Effective Hazard Recognition and Control

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Table of contents

Table of Contents

Introduction

Effective Hazard Recognition and Control

Oregon's Safe Employment Act states that, "Every employer shall furnish employment and a place of employment which are safe and healthful for employees therein . . ." (ORS 654.010).

Recognizing and controlling hazards is an essential part of this responsibility. Other essential aspects of an effective accident prevention program include training employees, monitoring work practices, and ensuring accountability.

Oregon OSHA defines a hazard as, "A condition, practice, or act that could result in an injury or illness to an employee" (OAR 437-001-0015). Note that this definition is not limited to physical conditions. Unsafe work practices and acts are, by far, the leading causes of workplace injuries and should always be included in a workplace hazard inspection.

Understanding this definition and following an established methodology for identifying and correcting hazards is essential to creating a safe work environment. This guide will provide you with solid ideas to elevate safety through your hazard identification efforts.

This guide is focused on conducting workplace inspections and is designed to help employers improve the effectiveness of these activities.

ORS – Oregon Revised Statutes
OAR – Oregon Administrative Rules
CFR – Code of Federal Regulations

Safety committee inspection requirements

For a more detailed explanation, go to:

http://www.cbs.state.or.us/osha/pdf/rules/division_1/437-001-0765.pdf

A well-run safety committee can have a powerful impact on the safety of an organization. OAR 437-001-0765 establishes guidelines and requirements for the formation and operation of safety committees in Oregon. One key requirement is that safety committees conduct hazard identification inspections at least on a quarterly basis. The following are a summary of the main requirements pertaining to inspections:

Training

Each person conducting safety and health inspections must be trained. The training should include your company's inspection procedures, hazards in the workplace and methods to correct hazards. It is also important that identifying and addressing unsafe work practices be a part of the inspection training.

Inspection procedures

Procedures need to be established to effectively conduct workplace inspections. This includes assigning areas to be inspected, documentation, and actions to be taken following the inspection. Additionally, someone should be accountable to ensure follow up and correction of hazards.

Quarterly inspections

Safety committee inspections need to be conducted on at least a quarterly basis and cover the entire facility each time. This can be accomplished by inspecting the entire facility with the inspection team or by splitting up the inspection team, with each group inspecting a different part of the facility. For larger and more complex facilities, an alternative method is to inspect one-third of the property each month.

Reviewing inspection reports

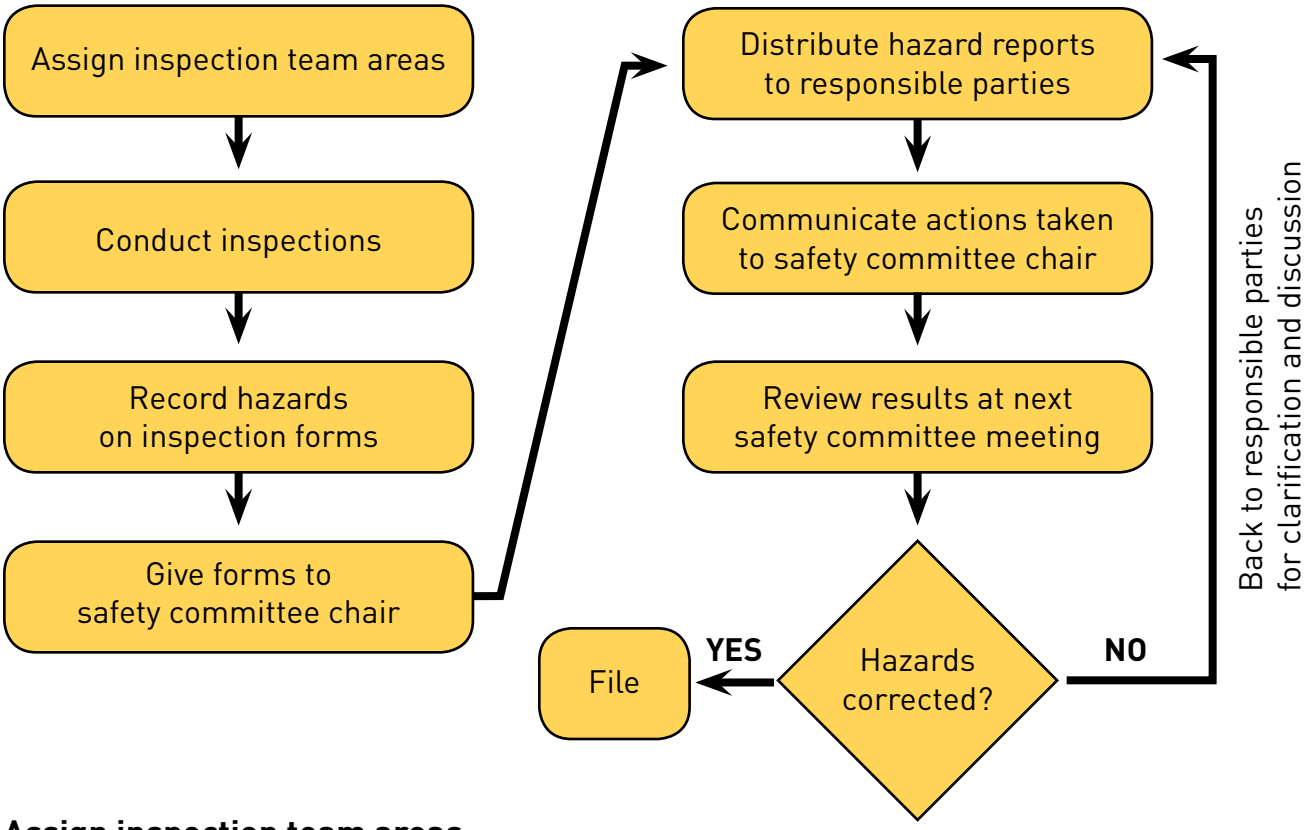
A part of establishing inspection procedures is to determine who will be reviewing the inspection reports and how recommendations will be submitted to management. Management needs to be involved in the inspection process so that recommendations can be approved and to make sure corrective actions are taken.

System for reporting hazards

In addition to the above inspection requirements, a system needs to be established that allows employees an opportunity to report hazards and submit safety- and health-related suggestions. The classic example is a safety suggestion box. Other examples include creating an email address specifically for making suggestions, suggestion competitions, direct communications, and more.

Inspection procedures

A variety of methods are employed when conducting inspections; some are very informal, while others are quite elaborate and methodical. The following model is somewhere in between in that it combines simplicity with accountability and follow up to ensure hazards are corrected in a timely manner.



Assign inspection team areas

Individual inspection team members are assigned to specific areas within the facility. In a small operation, the entire inspection team may visit all areas of the facility. Larger operations may need to parcel out areas for smaller inspection teams.

Conduct inspections

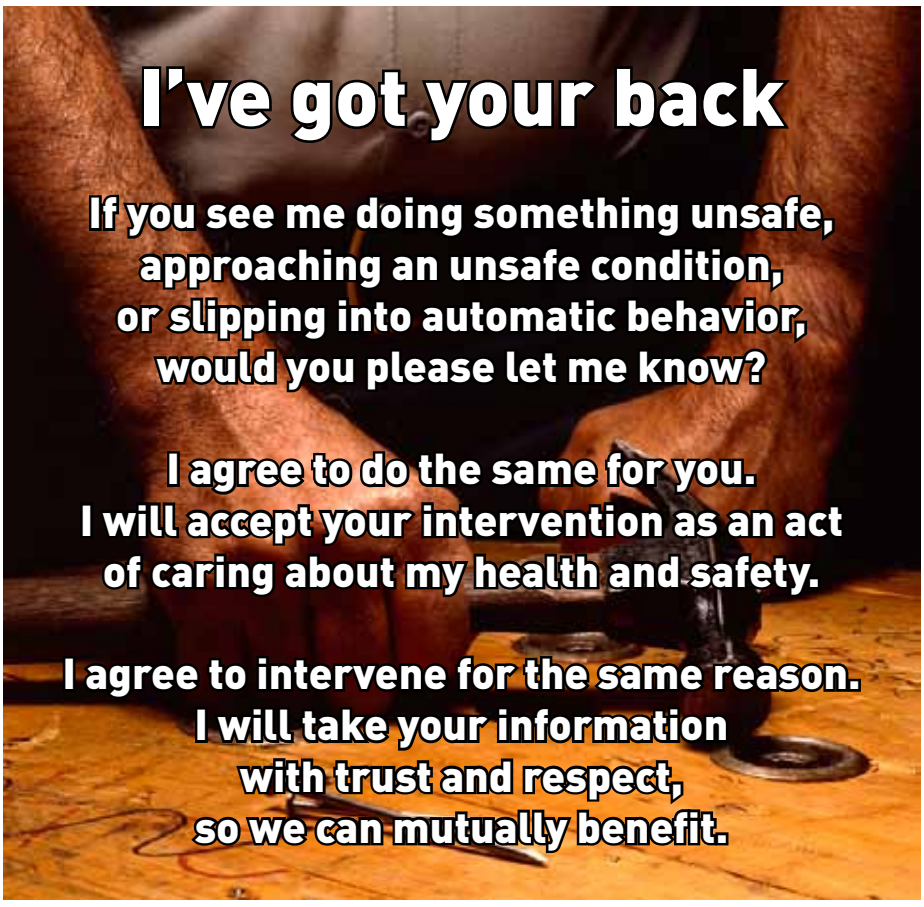
Because the entire facility needs to be inspected at least quarterly, planning should focus on accomplishing this in a timely manner. A good strategy is to conduct inspections at different times of the day, throughout the year, so that different operating conditions and schedules can be observed. In production areas, an effective method is to begin where raw materials arrive and follow the flow through machining, assembly, finishing, and shipping. At each process, identify activities and conditions where an injury is likely. If any items are of a critical nature or present an imminent danger, these critical items should be immediately reported to the person responsible for taking action.

Inspection procedures

Addressing unsafe work practices

When an unsafe work practice is observed during a hazard inspection, it is important that it be treated as any other hazard. The observed action should be recorded on the inspection form and dealt with through the safety committee. Typically, only the unsafe act and location are recorded. The employee's identity is omitted, but the person responsible for that area is informed of the unsafe work practice so that changes can be made. Changes may include training the group and reinforcing the safe work practice or making a physical change so the unsafe act is less likely.

It may be beneficial to have the responsible supervisor accompany the inspection team so that observed unsafe acts can be addressed immediately. Companies with strong safety cultures may have policies that permit, and even encourage, workers to openly discuss unsafe work practices when they are observed. Formalized programs often referred to as "tough caring" or "I've got your back" empower employees by establishing mutual agreements to look out for one another. Each party promises to accept corrective comments as a show of concern for their safety. This philosophy applies even when the offender is a supervisor.

