.7]

40.7.2.2.2\*

In Class II electrically classified (hazardous) locations, electrically powered vacuum cleaners shall be listed for the purpose and location or shall be a fixed-pipe suction system with a remotely located exhauster and an AMS installed in conformance with Section 9.3 of NFPA 652, and they shall be suitable for the dust being collected. [652:8.4.2.2.2]

40.7.2.2.3

Where flammable vapors or gases are present in Class II areas, vacuum cleaners shall be listed for both Class I and Class II hazardous locations. [652:8.4.2.2.3]

40.7.2.3\* Sweeping, Shoveling, Scoop, and Brush Cleaning Method

The use of scoops, brooms, and brushes for sweeping and shoveling shall be a permitted cleaning method. [652:8.4.2.3]

40.7.2.4\* Water Washdown Cleaning Method

40.7.2.4.1

The use of water washdown shall be a permitted cleaning method. [652:8.4.2.4.1]

40.7.2.4.2

Where the combustible dust being removed is metal or metal-containing dust or powder within the scope of NFPA 484, the requirements of NFPA 484 shall be followed. [652:8.4.2.4.2]

40.7.2.4.3\*

Where the combustible dust being removed is a water-reactive material, additional precautions shall be taken to control the associated hazards. [652:8.4.2.4.3]

40.7.2.5 Water Foam Washdown Systems. (Reserved)

40.7.2.6 Compressed Air Blowdown Method

40.7.2.6.1\*

Blowdowns using compressed air shall be permitted to be used as a cleaning method in accordance with the provisions of 40.7.2.6.2. [652:8.4.2.6.1]

40.7.2.6.2\*

Where blowdown using compressed air is used, the following precautions shall be followed:

Prior to using compressed air, vacuum cleaning, sweeping, or water washdown methods are used to clean surfaces that can be safely accessed.

Dust accumulations in the area after vacuum cleaning, sweeping, or water washdown do not exceed the threshold housekeeping dust accumulation.

Compressed air hoses are equipped with pressure relief nozzles limiting the discharge pressure to 30 psi (207 kPa) in accordance with OSHA requirements in 29 CFR 1910.242(b), "Hand and Portable Powered Tools and Equipment, General."

All electrical equipment, including lighting, potentially exposed to airborne dust in the area during cleaning is suitable for use in a Class II, Division 2, hazardous (classified) location in accordance with NFPA 70.

All ignition sources and hot surfaces capable of igniting a dust cloud or dust layer are shut down or removed from the area.

After blowdown is complete, residual dust on lower surfaces is cleaned prior to re-introduction of potential ignition sources.

Where metal or metal-containing dust or powder under the scope of NFPA 484 is present, the requirements of NFPA 484 apply.

[652:8.4.2.6.2]

40.7.2.7 Steam Blow Down Method. (Reserved)

40.7.3 Training

Employee and contractor training shall include housekeeping procedures, required personal protective equipment (PPE) during housekeeping, and proper use of equipment. [652:8.4.3]

40.7.4 Equipment. (Reserved)

40.7.5 Vacuum Trucks

40.7.5.1

Vacuum trucks shall be grounded and bonded. [652:8.4.5.1]

40.7.5.2

Vacuum truck hoses and couplings shall be static dissipative or conductive and grounded. [652:8.4.5.2]

40.7.6 Frequency and Goal

40.7.6.1\*

Housekeeping frequency and accumulation goals shall be established to ensure that the accumulated fugitive dust levels on surfaces do not exceed the threshold housekeeping dust accumulation limits. [652:8.4.6.1]

40.7.6.2

The threshold housekeeping dust accumulation limits shall be in accordance with the industry- or commodity-specific NFPA standard. (See 1.3.1 of NFPA 652.) [652:8.4.6.2]

40.7.6.3\*

Provisions for unscheduled housekeeping shall include specific requirements establishing time to clean local dust spills or transient releases. [652:8.4.6.3]

40.7.7 Auditing and Documentation

40.7.7.1\*

Housekeeping effectiveness shall be assessed based on the results of routine scheduled cleaning and inspection, not including transient releases. [652:8.4.7.1]

40.7.7.2

The owner/operator shall retain documentation that routine scheduled cleaning occurs in accordance with the frequency and accumulation goals established in 40.7.6.1. [652:8.4.7.2]

