Course Instructions

The following pages contain all course materials in addition to a preview of the course completion form. The form given here is identical to the form available online after purchase of the course.

Upon purchase of the course online, you will be directed to a receipt page online which contains the link to fill out the course completion form online. You will then click that link to complete your course.

4 Easy Steps to Complete this Course:

1. **Read the course PDF below.**
2. **Purchase the course online.**
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4. **Print out your certificate.**

COURSE COMPLETION FORM

Construction Job Hazards

SRA0281

First Name: _____ Last Name: _____Date: _____

Address: _____City: _____ State: _____ Zip: _____

Phone: _____ Email: _____

Oregon Contractor CCB Number: _____

To receive credit for this 5 Hour Series A course titled *Construction Job Hazards*, complete the form below.

I, _____ (print name) hereby attest to the following:

I have personally completed the entire course. My work in this course was based solely on my own efforts, unassisted by any unauthorized individual or resource. I have spent 5 hours (250 minutes) completing the course *Construction Job Hazards*. I understand that receiving unauthorized assistance and/or not spending the designated amount of time on the course will invalidate my course credit.

_____ (Signature) _____ (Date)

CHAPTER 1 – JOB HAZARDS

What is the purpose of this chapter?

The purpose of this chapter is to help employers, foremen, supervisors, and employees analyze their jobs and recognize workplace hazards so they can be reported. It explains what job hazard analysis is and offers guidelines to help conduct step-by-step analysis.

What is a hazard?

A hazard is the potential for harm. In practical terms, a hazard is often associated with a condition or activity that, if left uncontrolled, can result in an injury or illness. (See Appendix 2 for a list of common hazards and descriptions.) Identifying hazards and eliminating or controlling them as early as possible will help prevent injuries and illnesses in the workplace.

What is a job hazard analysis?

A job hazard analysis is a technique that focuses on job tasks as a way to identify hazards before they occur. It focuses on the relationship between the worker, the task, the tools, and the work environment. Ideally, after you identify uncontrolled hazards, you will take steps to eliminate or reduce them to an acceptable risk level.

Why is job hazard analysis important?

Many workers are injured and killed at the workplace every day in the United States. You can help prevent workplace injuries and illnesses by looking at your workplace operations, establishing proper job procedures, and ensuring that all employees are trained properly.

One of the best ways to determine and establish proper work procedures is to conduct a job hazard analysis. A job hazard analysis is one component of the larger commitment to a safety and health management system.

What is the value of a job hazard analysis?

Supervisors can use the findings of a job hazard analysis to eliminate and prevent hazards in their workplaces. This is likely to result in fewer worker injuries and illnesses; safer, more effective work methods; reduced workers' compensation costs; and increased worker productivity. The analysis also can be a valuable tool for training new employees in the steps required to perform their jobs safely.

For a job hazard analysis to be effective, management must demonstrate its commitment to safety and health and follow through to correct any uncontrolled hazards identified. Otherwise, management will lose credibility and employees may hesitate to go to management when dangerous conditions threaten them.

What jobs are appropriate for a job hazard analysis?

- A job hazard analysis can be conducted on many jobs in your workplace. Priority should go to the following types of jobs:
- Jobs with the highest injury or illness rates;
- Jobs with the potential to cause severe or disabling injuries or illness, even if there is no history of previous accidents;
- Jobs in which one simple human error could lead to a severe accident or injury;
- Jobs that are new to your operation or have undergone changes in processes and procedures; and
- Jobs complex enough to require written instructions.

Where do I begin?

Involve your employees. It is very important to involve employees in the hazard analysis process. Employees have a unique understanding of the job, and this knowledge is invaluable for finding hazards. Involving employees will help minimize oversights, ensure a quality analysis, and get workers to "buy in" to the solutions because they will share ownership in their safety and health program.

Review your accident history. Review with employees the worksite's history of accidents and occupational illnesses that needed treatment, losses that required repair or replacement, and any "near misses" — events in which an accident or loss did not occur, but could have. These events are indicators that the existing hazard controls (if any) may not be adequate and deserve more scrutiny.

Conduct a preliminary job review. Discuss with your employees the hazards they know exist in their current work and surroundings. Brainstorm with them for ideas to eliminate or control those hazards.