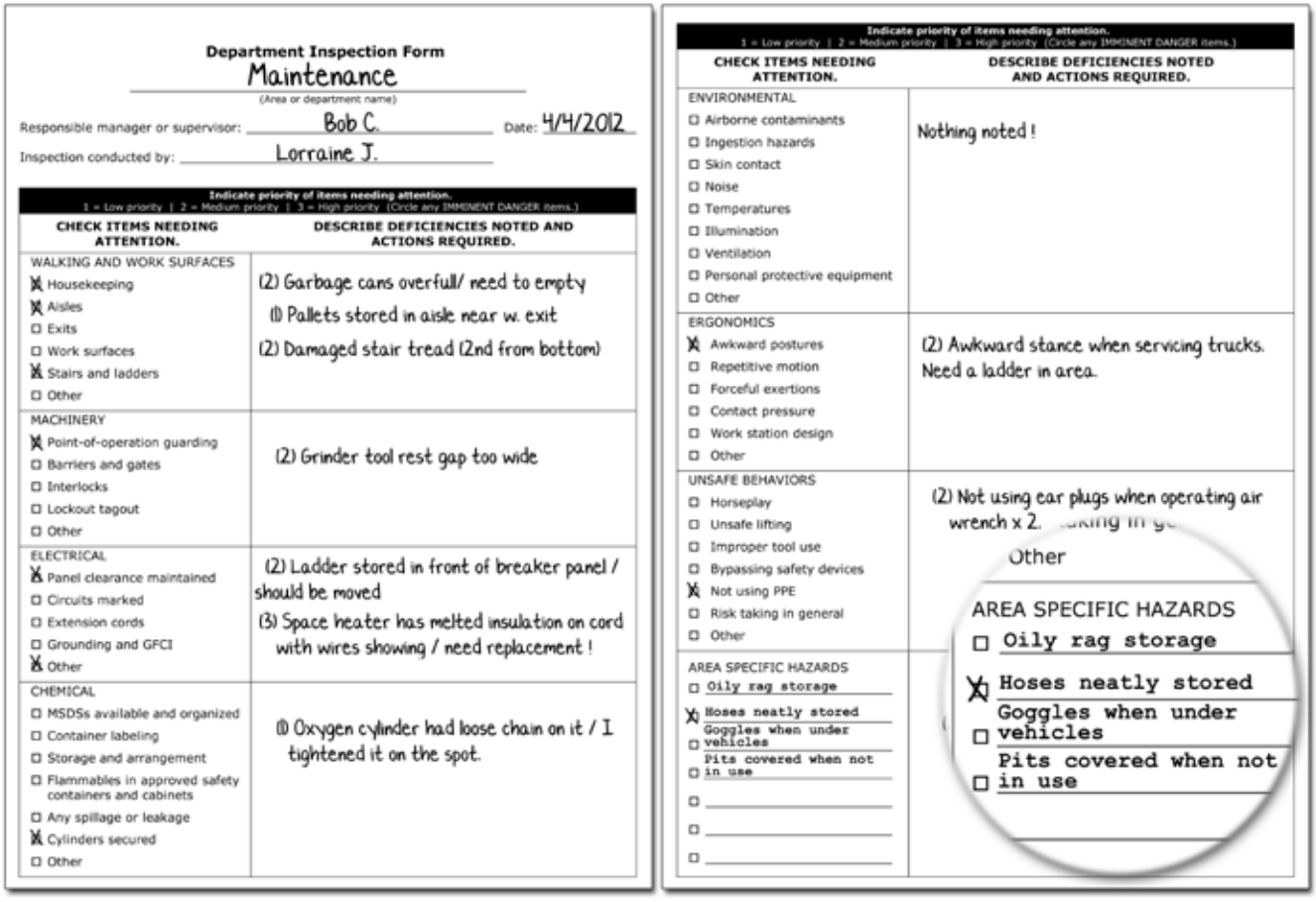


Record hazards on inspection forms

Many companies use their own inspection forms as part of the inspection process. This tends to be superior to using a generic downloaded form. There are certainly hazards common to most operations, but each business also has its own unique hazards. The best forms combine common and job-specific hazards to guide inspection teams.

Inspection checklists are popular for conducting inspections because they provide guidance in what to look for. This is particularly useful when the inspection team members are inexperienced and unfamiliar with the hazards in the workplace. However, a drawback to checklists is that they often get checked off without much other information. Checklists also frequently omit a section for unsafe work practices and are rarely customized for a specific work area.

The example form pictured below is provided full-size in the forms section. It combines common and area-specific hazards, with broad checklist categories as prompts for the inspection team. Ample space is provided to elaborate or explain hazards observed.



Department Inspection Form

Maintenance
(Area or department name)

Responsible manager or supervisor: Bob C. Date: 4/4/2012

Inspection conducted by: Lorraine J.

Indicate priority of items needing attention.
1 = Low priority | 2 = Medium priority | 3 = High priority (Circle any IMMINENT DANGER items.)

CHECK ITEMS NEEDING ATTENTION.	DESCRIBE DEFICIENCIES NOTED AND ACTIONS REQUIRED.
WALKING AND WORK SURFACES ☒ Housekeeping ☒ Aisles ☐ Exits ☐ Work surfaces ☒ Stairs and ladders ☐ Other	(2) Garbage cans overfull/ need to empty (1) Pallets stored in aisle near w. exit (2) Damaged stair tread (2nd from bottom)
MACHINERY ☒ Point-of-operation guarding ☐ Barriers and gates ☐ Interlocks ☐ Lockout tagout ☐ Other	(2) Grinder tool rest gap too wide
ELECTRICAL ☒ Panel clearance maintained ☐ Circuits marked ☐ Extension cords ☐ Grounding and GFCI ☒ Other	(2) Ladder stored in front of breaker panel / should be moved (3) Space heater has melted insulation on cord with wires showing / need replacement !
CHEMICAL ☐ MSDSs available and organized ☐ Container labeling ☐ Storage and arrangement ☐ Flammables in approved safety containers and cabinets ☐ Any spillage or leakage ☒ Cylinders secured ☐ Other	(1) Oxygen cylinder had loose chain on it / I tightened it on the spot.

Indicate priority of items needing attention.
1 = Low priority | 2 = Medium priority | 3 = High priority (Circle any IMMINENT DANGER items.)

CHECK ITEMS NEEDING ATTENTION.	DESCRIBE DEFICIENCIES NOTED AND ACTIONS REQUIRED.
ENVIRONMENTAL ☐ Airborne contaminants ☐ Ingestion hazards ☐ Skin contact ☐ Noise ☐ Temperatures ☐ Illumination ☐ Ventilation ☐ Personal protective equipment ☐ Other	Nothing noted !
ERGONOMICS ☒ Awkward postures ☐ Repetitive motion ☐ Forceful exertions ☐ Contact pressure ☐ Work station design ☐ Other	(2) Awkward stance when servicing trucks. Need a ladder in area.
UNSAFE BEHAVIORS ☐ Horseplay ☐ Unsafe lifting ☐ Improper tool use ☐ Bypassing safety devices ☒ Not using PPE ☐ Risk taking in general ☐ Other	(2) Not using ear plugs when operating air wrench x 2.
AREA SPECIFIC HAZARDS ☐ Oily rag storage ☒ Hoses neatly stored ☐ Goggles when under vehicles ☐ Pits covered when not in use ☐ _____ ☐ _____ ☐ _____	

Other

AREA SPECIFIC HAZARDS
☐ Oily rag storage
☒ Hoses neatly stored
☐ Goggles when under vehicles
☐ Pits covered when not in use

Inspection procedures

Send completed forms to committee chair

Once the inspection is complete and the inspection form filled out, it should be given to the safety committee chair or the company's safety coordinator.

Distribute hazard report to responsible parties

When the safety committee chair or safety coordinator receives inspection reports, they should be reviewed and items recorded for future discussion. The forms or other communication device should be used to inform the responsible parties of any hazards needing action. A reasonable amount of time should be determined for a response.

If not addressed on the inspection form itself, the specific items should be prioritized, particularly if there are any critical items needing attention.

Communicate actions taken to safety committee

Responsible parties should communicate back to the safety committee chair or safety coordinator the status of the items noted. If the item has been taken care of, the date of correction should be noted.

Review results at next safety committee meeting

At the very next safety committee meeting, the results of the inspections and the status of items noted should be discussed. Individual inspection forms can be used or, if appropriate, a compiled list of hazards can be reviewed.

It is important that safety committee members be kept informed of hazard status so they can see the results of their efforts.

Hazards corrected

Corrected hazards should be noted in the safety committee minutes and removed from the list for future review.

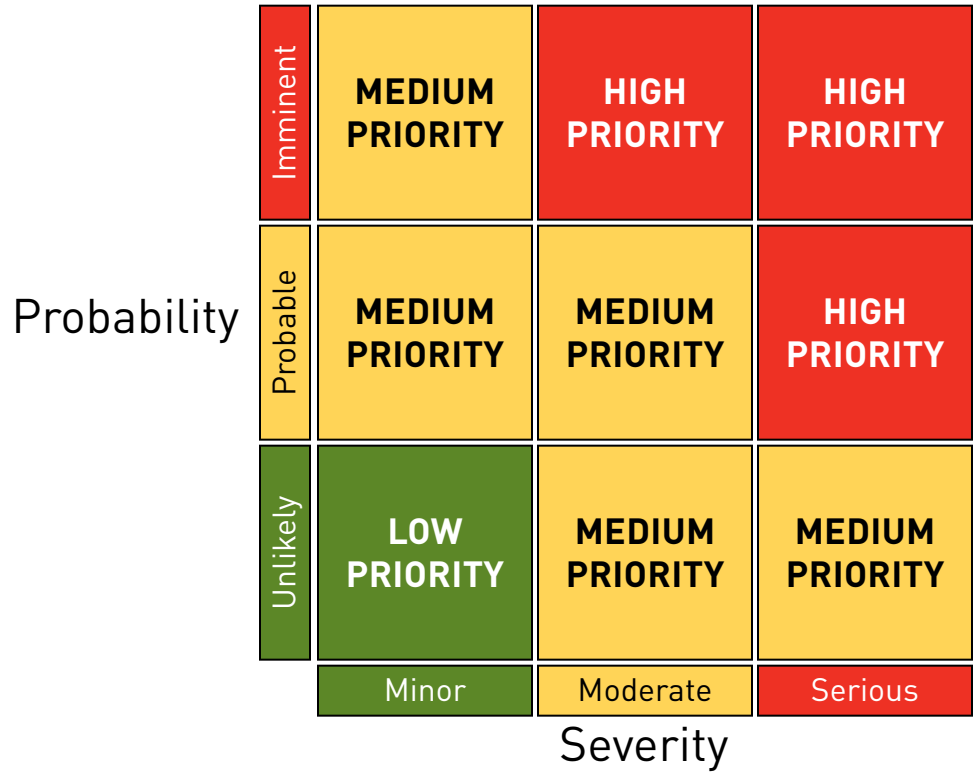
Hazards not corrected

Hazards that have not been corrected need to remain on the safety committee list until resolved or management finds an alternative way to make sure the hazard will not result in injury.

Sometimes a hazard cannot be completely eliminated, but alternative methods may be employed to make the situation less hazardous or to otherwise safeguard workers. Low priority items need no further action as long as a responsible party agrees to make needed corrections.

Determining priority

New inspection teams sometimes have a tendency to create long laundry lists of trivial items with little or no safety consequence. Keeping the inspection focused on the things that can truly lead to accidents will give the effort more credibility with management. In order for identified hazards to be given due consideration by management and other responsible parties, they must be prioritized.