40.8 Hot Work

40.8.1\*

In addition to the requirements of NFPA 51B, all hot work activities shall comply with the requirements in 40.8.2 through 40.8.5. [652:8.5]

40.8.2\*

The area affected by hot work shall be thoroughly cleaned of combustible dust prior to commencing any hot work. [652:8.5.2]

40.8.3

Equipment that contains combustible dust and is located within the hot work area shall be shut down, shielded, or both. [652:8.5.3]

40.8.4

When the hot work poses an ignition risk to the combustible dust within equipment, the equipment shall be shut down and cleaned prior to commencing such hot work. [652:8.5.4]

40.8.5

Floor and wall openings within the hot work area shall be covered or sealed. [652:8.5.5]

40.8.6

Use of portable electrical equipment that does not comply with the electrical classification of the area where it is to be used shall be authorized and controlled in accordance with the hot work procedure as outlined in Section 40.8. [652:8.5.6]

40.9 Personal Protective Equipment

40.9.1 Workplace Hazard Assessment

40.9.1.1\*

An assessment of workplace hazards shall be conducted as described in NFPA 2113. [652:8.6.1.1]

40.9.1.2

When the assessment in 40.9.1.1 has determined that flame-resistant garments are needed, personnel shall be provided with and wear flame-resistant garments. [652:8.6.1.2]

40.9.1.3\*

When flame-resistant clothing is required for protecting personnel from flash fires, it shall comply with the requirements of NFPA 2112. [652:8.6.1.3]

40.9.1.4\*

Consideration shall be given to the following:

Thermal protective characteristics of the fabric over a range of thermal exposures

Physical characteristics of the fabric

Garment construction and components

Avoidance of static charge buildup

Design of garment

Conditions under which garment will be worn

Garment fit

Garment durability/wear life

Recommended laundering procedures

Conditions/features affecting wearer comfort

[652:8.6.1.4]

40.9.1.5

Flame-resistant garments shall be selected, procured, inspected, worn, and maintained in accordance with NFPA 2113. [652:8.6.1.5]

40.9.1.6\*

The employer shall implement a policy regarding care, cleaning, and maintenance for flame-resistant garments. [652:8.6.1.6]

40.9.2 Limitations of PPE Application. (Flame-Resistant Garments)

40.9.2.1\*

When required by 40.9.1.2, flame-resistant or nonmelting undergarments shall be used. [652:8.6.2.1]

40.9.2.2\*

When determined by 40.9.1.1 that flame-resistant garments are needed, only flame-resistant outerwear shall be worn over flame-resistant daily wear. [652:8.6.2.2]

40.9.3 Limitations of PPE to Combustible Dust Flash Fires. (Reserved)

40.9.4 Face, Hands, and Footwear Protection. (Reserved)

40.10 Inspection, Testing, and Maintenance

40.10.1\*

Equipment affecting the prevention, control, and mitigation of combustible dust fires, deflagrations, and explosions shall be inspected and tested in accordance with the applicable NFPA standard and the manufacturers' recommendations. [652:8.7.1]

40.10.2

The inspection, testing, and maintenance program shall include the following:

Fire and explosion protection and prevention equipment in accordance with the applicable NFPA standards

Dust control equipment

Housekeeping

Potential ignition sources

\* Electrical, process, and mechanical equipment, including process interlocks

Process changes

Lubrication of bearings

[652:8.7.2]

40.10.3

The owner/operator shall establish procedures and schedules for maintaining safe operating conditions for its facility and equipment in regard to the prevention, control, and mitigation of combustible dust fires and explosions. [652:8.7.3]

40.10.4\*

Where equipment deficiencies that affect the prevention, control, and mitigation of dust fires, deflagrations, and explosions are identified or become known, the owner/operator shall establish and implement a corrective action plan with an explicit deadline. [652:8.7.4]

40.10.5\*

Inspections and testing activities that affect the prevention, control, and mitigation of dust fires, deflagrations, and explosions shall be documented. [652:8.7.5]

40.10.6

A periodic walk-through review of operating areas shall be conducted, on a schedule established by the owner/operator per the requirement in 40.10.3, to verify that the equipment is in safe operating condition. [652:8.7.6]

40.11 Training and Hazard Awareness

40.11.1\*

Employees, contractors, temporary workers, and visitors shall be included in a training program according to the potential exposure to combustible dust hazards and the potential risks to which they might be exposed or could cause. [652:8.8.1]