If any hazards exist that pose an immediate danger to an employee's life or health, take immediate action to protect the worker. Any problems that can be corrected easily should be corrected as soon as possible. Do not wait to complete your job hazard analysis. This will demonstrate your commitment to safety and health and enable you to focus on the hazards and jobs that need more study because of their complexity. For those hazards determined to present unacceptable risks, evaluate types of hazard controls.

More information about hazard controls is found in Appendix 1.

List, rank, and set priorities for hazardous jobs. List jobs with hazards that present unacceptable risks, based on those most likely to occur and with the most severe consequences. These jobs should be your first priority for analysis.

Outline the steps or tasks. Nearly every job can be broken down into job tasks or steps. When beginning a job hazard analysis, watch the employee perform the job and list each step as the worker takes it. Be sure to record enough information to describe each job action without getting overly detailed. Avoid making the breakdown of steps so detailed that it becomes unnecessarily long or so broad that it does not include basic steps. You may find it valuable to get input from other workers who have performed the same job. Later, review the job steps with the employee to make sure you have not omitted something. Point out that you are evaluating the job itself, not the employee's job performance. Include the employee in all phases of the analysis— from reviewing the job steps and procedures to discussing uncontrolled hazards and recommended solutions.

Sometimes, in conducting a job hazard analysis, it may be helpful to photograph or videotape the worker performing the job. These visual records can be handy references when doing a more detailed analysis of the work.

How do I identify workplace hazards?

A job hazard analysis is an exercise in detective work. Your goal is to discover the following:

- What can go wrong?
- What are the consequences?
- How could it arise?
- What are other contributing factors?
- How likely is it that the hazard will occur?

To make your job hazard analysis useful, document the answers to these questions in a consistent manner.

Describing a hazard in this way helps to ensure that your efforts to eliminate the hazard and implement hazard controls help target the most important contributors to the hazard.

Good hazard scenarios describe:

- Where it is happening (environment),
- Who or what it is happening to (exposure),
- What precipitates the hazard (trigger),
- The outcome that would occur should it happen (consequence), and
- Any other contributing factors.

A sample form found in Appendix 3 helps you organize your information to provide these details.

Rarely is a hazard a simple case of one singular cause resulting in one singular effect. More frequently, many contributing factors tend to line up in a certain way to create the hazard.

Here is an example of a hazard scenario:

In the metal shop (environment), while clearing a snag (trigger), a worker's hand (exposure) comes into contact with a rotating pulley. It pulls his hand into the machine and severs his fingers (consequences) quickly.

To perform a job hazard analysis, you would ask:

What can go wrong? The worker's hand could come into contact with a rotating object that "catches" it and pulls it into the machine.

What are the consequences? The worker could receive a severe injury and lose fingers and hands.

How could it happen? The accident could happen as a result of the worker trying to clear a snag during operations or as part of a maintenance activity while the pulley is operating. Obviously, this hazard scenario could not occur if the pulley is not rotating.

What are other contributing factors? This hazard occurs very quickly. It does not give the worker much opportunity to recover or prevent it once his hand comes into contact with the pulley. This is an important factor, because it helps you determine the severity and likelihood of an accident when selecting appropriate hazard controls. Unfortunately, experience has shown that training is not very effective in hazard control when triggering events happen quickly because humans can react only so quickly.

How likely is it that the hazard will occur? This determination requires some judgment. If there have been "near-misses" or actual cases, then the likelihood of a recurrence would be considered high. If the pulley is exposed and easily accessible, that also is a consideration. In the example, the likelihood that the hazard will occur is high because there is no guard preventing contact, and the operation is performed while the machine is running.

The examples that follow show how a job hazard analysis can be used to identify the existing or potential hazards for each basic step involved in grinding iron castings.

Grinding Iron Castings: Job Steps

Step 1. Reach into metal box to right of machine, grasp casting, and carry to wheel.

Step 2. Push casting against wheel to grind off burr.

Step 3. Place finished casting in box to left of machine.

Example Job Hazard Analysis Form

***Job Location*:** Metal Shop	***Analyst*:** Joe Safety	***Date*:**

***Task Description*:** Worker reaches into metal box to the right of the machine, grasps a 15-pound casting and carries it to grinding wheel. Worker grinds 20 to 30 castings per hour.

Hazard Description: Picking up a casting, the employee could drop it onto his foot. The casting's weight and height could seriously injure the worker's foot or toes.