In this illustration, the probability of injury and severity of injury are on the X-Y axis. Low-priority items are unlikely to result in an injury and such injuries will tend to be minor. In contrast, high-priority items are likely to result in injuries, with a more severe outcome.

For example, a glass jar of peanut butter sitting near the edge of a shelf could get knocked off and could result in an injury. However, the probability of this occurring is low and the resulting injury, if any, would most likely be a minor cut. Therefore, these conditions would result in a Low Priority being assigned to it.

In another example, a worker repairing a leaking pipe in a 6 foot trench with vertical sides and sandy soil has a high probability that an accident will occur by the sides collapsing. The most likely outcome would be a serious or fatal injury. As such, this would be a high priority item.

When the probability of an injury is "Imminent" and the likely severity is "Serious", a special condition, known as an "Imminent Danger" is present. Swift action is required because of the urgency of the situation. This should require the temporary suspension of the specific operation until the condition is mitigated.

Controlling hazards

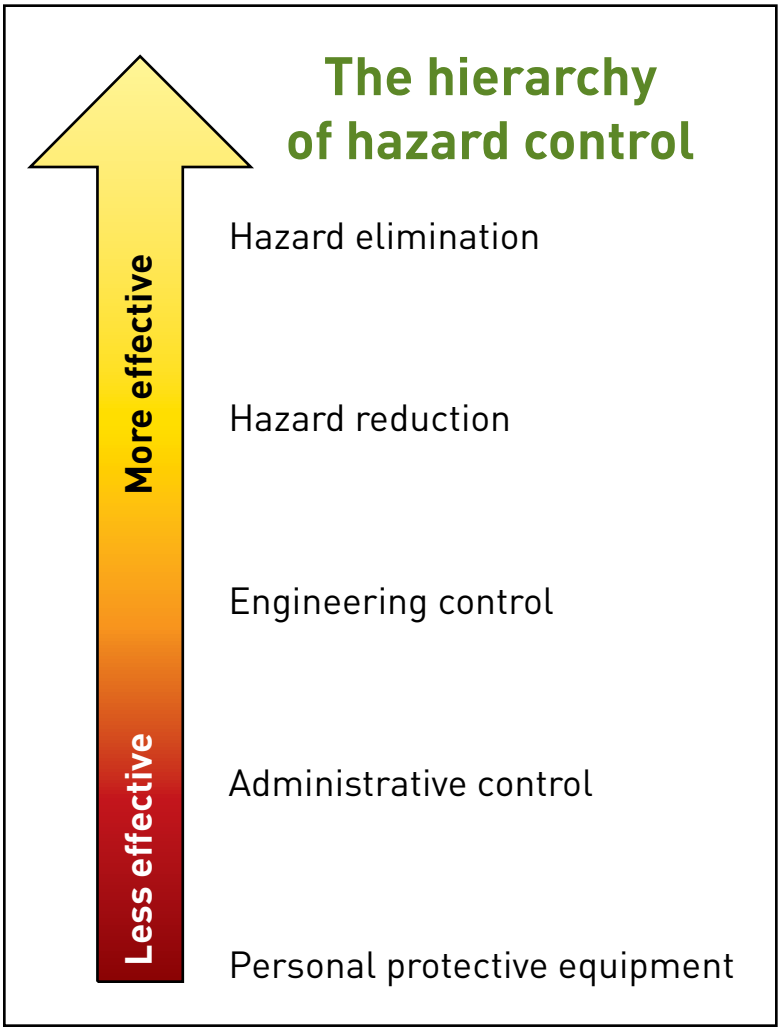
Once hazards have been identified, finding a means to effectively eliminate or control them is crucial. The best hazard identification program can be a huge waste of time if the hazards remain or are ineffectively dealt with. In addition, unresolved hazards can adversely impact the attitudes of the safety committee and the company as a whole.

Hazard elimination

The best way to deal with a hazard is to eliminate it. This can be done by discontinuing a process, automating a process, or providing a tool or device that removes the employee from the hazard zone.

Hazard reduction

If you can't completely eliminate a hazard, make a change that reduces the hazard to an acceptable level. If a chemical is involved, finding a less hazardous, but equally effective chemical is desirable.



Engineering control

Providing an engineering control isolates, ventilates, contains, or otherwise controls the hazard through some physical means. Placing a guard on a hazardous moving part is an example. The hazard remains, but the workers are protected from the point of operation. The reason this is less effective than hazard elimination or hazard control is because it is possible to remove an engineering control or shut off the means of control, thus exposing employees.

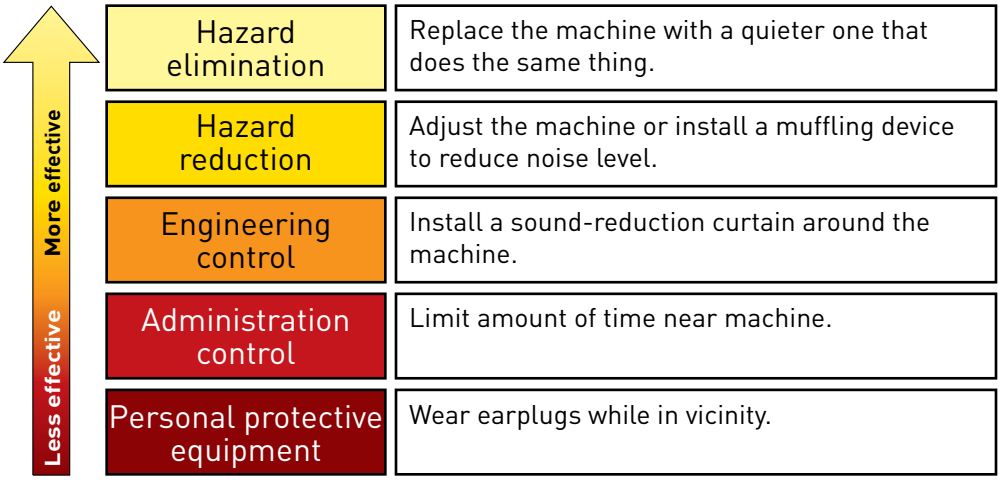
Administrative controls

Administrative controls are best used in combination with a more effective means of control. Administrative controls include procedures and training to avoid or reduce exposure to the hazard.

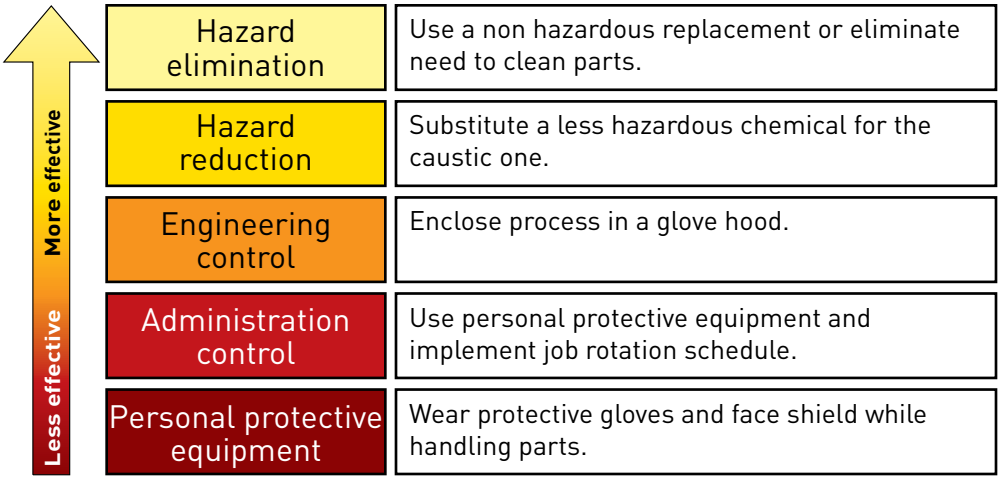
Personal protective equipment (PPE)

PPE provides a barrier between the worker and the hazard. It never eliminates the hazard, but will provide a degree of protection should the worker come in contact with the hazard, whether it be physical or chemical in nature.

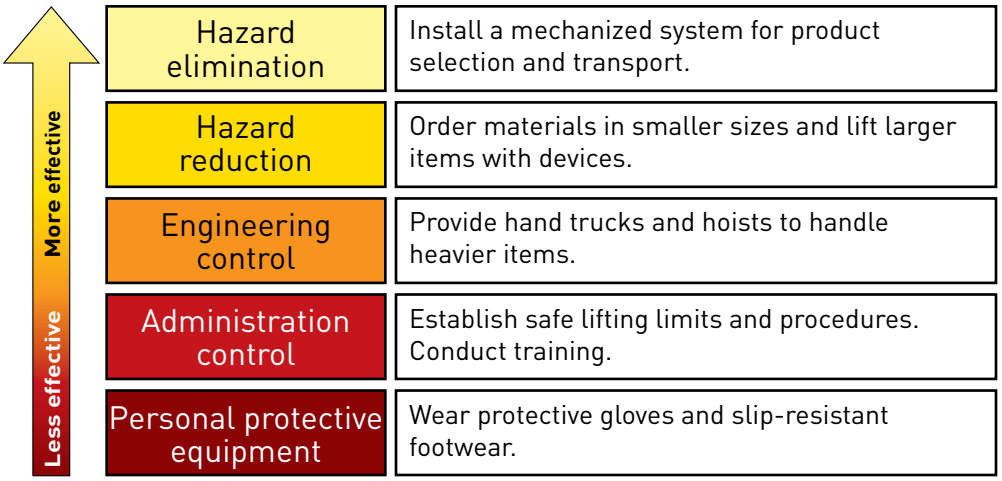
Hazard control examples



Example:
Noisy processing machine



Example:
Caustic chemical for parts cleaning



Example:
Frequent and heavy lifting

Recognizing hazards

The best tools for identifying hazards are experience and knowledge of your industry. In addition, understanding your company's prior accident history can give you a great perspective for what can and has gone wrong. Your accident history should be reviewed and analyzed by the safety committee regularly.