40.11.2\*

General safety training and hazard awareness training for combustible dusts and solids shall be provided to all affected employees. [652:8.8.2]

40.11.2.1\*

Job-specific training shall ensure that employees are knowledgeable about fire and explosion hazards of combustible dusts and particulate solids in their work environment. [652:8.8.2.1]

40.11.2.2

Employees shall be trained before taking responsibility for a task. [652:8.8.2.2]

40.11.2.3\*

Where explosion protection systems are installed, training of affected personnel shall include the operations and potential hazards presented by such systems. [652:8.8.2.3]

40.11.3

Refresher training shall be provided as required by the AHJ and as required by other relevant industry- or commodity-specific NFPA standards. [652:8.8.3]

40.11.4

The training shall be documented. [652:8.8.4]

40.12 Contractors

40.12.1

Owner/operators shall ensure the requirements of Section 40.12 are met. [652:8.9.1]

40.12.2\*

Only qualified contractors shall be employed for work involving the installation, repair, or modification of buildings (interior and exterior), machinery, and fire and explosion protection equipment that could adversely affect the prevention, control, or mitigation of fires and explosions. [652:8.9.2]

40.12.3\* Contractor Training

40.12.3.1

Contractors operating owner/operator equipment shall be trained and qualified to operate the equipment and perform the work. [652:8.9.3.1]

40.12.3.2

Contractor training shall be documented. [652:8.9.3.2]

40.12.3.3\*

Contractors working on or near a given process shall be made aware of the potential hazards from and exposures to fires and explosions. [652:8.9.3.3]

40.12.3.4

Contractors shall be trained and required to comply with the facility's safe work practices and policies in accordance with 40.6.2. [652:8.9.3.4]

40.12.3.5

Contractors shall be trained on the facility's emergency response and evacuation plan, including, but not limited to, emergency reporting procedures, safe egress points, and evacuation area. [652:8.9.3.5]

40.13 Emergency Planning and Response

40.13.1\*

A written emergency response plan shall be developed for preparing for and responding to work-related emergencies including, but not limited to, fire and explosion. [652:8.10.1]

40.13.2

The emergency response plan shall be reviewed and validated at least annually. [652:8.10.2]

40.14\* Incident Investigation

40.14.1\*

The owner/operator shall have a system to ensure that incidents that result in a fire, deflagration, or explosion are reported and investigated in a timely manner. [652:8.11.1]

40.14.2

The investigation shall be documented and include findings and recommendations. [652:8.11.2]

40.14.3

A system shall be established to address and resolve the findings and recommendations. [652:8.11.3]

40.14.4\*

The investigation findings and recommendations shall be reviewed with affected personnel. [652:8.11.4]

40.15 Management of Change

40.15.1\*

Written procedures shall be established and implemented to manage proposed changes to process materials, staffing, job tasks, technology, equipment, procedures, and facilities. [652:8.12.1]

40.15.2

The procedures shall ensure that the following are addressed prior to any change:

\* The basis for the proposed change

\* Safety and health implications

Whether the change is permanent or temporary, including the authorized duration of temporary changes

Modifications to operating and maintenance procedures

Employee training requirements

Authorization requirements for the proposed change

Results of characterization tests used to assess the hazard, if conducted

[652:8.12.2]

40.15.3\*

Implementation of the management of change procedure shall not be required for replacements-in-kind. [652:8.12.3]

40.15.4

Design and procedures documentation shall be updated to incorporate the change. [652:8.12.4]

40.16\* Documentation Retention

40.16.1

The owner/operator shall establish a program and implement a process to manage the retention of documentation, including, but not limited to, the following:

Training records

Equipment inspection, testing, and maintenance records

\* Incident investigation reports

Dust hazards analyses

\* Process and technology information

\* Management of change documents

Emergency response plan documents

\* Contractor records

[652:8.13.1]

40.17 Management Systems Review

40.17.1

The owner/operator shall evaluate the effectiveness of the management systems presented in this standard by conducting a periodic review of each management system. [652:8.14.1]

The owner/operator shall be responsible for maintaining and evaluating the ongoing effectiveness of the management systems presented in this standard. [652:8.14.2]

40.18\* Employee Participation

Owner/operators shall establish and implement a system to consult with and actively involve affected personnel and their representatives in the implementation of this standard. [652:8.15]