Hazard Controls:

1. Remove castings from the box and place them on a table next to the grinder.
2. Wear steel-toe shoes with arch protection.
3. Change protective gloves that allow a better grip.
4. Use a device to pick up castings.

***Job Location*:** Metal Shop	***Analyst*:** Joe Safety	***Date*:**

***Task Description*:** Worker reaches into metal box to the right of the machine, grasps a 15-pound casting and carries it to grinding wheel. Worker grinds 20 to 30 castings per hour.

***Hazard Description*:** Castings have sharp burrs and edges that can cause severe lacerations.

Hazard Controls:

1. Use a device such as a clamp to pick up castings.
2. Wear cut-resistant gloves that allow a good grip and fit tightly to minimize the chance that they will get caught in grinding wheel.

***Job Location*:** Metal Shop	***Analyst*:** Joe Safety	***Date*:**

***Task Description*:** Worker reaches into metal box to the right of the machine, grasps a 15-pound casting and carries it to grinding wheel. Worker grinds 20 to 30 castings per hour.

***Hazard Description*:** Reaching, twisting, and lifting 15-pound castings from the floor could result in a muscle strain to the lower back.

Hazard Controls:

1. Move castings from the ground and place them closer to the work zone to minimize lifting. Ideally, place them at waist height or on an adjustable platform or pallet.
2. Train workers not to twist while lifting and reconfigure work stations to minimize twisting during lifts.

Repeat similar forms for each job step.#

How do I correct or prevent hazards?

After reviewing your list of hazards, consider what control methods will eliminate or reduce them. For more information on hazard control measures, see Appendix 1. The most effective controls are engineering controls that physically change a machine or work environment to prevent employee exposure to the hazard. The more reliable or less likely a hazard control can be circumvented, the better. If this is not feasible, administrative controls may be appropriate. This may involve changing how employees do their jobs.

Discuss recommendations with all employees who perform the job and consider their responses carefully. If you plan to introduce new or modified job procedures, be sure they understand what they are required to do and the reasons for the changes.

What else do I need to know before starting a job hazard analysis?

The job procedures discussed in this booklet are for illustration only and do not necessarily include all the steps, hazards, and protections that apply to your industry. When conducting your own job safety analysis, be sure to consult the Occupational Safety and Health Administration standards for your industry. Compliance with these standards is mandatory, and by incorporating their requirements in your job hazard analysis, you can be sure that your health and safety program meets federal standards. OSHA standards, regulations, and technical information are available online at www.osha.gov.

Why should I review my job hazard analysis?

Periodically reviewing your job hazard analysis ensures that it remains current and continues to help reduce workplace accidents and injuries. Even if the job has not changed, it is possible that during the review process you will identify hazards that were not identified in the initial analysis.

It is particularly important to review your job hazard analysis if an illness or injury occurs on a specific job. Based on the circumstances, you may determine that you need to change the job procedure to prevent similar incidents in the future. If an employee's failure to follow proper job procedures results in a "close call," discuss the situation with all employees who perform the job and remind them of proper procedures. Any time you revise a job hazard analysis, it is important to train all employees affected by the changes in the new job methods, procedures, or protective measures adopted.

When is it appropriate to hire a professional to conduct a job hazard analysis?

If your employees are involved in many different or complex processes, you need professional help conducting your job hazard analyses. Sources of help include your insurance company, the local fire department, and private consultants with safety and health expertise. In addition, OSHA offers assistance through its regional and area offices and consultation services. Contact numbers are listed at the back of this publication.

Even when you receive outside help, it is important that you and your employees remain involved in the process of identifying and correcting hazards because you are on the worksite every day and most likely to encounter these hazards. New circumstances and a recombination of existing circumstances may cause old hazards to reappear and new hazards to appear. In addition, you and your employees must be ready and able to implement whatever hazard elimination or control measures a professional consultant recommends.

OSHA ASSISTANCE, SERVICES, AND PROGRAMS

How can OSHA help me?

OSHA can provide extensive help through a variety of programs, including assistance about safety and health programs, state plans, workplace consultations, Voluntary Protection Programs, strategic partnerships, training and education, and more.

How does safety and health program management assistance help employers and employees?

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.

The following are four general elements that are critical to the development of a successful safety and health management program:

- Management, leadership and employee involvement;
- Worksite analysis;
- Hazard prevention and control; and
- Safety and health training.