Other excellent sources for identifying hazards in your workplace include:

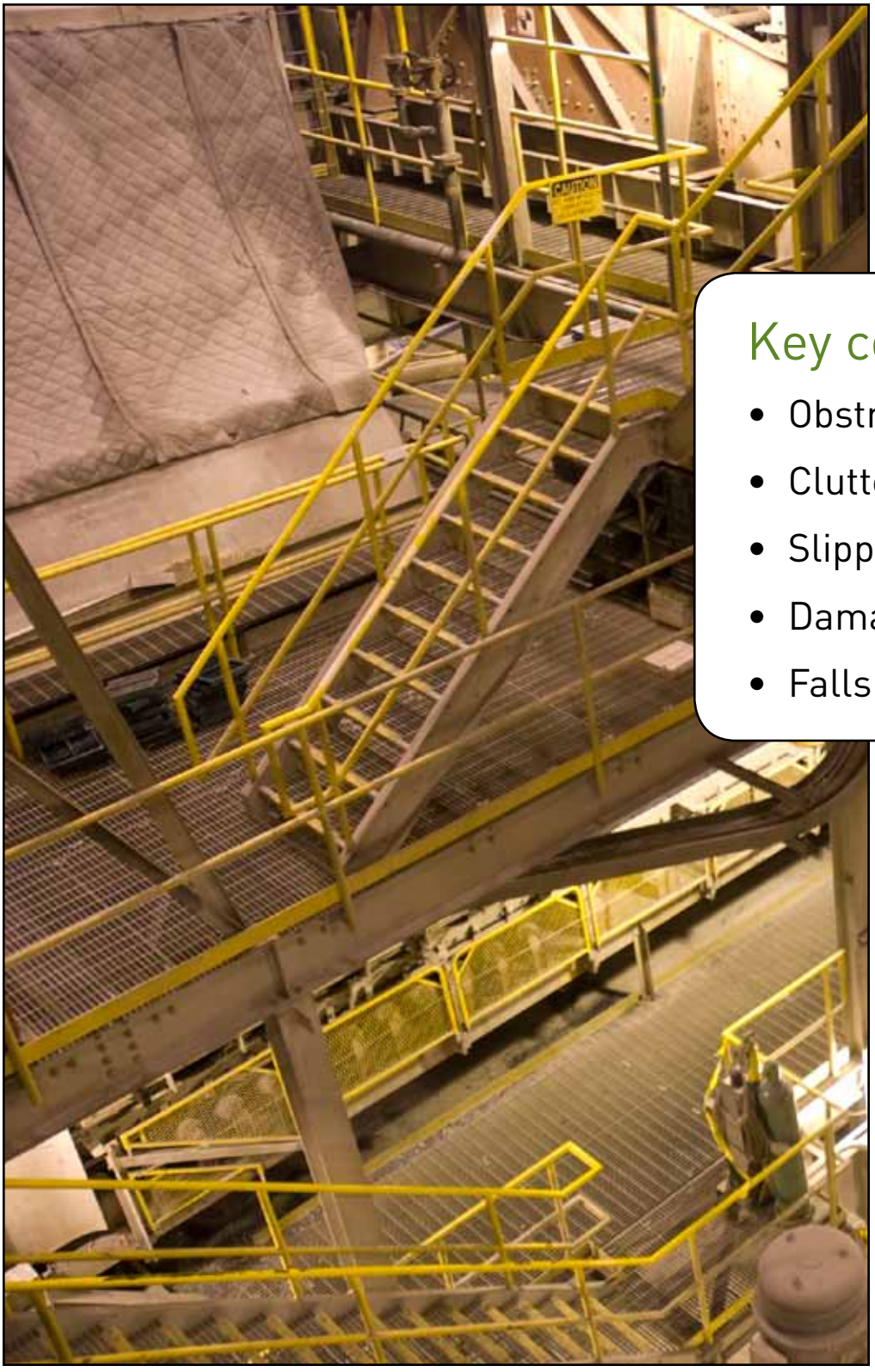
- Oregon OSHA **www.orosha.org** for links to rules, publications and topical resources. A number of specialized inspection checklists are available.
- SAIF Corporation **www.saif.com** for links to various safety topics. Also, a safety consultant can provide guidance and assist you in hazard identification at your location.
- Local fire department.
- Industry associations and publications.

The remainder of this guide provides numerous examples of hazards typical in many work environments. These provide visual cues and written descriptions of the types of things to observe for while conducting inspections. For the sake of order and brevity, the hazards have been organized into seven categories.

- Work surface and walkway hazards
- Machinery hazards
- Electrical hazards
- Chemical hazards
- Environmental hazards
- Ergonomic hazards
- Unsafe work practices

Although this guide should provide hazard inspection teams a fairly comprehensive list of hazards typical in the workplace, it does not attempt to address each and every hazard which might be anticipated. These hazards however, are common in most workplaces.

Work surface and walkway hazards



Key concerns

- Obstructions
- Clutter
- Slippery surfaces
- Damage
- Falls from elevations

Work surface and walkway hazards

Obstructions and clutter

Floors may be cluttered with furniture, electrical cords, and materials that pose a trip hazard.

How is the overall housekeeping? A disorganized or dirty area may be reflective of an underlying poor safety attitude. Inspecting authorities tend to be more thorough when the first impression is one of poor housekeeping.

Inadequate housekeeping practices produce fire and trip hazards. Frequent and regularly scheduled cleanups should be part of the company's safety culture.

<<

Emergency exits should always be free of obstructions and kept unlocked during business hours.

Aisles, whether at ground level or on a catwalk, need to be wide enough to safely traverse. OSHA has established that aisles need to be maintained at least 22 inches wide. Aisles leading to exits may need to be wider.

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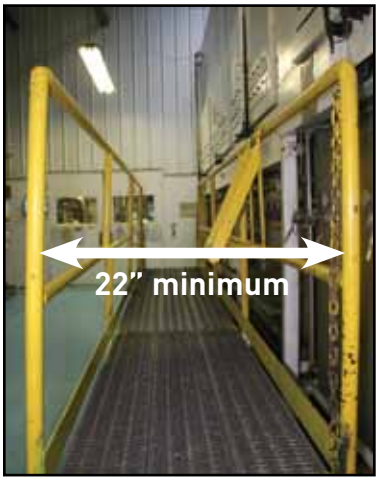


OAR 437-02-0022(3)

Work surface and walkway hazards

Slippery surfaces

Walking surfaces can be very hazardous if they are slippery. Floors become "skating rinks" when liquid spills are not swiftly cleaned up. Outside walkways and parking lots are hazardous when rain, snow or ice is present. Walk-in coolers and freezers present special hazards because ice can form on the floor.

Damaged surfaces

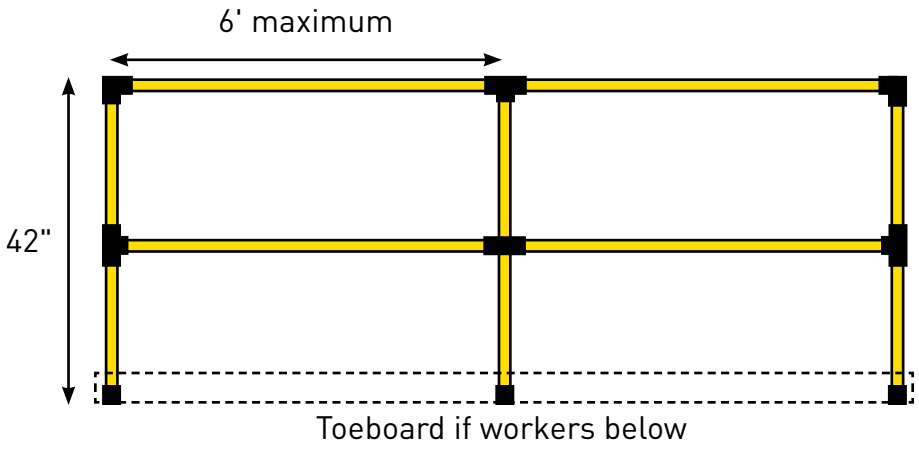
Broken flooring, damaged steps, potholes and other damaged surfaces can result in trips and falls, as well as twisted ankles and even fractures. In addition, be watchful for damaged ladders and the condition of stairs.

Work surface and walkway hazards

22 CFR 1910.23(e)

Elevations

Standard railings are required for any open-sided floor or platform that is four or more feet above the adjacent floor surface; or any open-sided floor or platform when it is above an adjacent hazard.



OAR 437-002-0026

When placing a ladder, make sure that its base is one foot out for every four feet in height.

The ladder rails should also extend at least three feet above the edge of the roof.

If the ladder is to be used throughout a work shift, it should also be secured in place.

Machinery hazards

Key concerns

- Guarding for:
  - Point of operation
  - In-running nip points
  - Rotating motion
  - Flying chips and sparks
- Lockout/tagout

Machinery hazards

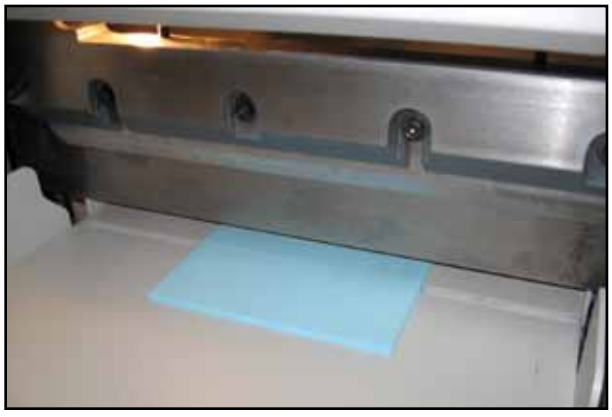
General requirement for machine guarding

CFR 1910.212(a)(1)

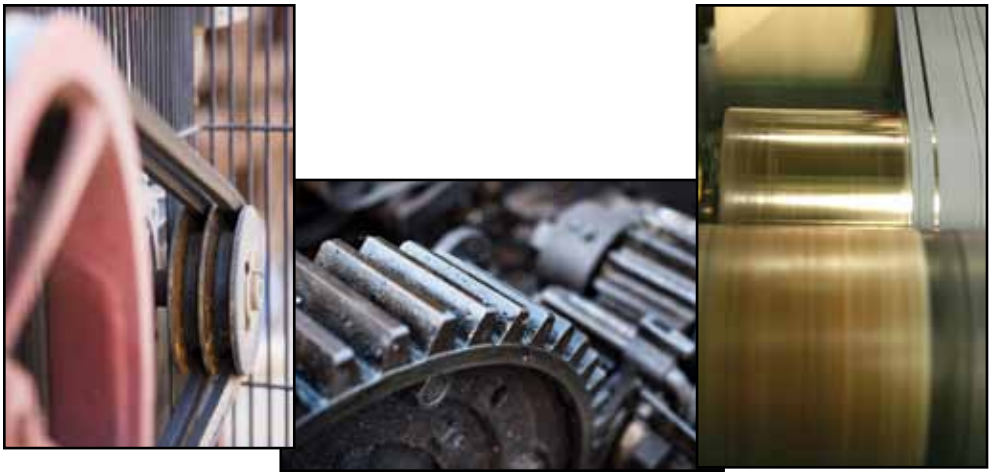
One or more methods of machine guarding shall be provided to protect the operator and other employees in the machine area from hazards such as those created by:

- Point of operation
- In-going nip points
- Rotating parts
- Flying chips
- Sparks

Point of operation
This is the point at which cutting, shaping, or forming is accomplished.



Machinery hazards



In-running nip points

This hazard occurs when rotating parts on machinery come close together or are intermeshed.

Rotating motion

Rotating motion takes the form of shafts, shaft ends, collars, couplings, flywheels and spindles, whether fast or slow.

Flying chips and sparks

Flying chips and sparks are generated from material shaping (for example, drilling, milling, and grinding) and welding processes.

Machinery hazards

If you can reach it or it can reach you,

you need to safeguard it.

Safeguarding methods

Guards
- Fixed
- Interlocked
- Adjustable
- Self-adjusting

Devices
- Presence sensing
- Pullback
- Restraint
- Safety controls (tripwire cable, two-hand control, etc.)
- Gates

Location and distance

Feeding and ejection methods
- Automatic or semi-automatic feed and ejection
- Robots

Miscellaneous Aids
- Awareness barriers
- Protective shields
- Hand-feeding tools
- Sawstop®

Guards

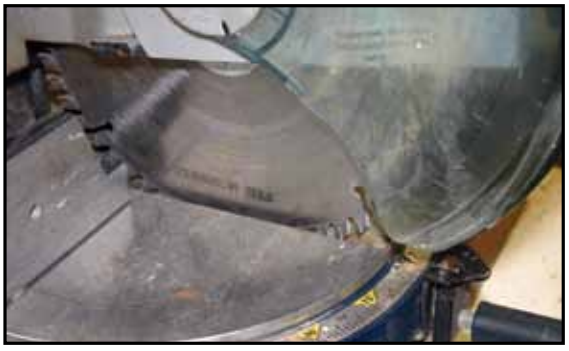
Mechanical guards provide a physical barrier to prevent contact with the point of operation.

In general, adjustable and fixed guards should be positioned just above the material being processed, so that a finger cannot pass between the material and point of operation.

Adjustable guards need to be continually monitored to ensure hand and finger protection because material sizes can vary, thus increasing the gap between guard and material.

Fixed guards

Adjustable guard



Self-adjusting guard

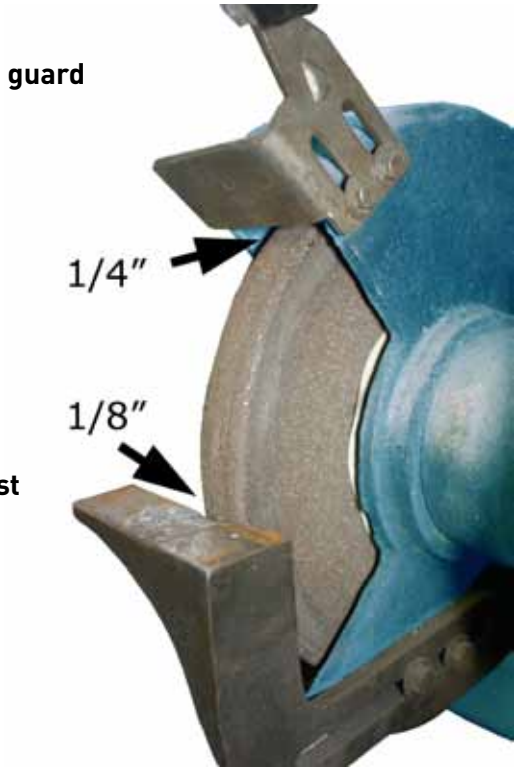
Barrier

Interlock device

Interlocked guards are usually installed on moveable barriers that, when opened, will shut down power to the machine being protected.

Machinery hazards

CFR 1910.215(b)(9) Tongue guard



CFR 1910.215(a)(4) Tool rest

Bench grinders

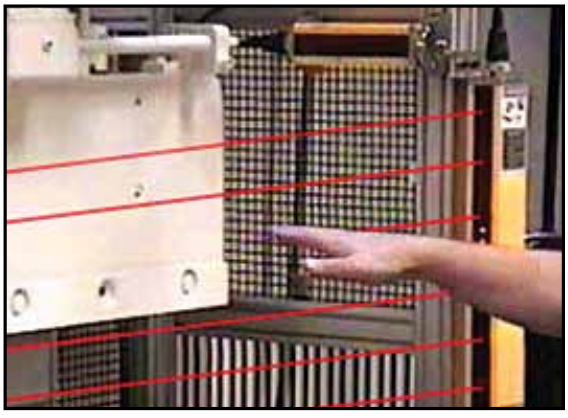
One of the more common machine hazards cited by OSHA is the adjustment of a bench grinder's tool rest and tongue guard. The gap between each of these and the grinding wheel should never exceed 1/8" and 1/4" respectively.

Guarding devices

Guarding devices do not provide a physical barrier, but protect the worker through other methods.

Two-hand controls require the worker to depress two buttons simultaneously to engage the machine. This is effective as long as the devices remain in good repair and a worker does not bypass the safety feature.

Two-hand control



Presence sensing device

Presence sensing devices use an infrared beam to shut the machine off whenever something blocks the light. Another type of presence sensing device is a pressure-sensitive mat placed on the floor in a danger area. Pullback devices are an older technology that physically pull the hands out of the way when the machine engages.

Interlocked gate

Pullback device

Other guarding methods

Numerous other guarding methods have been developed to prevent or reduce the possibility of injury when working around points of operation.

Points of operation more than seven feet above the floor are considered safe and do not need to be guarded.

Keeping a point of operation behind a closed and locked door enclosure effectively prevents most people from accessing it.

Height

> 7 feet

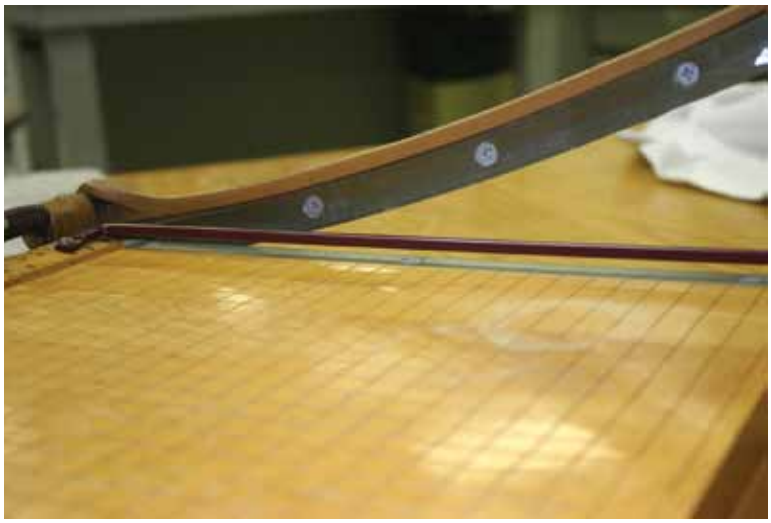
SawStop® is a specially designed table saw with a built-in safety device that detects when a finger or other body part makes contact with the blade. Within milliseconds, the blade drops below the table surface and imbeds in a braking material, completely stopping the blade. This greatly reduces or eliminates an injury from the saw blade.

Machinery hazards

Awareness barriers work like the warning track on a baseball field. They don't really prevent injury, but let you know when you are close.

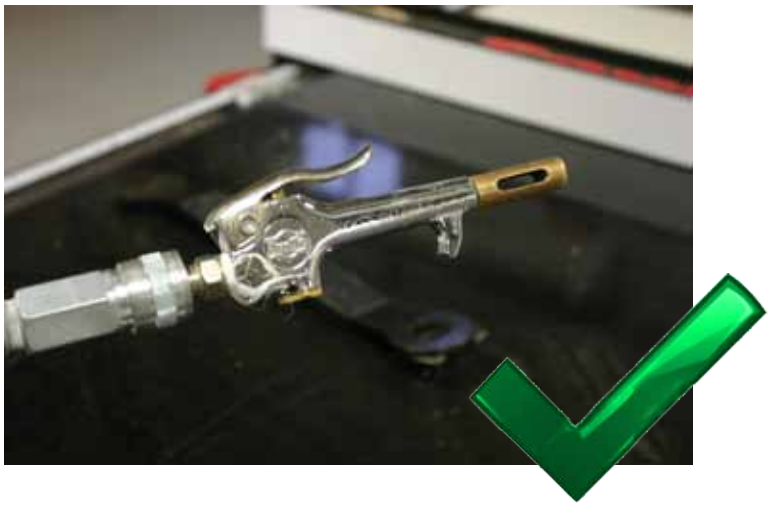
Robotics or other automation methods are effective at preventing workers from being exposed to points of operation. However, any task using robotics needs to be carefully evaluated to ensure barriers or other devices protect workers against robot swing and movements.

Robotics



Awareness barrier

CFR 1910.242(b) When pressurized air greater than 30 psi is used for cleaning purposes, the nozzle needs a pressure relief device that limits pressure to 30 psi if the flow is dead-ended.



Determining the adequacy of fixed guards

When a guard has been installed to protect workers from the point of operation, the most important consideration is whether or not a worker can reach the point of operation, and consequently be injured.

OSHA has published guidelines for allowable guard opening sizes. This is based upon distance from the point of operation. The further from the point of operation, the larger the opening can be.

CFR 1910.217(c)(2)(i)

Point of operation

Guard opening requirements

Distance of opening from point of operation			Maximum width of opening
1/2"	to	1 1/2"	1/4"
1 1/2"	to	2 1/2"	3/8"
2 1/2"	to	3 1/2"	1/2"
3 1/2"	to	5 1/2"	5/8"
5 1/2"	to	6 1/2"	3/4"
6 1/2"	to	7 1/2"	7/8"
7 1/2"	to	12 1/2"	1 1/4"
12 1/2"	to	15 1/2"	1 1/2"
15 1/2"	to	17 1/2"	1 7/8"
17 1/2"	to	31 1/2"	2 1/8"
Over 31 1/2"			6"

As an example, if a guard is 7 inches from the point of operation, the maximum allowable guard opening is 7/8" wide.

A guard opening gauge can be purchased or made to help assess the safety of a guard's openings. It is commonly referred to as a "gotcha stick," and its stair step design allows you to determine if a guard's gaps are too wide. As long as the tip cannot touch the point of operation, the guard's openings are narrow enough.

A template to assist you in making your own guard opening gauge can be found at the end of this guide. The photo to the right illustrates the use of such a device.

Machinery hazards

Lockout/tagout

When conducting a hazard assessment, it is important to be on the lookout for repair tasks where workers may be exposed to various energy sources.

If someone is performing maintenance or repairs

and a form of energy is present or stored

it must be isolated or dissipated.

Energy sources

Electricity is the most common energy source associated with locking out a piece of equipment. Workers need to be protected against the accidental energizing of a circuit when repairs are being made.

Stored hydraulic, pneumatic, and steam pressure can also pose significant risks. Generally, such sources need to be dissipated or blocked off so moving parts are not activated.

Suspended items (gravity) need to be blocked up while doing work.

Spring tension needs to be blocked or released, and piped chemicals need to be blocked off or drained.