How can consultation assistance help employers?

In addition to helping identify and correct specific hazards, OSHA's consultation service provides free, onsite assistance in developing and implementing effective workplace safety and health management systems that emphasize the prevention of worker injuries and illnesses.

Comprehensive consultation assistance provided by OSHA includes a hazard survey of the worksite and an appraisal of all aspects of the employer's existing safety and health management system. In addition, the service offers assistance to employers in developing and implementing an effective safety and health management system. Employers also may receive training and education services, as well as limited assistance away from the worksite.

Who can get consultation assistance and what does it cost?

Consultation assistance is available to small employers (with fewer than 250 employees at a fixed site and no more than 500 corporate wide) who want help in establishing and maintaining a safe and healthful workplace.

Funded largely 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. No penalties are proposed or citations issued for hazards identified by the consultant. The employer's only obligation is to correct all identified serious hazards within the agreed-upon correction time frame.

Can OSHA assure privacy to an employer who asks for consultation assistance?

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.

Does OSHA provide any incentives for seeking consultation assistance?

Yes. 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, but is not limited to, receiving a full-service, comprehensive consultation visit, correcting all identified hazards, and developing an effective safety and health management system.

Employers accepted into SHARP may receive an exemption from programmed inspections (not complaint or accident investigation inspections) for a period of 1 year initially, or 2 years upon renewal.

What are the Voluntary Protection Programs?

Voluntary Protection Programs (VPPs) represent one part of OSHA's effort to extend worker protection beyond the minimum required by OSHA standards. VPP represents a cooperative approach which, when coupled with an effective enforcement program, expands worker protection

How does VPP work?

There are three levels of VPP recognition: Star, Merit, and Demonstration. All are designed to do the following:

- Recognize employers who have successfully developed and implemented effective and comprehensive safety and health management systems;
- Encourage these employers to continuously improve their safety and health management systems;
- Motivate other employers to achieve excellent safety and health results in the same outstanding way; and
- Establish a relationship between employers, employees, and OSHA that is based on cooperation.

How does VPP help employers and employees?

VPP participation can mean the following:

- Reduced numbers of worker fatalities, injuries, and illnesses;
- Lost-workday case rates generally 50 percent below industry averages;
- Lower workers' compensation and other injury- and illness-related costs;
- Improved employee motivation to work safely, leading to a better quality of life at work;
- Positive community recognition and interaction;
- Further improvement and revitalization of already-good safety and health programs; and a
- Positive relationship with OSHA.

How does OSHA monitor VPP sites?

OSHA reviews an employer's VPP application and conducts a VPP Onsite Evaluation to verify that the safety and health management systems described are operating effectively at the site. OSHA conducts Onsite Evaluations on a regular basis, annually for participants at the Demonstration level, every 18 months for Merit, and every 3 to 5 years for Star. Each February, all participants must send a copy of their most recent Annual Evaluation to their OSHA regional office. This evaluation must include the worksite's record of injuries and illnesses for the past year.

Can OSHA inspect an employer who is participating in the VPP?

Sites participating in VPP are not scheduled for regular, programmed inspections. OSHA handles any employee complaints, serious accidents, or significant chemical releases that may occur at VPP sites according to routine enforcement procedures.

How can a partnership with OSHA improve worker safety and health?

OSHA has learned firsthand that voluntary, cooperative partnerships with employers, employees, and unions can be a useful alternative to traditional enforcement and an effective way to reduce worker deaths, injuries, and illnesses. This is especially true when a partnership leads to the development and implementation of a comprehensive workplace safety and health management system.

APPENDIX 1
Hazard Control Measures

Information obtained from a job hazard analysis is useless unless hazard control measures recommended in the analysis are incorporated into the tasks. Managers should recognize that not all hazard controls are equal. Some are more effective than others at reducing the risk.

The order of precedence and effectiveness of hazard control is the following:

1. Engineering controls.
2. Administrative controls.
3. Personal protective equipment.

Engineering controls include the following:

- Elimination/minimization of the hazard— Designing the facility, equipment, or process to remove the hazard, or substituting processes, equipment, materials, or other factors to lessen the hazard;
- Enclosure of the hazard using enclosed cabs, enclosures for noisy equipment, or other means;
- Isolation of the hazard with interlocks, machine guards, blast shields, welding curtains, or other means; and
- Removal or redirection of the hazard such as with local and exhaust ventilation.