Electricity

Piped chemicals

Spring tension

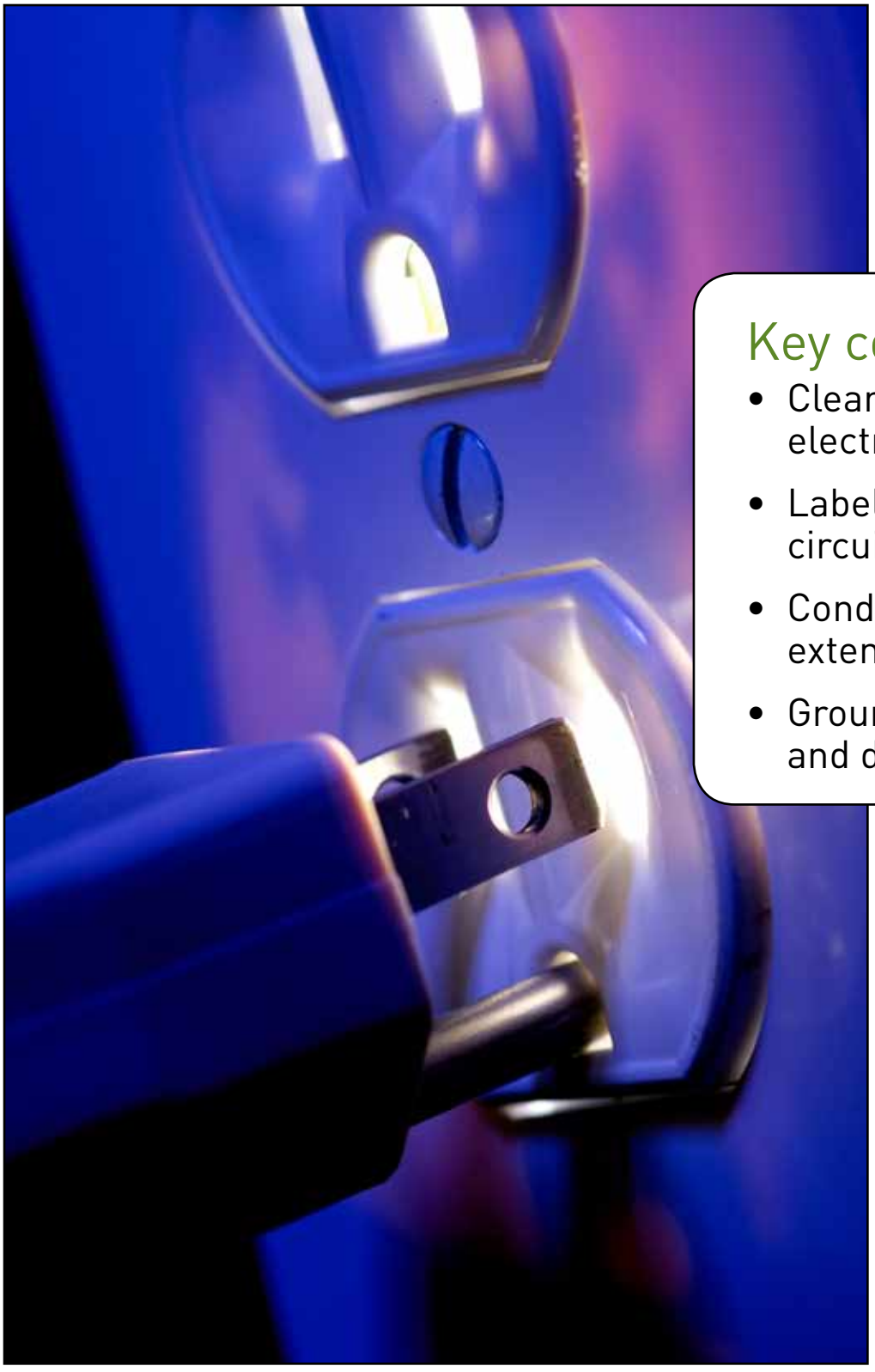
Steam pressure

Pneumatic pressure

Gravity

Hydraulic pressure

Electrical hazards



Key concerns

- Clear access to electric panels
- Labeling of electric circuits
- Condition and use of extension cords
- Grounding of cords and devices

Electrical hazards

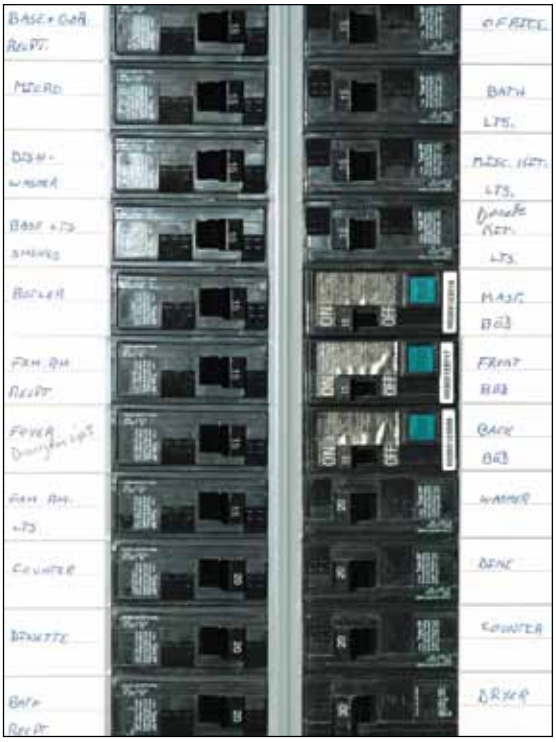
Blocked electrical panels

Electrical panels need to have direct access and at least 36 inches of clear space in front of them.

Electrical panel labeling

Each circuit needs to be clearly labeled. In an emergency, the quick location of specific circuits is essential.

Any open slots need to be covered with "blanks" to prevent inadvertent contact with electricity.



Power cords

Extension cords can be found in almost every work environment. Damaged cords can be dangerous as they can cause fires and serious injury.

Extension cords should be used for temporary tasks then put away afterwards. They should never be used in place of permanently wired electrical cable, nor should they be run where they are subject to damage. An additional outlet should be installed if an extension cord is being used on an ongoing basis.

Grounding prongs are sometimes broken off, accidentally or on purpose. This removes an important safety feature and can result in electrocution.

Power strips are sometimes "daisy chained" together. This increases the load on power strips and the circuit, which overheat the circuit, resulting in fire and/or injury.

Make sure electrical cords are neatly arranged and do not pose a trip hazard. Use a cord cover when a trip hazard is present.

Cords should be free of damage and splices

Never used for permanent power source

Cord worked lose from plug

Power strip daisychain

Grounding prong missing

Trip hazard

Not fully plugged into receptacle

Cord cover

Testing

An inexpensive and simple electrical circuit tester can be used to test cords and circuits. It can test for the presence of a ground, reversed polarity, short circuits, and other conditions. Some have trip buttons to test ground fault circuit interrupters (GFCIs).

Chemical hazards

Key concerns

- Material safety data sheets
- Container labeling
- Storage of chemicals

Chemical hazards

29 CFR 1910-1200

Material safety data sheets

Hazard Communication Standard establishes that MSDSs need to be available for all hazardous substances in the workplace.

Material safety data sheets provide detailed information about a chemical's hazardous properties, handling methods, PPE required, storage methods, and disposal.

The data sheets should be organized so that information on specific substances can be easily and quickly located. A well-written table of contents can effectively serve this purpose.

It is desirable to have one master MSDS book, in a central location and smaller books in areas containing MSDSs pertaining to those areas.

Container labeling

Containers of hazardous chemicals need to have labels. Secondary containers also need labels if the material will remain in the container beyond one shift.

The label needs to include:

- Product identification
- Hazard warning that communicates specific health and physical hazards

Various labeling systems exist. Some are peel-off labels you customize and print, or fill out by hand. Others are pre-printed by the manufacturer.

Storage of chemicals

Chemicals should be stored neatly at all times. Steps should be taken to make sure the materials do not leak. This is typically accomplished by providing chemical-resistant trays or containment pallets.

Excellent storage methods

Make sure incompatible materials are not stored together. For example, oxidizers (OXY) should not be stored with combustible materials, since oxygen is released with heat and can greatly increase a fire's intensity. In a confined area, an explosion can occur.

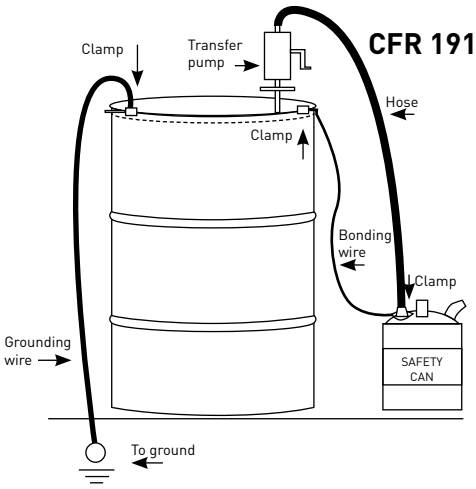
Poor storage methods

Drum storage

CFR 1910.106(e)(6)

When dispensing flammable liquids, the fluid motion can cause a static charge to build up. A spark can then ignite flammable vapors in the area.

Therefore, drums containing flammable liquids need to be electrically grounded to prevent the buildup of static electricity. Also, cable and clips should be used to bond the drum with a secondary container during dispensing.



Flammable liquid storage

CFR 1910.106(d)(3)

Flammable liquids stored in an area should be kept in an approved cabinet any time the total quantity exceeds 25 gallons.

Approved cabinets may contain up to 60 gallons of class I flammables and/or class II combustibles, or up to 120 gallons of class III combustibles.

- Class I flammable: Flashpoint below 100 degrees F
- Class II combustibles: Flashpoint at or above 100 degrees F, but below 140 degrees F
- Class III combustibles: Flashpoint above 140 degrees F

A maximum of three approved cabinets may be kept in an area.

Chemical hazards

OAR 437-002-0293

Gas cylinder storage

Because gas cylinders are under extremely high pressure, damage to their valve can cause them to be propelled, like a rocket, causing serious property damage and injury.

Consequently, gas cylinders need to be secured against falling and damage.

Securely strapping or chaining them to a structural member is an effective way to protect them from falling over. Caging them is even better. Protective caps need to be in place when the cylinders are not in use.

Unsafe

Better

Even better

CFR 1910.253(b)(4)(iii)

Cylinder separation

Flammable gasses cannot be stored with or near oxygen cylinders. They must be separated by at least 20 feet or stored on opposite sides of a non-combustible barrier at least five feet tall.

Flammable gas and combustibles

20 foot minimum

or non-combustible barrier at least five feet high

Oxygen

Environmental hazards

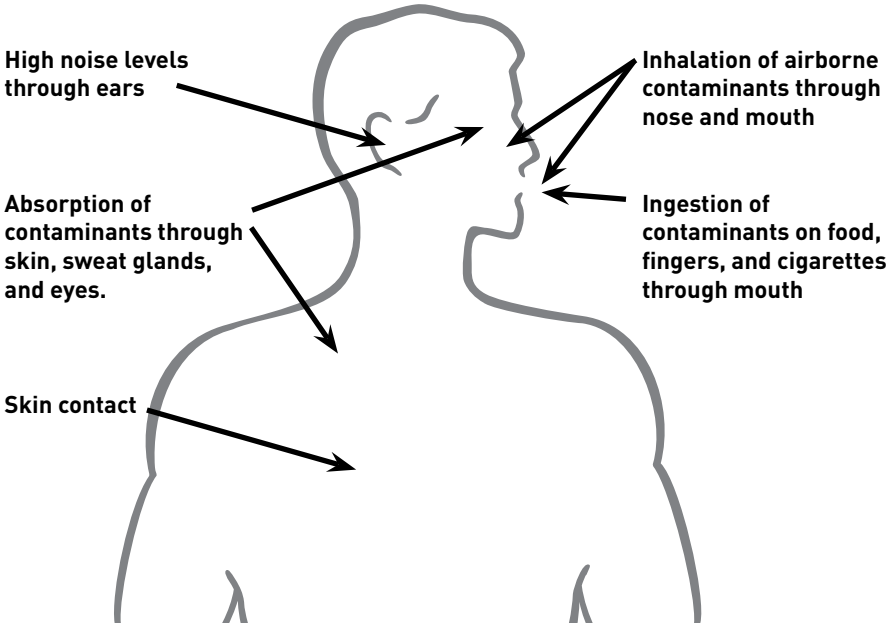
Key concerns

- Routes of exposure
- Types of contaminants
- Noise and other contaminants
- Environmental controls

Environmental hazards

Routes of exposure

Routes of exposure are the ways a hazardous substance may enter the body.



Airborne contaminants

Vapors

Vapors form above a liquid as a result of evaporation. The term "vapor" comes from evaporation.

These are typically present above open containers with flammables or heated liquids (such as dipping processes).

Liquid spills also form vapors, and they are present when wiping down surfaces with a chemical.

Fumes

Fumes are produced when metals are heated. This is most common during welding and cutting, soldering, and heat treating.

The nature of welding is such that workers often have to get in close to see what they are doing. Consequently, the welding plume is often right in their breathing zone. Effective local exhaust ventilation is important.

Environmental hazards

Gases

Gases are typically stored in pressurized cylinders such as welding gasses (acetylene, O2), liquid nitrogen, carbon dioxide, and chlorine gas.

Mists

Mists are produced when a liquid, under pressure, is atomized.

Common mist-producing activities include spray finishing, pesticide application, and airbrush work.

Also, a hydraulic line can produce a mist if the line is ruptured.

Smoke

Smoke is produced when "ordinary" combustibles are burned.

Common sources include cigars and cigarettes, structural fires, incinerators, and burn piles.

Dust

Dust is created whenever dried particulates are disturbed. Most of the time, dust is an irritant rather than a health hazard.

Common dust-producing activities include sweeping, blowing down surfaces, construction, and various manufacturing processes.

Environmental hazards

Ingestion

Contaminants can be ingested intentionally, but in an occupational setting, this most commonly is done unknowingly.

Transfer of contaminants to food can occur if they are kept in proximity to each other. Food should not be opened, exposed, or consumed in contaminated areas.

Not washing hands thoroughly can result in contamination from handling food or placing fingers in the mouth.

Smoking can also permit contaminants to be ingested or breathed.

Absorption

Contaminants can also be absorbed through the eyes, sweat glands, skin, and hair.

Wearing the correct personal protective equipment is essential to prevent this kind of contaminant exposure.

Eyes

Sweat glands

Skin

Hair

Environmental hazards

Skin contact

OAR 437-002-0161(5)

Caustic chemicals and acids can seriously damage the skin if a spill occurs. Properly selected gloves and safe chemical-handling procedures are essential to prevent such injuries.

In general, the longer the skin contact, the worse the damage. Sometimes a minor spill on clothing or inside a glove can be very serious, as it can remain in contact with the skin for an extended period of time.

Eyewash stations and/or showers are necessary when caustic chemicals are in use and should be located less than ten seconds walking distance from the anticipated hazard. Eye wash stations should be capable of a water flow of at least .4 GPM for 15 minutes. Safety showers should be capable of 20 PGM for 15 minutes. Both should be kept clean and tested weekly.

Noise

Whenever high noise levels are encountered, hearing protection should be worn.

If the average noise level for an eight hour shift is at or above 85 decibels, a full hearing conservation program is required.

Examples

Quiet country stroll	30 dB
Library	40 dB
Typical office	60 dB
Vacuum cleaner running	70 dB
Typical factory	80 dB
Milling machine	85 dB
Motorcycle at 25 ft	90 dB
Power mower	95 dB
Helicopter taking off	100 dB
Steel mill, auto horn	110 dB
Thunderclap, chain saw	120 dB
Military jet taking off	130 dB

70 dB

90 dB

103 dB

110 dB

Environmental hazards

Other environmental hazards

A number of other environmental hazards may present themselves, depending on the kind of activities your business engages in.

Some examples:

Hot or cold environments

Glare

Radioactive energy

Biological materials

Environmental controls

Substitution

Substitution is an excellent way to reduce or eliminate an environmental hazard. When you use a less hazardous substance to perform a given task, the task becomes inherently safer.

Environmental hazards

Ventilation

Airborne contaminants should be kept away from the work area as much as possible. When a contaminant is present, it needs to be diluted or, better yet, removed from the breathing zone.

Ventilation can be as simple as opening a door or window in order to allow a fresh air exchange. Specific hazards require more controlled ventilation such as local exhaust, where a hood or exhaust duct will draw away airborne contaminants. Sometimes, ventilation may take the form of a spray finishing booth or room.

Local exhaust ventilation

General ventilation

Personal protective equipment

CFR 1910.132(d)

Personal protective equipment (PPE) can be an effective means of protective workers against hazards, especially when used in conjunction with other control measures such as hazard reduction or engineering controls. Its effectiveness is greatly impacted by inconsistent use of and poor maintenance of PPE.

CFR 1910.132(d), also known as the PPE standard, requires that a hazard assessment be conducted to determine which tasks require the use of PPE. This assessment needs to document the type and usage of PPE to be worn. Affected employees are to receive training in the care and use of the required PPE and employers are required to enforce its use.

Ergonomic hazards

Key concerns

- Soft tissue injuries (acute and cumulative)
- Force
- Frequency
- Posture

Ergonomic hazards

Soft tissue injuries

Muscles are used to perform work. The more frequently a particular set of muscles is used, the more fatigue results. When you rest, these muscles are restored.

Similarly, a container with water dripping in the top will soon overflow unless a valve is opened to drain off the water. However if the water flows too swiftly or the valve is not opened enough, the container can soon overflow.

Your body, in a similar fashion, needs rest following work. If the task is too forceful, repetitive, involves poor postures or goes too long without a break, fatigue can turn into a soft tissue injury.

Soft tissue injuries typically take the form of sprains and strains. They are injuries resulting from acute overexertion, inflammation or long term repetitive motions. Soft tissues include joints, muscles, ligaments, and tendons.

Examples of acute sprains and strains include:

- Back strain from lifting
- Twisted ankle or knee
- Jammed finger/thumb
- Any overexertion injury from a single event

Examples of repetitive conditions, otherwise known as cumulative trauma, include:

- Carpal tunnel syndrome
- Bursitis
- Tendonitis
- Tenosynovitis
- Trigger finger
- Any inflammation from repetitive motion

Risk Factors

The elements of force, frequency, and posture each play a role in the cause and prevention of soft tissue injuries.

Be aware of these specific aspects of tasks in your inspection areas in order to spot situations where an employee may be in danger of developing a disabling condition.

Typically, this begins as discomfort, then develops into pain, and then finally becomes an injury.

Ergonomic hazards

Force

Forces include the weight of an object being lifted, the amount of exertion to push or pull an object, and contact pressure against a hand or other body part when exerting a force.

In seeking solutions, try to limit loads to 35 pounds. This can sometimes be done by ordering supplies in smaller sizes. When this cannot be done, team lifting is a good solution. However, the best solution is using a mechanical handling aid.

An alternative solution to a heavy lifting situation is to change the process so the load is too heavy to lift manually, and then use mechanical lifting equipment to do the job.

Frequency

Fatigue or injury may result when excessive joint or muscle flexion occurs without rest, regardless of forces applied.

To reduce frequency, consider cross training employees so that they can do various tasks. By varying the muscle groups used, the forces are spread out, which reduces fatigue. Scheduled job rotations throughout the day are a more formal means of reducing the effects of repetitive motion.

Any time you can automate a task, you will greatly reduce the potential for repetitive motion injuries. This can also save labor and other costs.

Posture

When work is done in an awkward posture, the forces exerted are often greater on muscles and joints being used. Consequently, injuries are more likely. A simple example is lifting an object near your body with your elbows in close to your sides. Compare that with lifting the object with your arms away from your body. With the arms extended, the force required to lift is increased and is transferred to your lower back.

Whenever possible, work should be done with neutral postures to reduce the possibility of soft tissue injuries.

Neutral postures include:

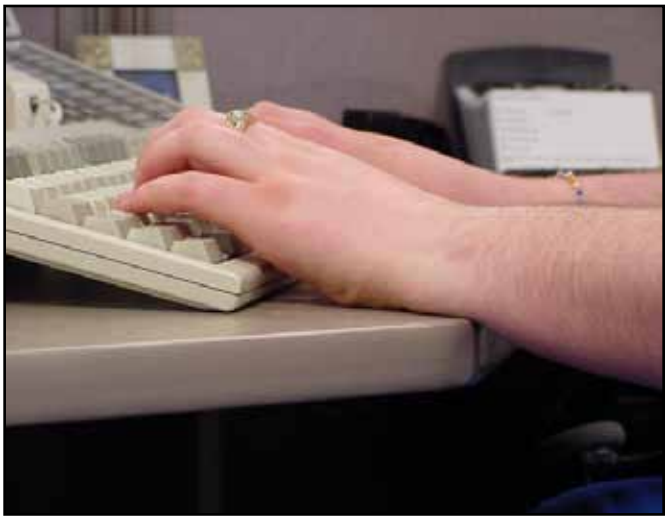
- Work performed close to the body
- Back in a natural s-curve (not stooping over)
- Head facing forward and level
- Shoulders relaxed
- Wrists straight and thumbs higher than little fingers

Ergonomic hazards

Common ergonomic hazards

Here are some common situations where injuries from force, frequency and posture are likely.

Bending over at the waist



Bent wrists

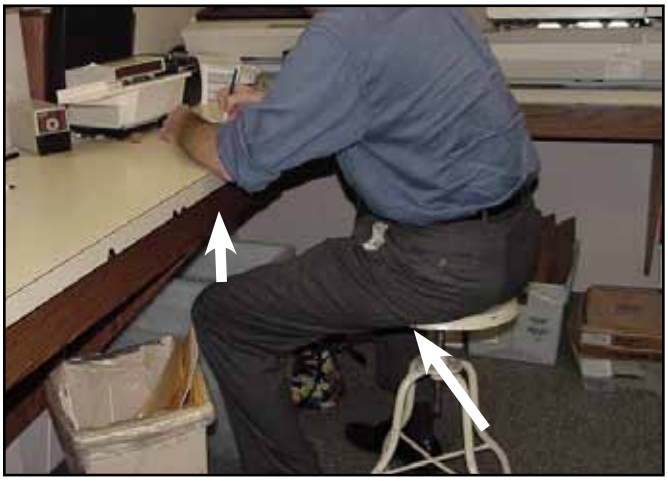
Elbows out and away from the body

Upper body twisting

Ergonomic hazards

Over reaching with upper body extended

Over reaching with arms suspended



Contact pressure on arm and thighs

Contact pressure on hand

Pinch grip

Pinch grip

Ergonomic hazards

Ergonomic solutions

Here are several examples of common ways to reduce or eliminate ergonomic hazards.

Install spring-loaded bottoms in bins or carts. This will allow the contents height to be raised as items are removed. This reduces the amount of bending over needed to reach items in the bottom.

Angle the work so that it can be handled at a more comfortable height and to reduce awkward postures.

Use load-leveling devices beneath pallets so that materials can be handled in the knee-to-shoulder zone. If the device is equipped with a turntable, use this feature to reduce the need to walk around the pallet. Never reach over the pallet to stack or unstack.