Administrative controls include the following:

- Written operating procedures, work permits, and safe work practices;
- Exposure time limitations (used most commonly to control temperature extremes and ergonomic hazards);
- Monitoring the use of highly hazardous materials;
- Alarms, signs, and warnings;
- Buddy system; and
- Training.

Personal Protective Equipment— such as respirators, hearing protection, protective clothing, safety glasses, and hardhats— is acceptable as a control method in the following circumstances:

- When engineering controls are not feasible or do not totally eliminate the hazard;
- While engineering controls are being developed;
- When safe work practices do not provide sufficient additional protection; and
- During emergencies when engineering controls may not be feasible.

Use of one hazard control method over another higher in the control precedence may be appropriate for providing interim protection until the hazard is abated permanently. In reality, if the hazard cannot be eliminated entirely, the adopted control measures will likely be a combination of all three items instituted simultaneously.

APPENDIX 2
Common Hazards and Descriptions

Hazards	Hazard Descriptions
Chemical (Toxic)	A chemical that exposes a person by absorption through the skin, inhalation, or through the bloodstream that causes illness, disease, or death. The amount of chemical exposure is critical in determining hazardous effects. Check Material Safety Data Sheets (MSDS), and/or OSHA 1910.1000 for chemical hazard information.
Chemical (Flammable)	A chemical that, when exposed to a heat ignition source, results in combustion. Typically, the lower a chemical's flash point and boiling point, the more flammable the chemical. Check MSDS for flammability information.
Chemical (Corrosive)	A chemical that, when it comes into contact with skin, metal, or other materials, damages the materials. Acids and bases are examples of corrosives.
Explosion (Chemical Reaction)	Self- explanatory.
Explosion Pressurization)	Sudden and violent release of a large amount of (Over gas/energy due to a significant pressure difference such as rupture in a boiler or compressed gas cylinder.
Electrical (Shock/ Circuit)	Contact with exposed conductors or a device that is incorrectly or inadvertently grounded, such as Short when a metal ladder comes into contact with power lines. 60Hz alternating current (common house current) is very dangerous because it can stop the heart.
Electrical (Fire)	Use of electrical power that results in electrical overheating or arcing to the point of combustion or ignition of flammables, or electrical component damage.
Electrical (Static/ESD)	The moving or rubbing of wool, nylon, other synthetic fibers, and even flowing liquids can generate static electricity. This creates an excess or deficiency of electrons on the surface of material that discharges (spark) to the ground resulting in the ignition of flammables or damage to electronics or the body's nervous system.
Electrical (Loss of Power)	Safety-critical equipment failure as a result of loss of power.

Ergonomics (Strain)	Damage of tissue due to overexertion (strains and sprains) or repetitive motion.
Ergonomics (Human Error)	A system design, procedure, or equipment that is error-provocative. (A switch goes up to turn something off).
Excavation (Collapse)	Soil collapse in a trench or excavation as a result of improper or inadequate shoring. Soil type is critical in determining the hazard likelihood.
Fall (Slip, Trip)	Conditions that result in falls (impacts) from height or traditional walking surfaces (such as slippery floors, poor housekeeping, uneven walking surfaces, exposed ledges, etc.)
Fire/Heat	Temperatures that can cause burns to the skin or damage to other organs. Fires require a heat source, fuel, and oxygen.
Mechanical/ Vibration (Chaffing/ Fatigue)	Vibration that can cause damage to nerve endings, or material fatigue that results in a safety-critical failure. (Examples are abraded slings and ropes, weakened hoses and belts.)
Mechanical Failure	Self explanatory; typically occurs when devices exceed designed capacity or are inadequately maintained.
Mechanical	Skin, muscle, or body part exposed to crushing, caught-between, cutting, tearing, shearing items or equipment.
Noise	Noise levels (>85 dBA 8 hr TWA) that result in hearing damage or inability to communicate safety-critical information.
Radiation (Ionizing)	Alpha, Beta, Gamma, neutral particles, and X-rays that cause injury (tissue damage) by ionization of cellular components.
Radiation Ionizing)	Ultraviolet, visible light, infrared, and microwaves (Non- that cause injury to tissue by thermal or photochemical means.
Struck By Acceleration)	Accelerated mass that strikes the body causing (Mass injury or death. (Examples are falling objects and projectiles.)
Struck Against	Injury to a body part as a result of coming into contact of a surface in which action was initiated by the person. (An example is when a screwdriver slips.)
Temperature (Heat/Cold)	Temperatures that result in heat stress, Extreme exhaustion, or metabolic slow down such as hypothermia.
Visibility	Lack of lighting or obstructed vision that results in an error or other hazard.
Weather Phenomena	Self explanatory.