Ergonomic hazards

Retract keyboard legs

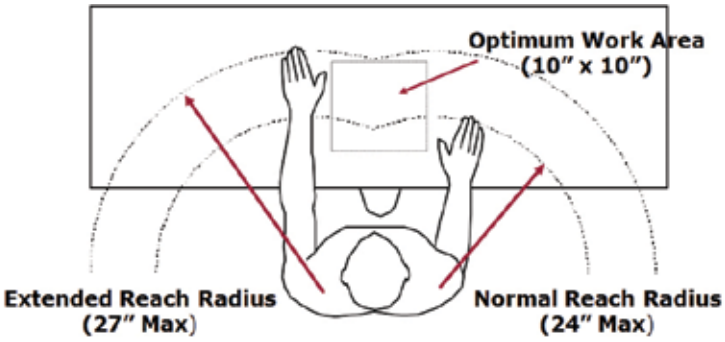
Retract keyboard legs as they tend to cause you to bend your wrists upward. Keyboarding with a bent wrist can lead to a soft tissue injury due to repetitive motion.

Position the keyboard so that your wrists remain straight

Adjust the keyboard and chair height so that your wrists remain straight when your fingers are on home row.

Suspend the tool

Strategically store items on shelves to minimize overreaching. Keep heavier and more frequently used items in the "knee to shoulder" range.



Arrange workstations so the majority of work is performed close in, with elbows near the sides. Frequent side tasks should be within the "normal reach radius" and infrequent side tasks within the "extended reach radius".

Unsafe work practices

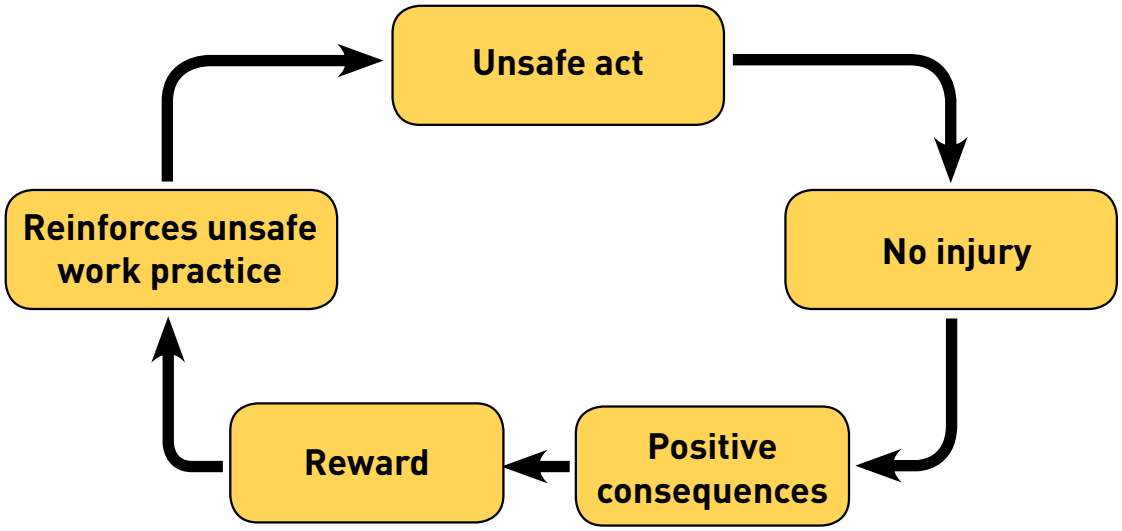
Key concerns

- Horseplay
- Improper tool use
- Unsafe lifting
- Bypassing safety devices
- Not using PPE

Unsafe work practices

The risk taking cycle

The risk taking cycle typically begins with an unsafe act that does not result in an injury. The absence of an injury is essentially a positive consequence for the risk taker, who may actually feel rewarded. These add up to positive reinforcement for taking the risk, which encourages even more risk taking.



It is estimated that more than 80 percent of all workplace accidents are the direct result of an unsafe act. Therefore, it is important that inspection teams observe work behaviors while conducting inspections.

The way behavior observations are done is dependent upon management policies and the company's safety culture. Some companies have a formal behavior observation program where areas and/or individuals are observed for safety practices, with input given on the spot. Without such a program, it may be best to passively observe and note any unsafe work practices, but not the names of the individuals observed. Management, now aware of specific unsafe work practices, can conduct training or implement other corrective measures.

The following examples were shared by SAIF safety management consultants when asked to describe the worst hazard they had ever seen. Note the unsafe behaviors associated with the causes of these accidents.

"In line with some of the other forklift 'worsts,' I saw the maintenance manager at one of my accounts standing on the mast of a forklift. He was at least 20 feet above the ground."

"My worst hazard was an individual powerwashing a concrete floor while standing in a pool of water that had extension cords snaking through it to the work lights he was using to illuminate the area."

Unsafe work practices

"I visited an employer that was manufacturing large steel plates to armor military vehicles that were being shipped to the Middle East. These plates were moved using large overhead cranes, and I would estimate the plates weighed several hundred, if not thousands, of pounds. As the crane was moving the plates, we witnessed workers standing under the plates as they were in motion. The consultant suggested to the safety contact who was with us that perhaps it was not a good idea to have workers standing directly under the plates as they were suspended from the crane and in motion."

"I was doing a safety ride-along observation with an employee when he suddenly drove through a gap in a highway divider barrier and proceeded to drive towards on coming traffic. He then made a sudden left turn into the company parking lot. He told me not to worry, he used this shortcut 'all the time.' I still remember his name. "

"At an auto repair shop, I saw a mechanic working under a car that was sitting on a wooden chock placed in the center to support the weight of the vehicle."

"This would probably be mine. It was at a nursery with underground piping that had burst. When I arrived, the worker was in this vertical trench trying to repair the pipe. The trench was about six feet deep, and some of the sides had already begun to collapse."

"I once saw a small chemical products manufacturer dispensing methanol from an ungrounded, unsecured spherical fiberglass tank (a 1,000 gallon tank intended for underground use) using a swimming pool pump plugged into an extension cord and plumbed with PVC. The tank was held upright by resting on a truck tire."

Common unsafe work practices

Unsafe acts may be committed intentionally or accidentally. Anytime one is observed, it is likely that dozens of other unsafe acts went unnoticed. It is not only important to note unsafe work practices, but to determine why they occurred. Often, it is a practice that has become accepted because of poor job design, lack of appropriate equipment or inadequate training.

Horseplay

Improper or no ladder use

Improper tool use

No seat belt

Unsafe lifting

Guard removed

Bypassing safety device

Not wearing personal protective equipment

Resources

Many resources are available to provide additional information and tools to strengthen your safety inspection program.

The safety section in the employer guide on saif.com has resources on a variety of industry-specific topics. Each topic has a list of related publications, videos, trainings, and websites.
www.saif.com/safety

Oregon OSHA has several materials specifically for inspection activities. General inspection information:
www.cbs.state.or.us/osha/subjects/inspection.html

Specific inspection checklists:
www.cbs.state.or.us/osha/standards/checklists.html

Worksafe BC is an excellent Canadian safety resource with many useful materials including safety posters, inspection checklists, video clips, and hazard spotting activities.
www2.worksafebc.com/Safety/Home.asp

CROET (Center for Research on Occupational Environmental Toxicology) is a research body of Oregon Health Sciences University. Useful data related to chemical hazards can be found here.
www.ohsu.edu/xd/research/centers-institutes/croet/

Department Inspection Form

_____
(Area or department name)

Responsible manager or supervisor: _____ Date: _____

Inspection conducted by: _____

Indicate priority of items needing attention. 1 = Low priority | 2 = Medium priority | 3 = High priority (Circle any IMMINENT DANGER items.)	
CHECK ITEMS NEEDING ATTENTION.	**DESCRIBE DEFICIENCIES NOTED AND ACTIONS REQUIRED.**
WALKING AND WORK SURFACES ☐ Housekeeping ☐ Aisles ☐ Exits ☐ Work surfaces ☐ Stairs and ladders ☐ Other	
MACHINERY ☐ Point-of-operation guarding ☐ Barriers and gates ☐ Interlocks ☐ Lockout tagout ☐ Other	
ELECTRICAL ☐ Panel clearance maintained ☐ Circuits marked ☐ Extension cords ☐ Grounding and GFCI ☐ Other	
CHEMICAL ☐ MSDSs available and organized ☐ Container labeling ☐ Storage and arrangement ☐ Flammables in approved safety containers and cabinets ☐ Any spillage or leakage ☐ Cylinders secured ☐ Other	

Indicate priority of items needing attention. 1 = Low priority | 2 = Medium priority | 3 = High priority (Circle any IMMINENT DANGER items.)	
CHECK ITEMS NEEDING ATTENTION.	**DESCRIBE DEFICIENCIES NOTED AND ACTIONS REQUIRED.**
ENVIRONMENTAL ☐ Airborne contaminants ☐ Ingestion hazards ☐ Skin contact ☐ Noise ☐ Temperatures ☐ Illumination ☐ Ventilation ☐ Personal protective equipment ☐ Other	
ERGONOMICS ☐ Awkward postures ☐ Repetitive motion ☐ Forceful exertions ☐ Contact pressure ☐ Work station design ☐ Other	
UNSAFE BEHAVIORS ☐ Horseplay ☐ Unsafe lifting ☐ Improper tool use ☐ Bypassing safety devices ☐ Not using PPE ☐ Risk taking in general ☐ Other	
AREA SPECIFIC HAZARDS ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____ ☐ _____	

Example of correspondence with responsible party for hazard corrections

(*Company name*)
Safety committee report

Date:

To:
Re: Safety inspection

During the safety committee inspection on your area on the above date, the following hazards or unsafe behaviors were observed. Please review and respond, noting actions or intended actions, and return by (*date*).

Yours in safety

(*Name of safety committee chair or safety coordinator*)

Item:

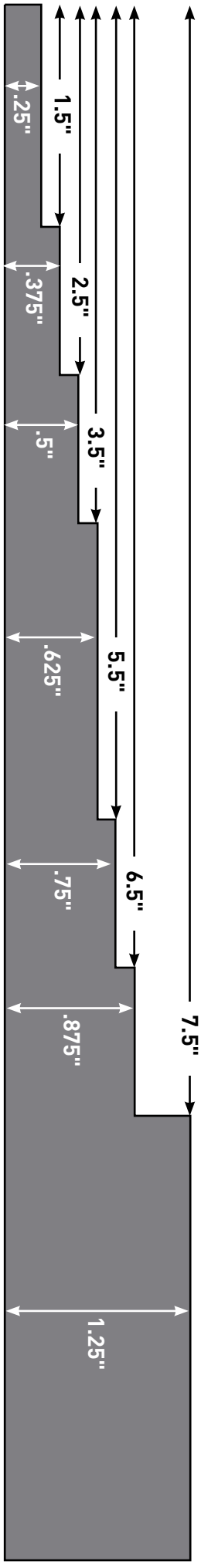
Actions: Date completed:

Item:

Actions: Date completed:

Item:

Actions: Date completed:



"Gotcha stick" template

Transfer the above template to wood, plastic, metal, or other durable material. To test if a guard's openings are narrow enough, insert the narrow tip of the gotcha stick between the widest openings.

As long as the tip does not reach the point of operation, the guard openings are narrow enough.

Note: Because some printers will render this image differently, make sure you double check the template's dimensions for accuracy.