APPENDIX 3
Sample Job Hazard Analysis Form

Job Title:	*Job Location*:	*Analyst*	*Date*
Task #	*Task Description*:		
Hazard Type:	*Hazard Description*:		
Consequence:	*Hazard Controls*:		
Rational or Comment:			

CHAPTER 2 – HAND AND POWER TOOL SAFETY

What is the Purpose of this Chapter?

This chapter is designed to present workers with the basic safety procedures and safeguards associated with hand and portable power tools.

The following sections identify various types of hand and power tools and their potential hazards. They also identify ways to prevent worker injury through proper use of the tools and through the use of appropriate personal protective equipment.

Please note: *Material in this course is based on the standards of the Occupational Safety and Health Administration (OSHA). This course should not be considered as a substitute for the full safety and health standards for general industry, or for the construction industry. These texts are available at www.osha.gov.*

The Danger of Hand and Portable Power Tools

Tools are such a common part of our lives that it is difficult to remember that they may pose hazards. A serious incident can occur before steps are taken to identify and avoid, or eliminate tool-related hazards.

The following measures should always be taken:

- Workers who use hand and power tools must be provided with the appropriate personal protective equipment.
- All electrical connections for these tools must be suitable for the type of tool and the working conditions (wet, dusty, flammable vapors).
- When a temporary power source is used for construction, a ground-fault circuit interrupter should be used.
- Workers should be trained in the proper use of all tools.
- Workers should be able to recognize the hazards associated with the different types of tools and the safety precautions necessary.

Here are five basic safety rules that can help prevent hazards associated with the use of hand and power tools:

- Keep all tools in good condition with regular maintenance.
- Use the right tool for the job.
- Examine each tool for damage before use and do not use damaged tools.
- Operate tools according to the manufacturers' instructions.
- Provide and use properly the right personal protective equipment.

Employees and employers should work together to establish safe working procedures. If a hazardous situation is encountered, it should be brought to the attention of the proper individual for hazard abatement immediately.

The Hazards of Hand Tools

What are hand tools?

Hand tools are tools that are powered manually. Hand tools include anything from axes to wrenches. The greatest hazards posed by hand tools result from misuse and improper maintenance.

Some examples of misuse include the following:

- If a chisel is used as a screwdriver, the tip of the chisel may break and fly off, hitting the user or other workers.
- If a wooden handle on a tool, such as a hammer or an axe, is loose, splintered, or cracked, the head of the tool may fly off and strike the user or other workers.
- If the jaws of a wrench are sprung, the wrench might slip.
- If impact tools such as chisels, wedges, or drift pins have mushroomed heads, the heads might shatter on impact, sending sharp fragments flying toward the user or other workers.

The employer is responsible for the safe condition of tools and equipment used by employees. Employers shall not issue or permit the use of unsafe hand tools. Employees should be trained in the proper use and handling of tools and equipment.

When using saw blades, knives, or other tools, workers should direct the tools away from aisle areas and away from others working in close proximity. Knives and scissors must be sharp; dull tools can cause more hazards than sharp ones. Cracked saw blades must be removed from service.

Wrenches must not be used when jaws are sprung to the point that slippage occurs. Impact tools such as drift pins, wedges, and chisels must be kept free of mushroomed heads. The wooden handles of tools must not be splintered.

Iron or steel hand tools may produce sparks that can be an ignition source around flammable substances. Where this hazard exists, spark-resistant tools made of non-ferrous materials should be used where flammable gases, highly volatile liquids, and other explosive substances are stored or used.

Appropriate personal protective equipment such as safety goggles and gloves must be worn to protect against hazards that may be encountered while using hand tools.

Workplace floors shall be kept as clean and dry as possible to prevent accidental slips with or around dangerous hand tools.

The Dangers of Power Tools

The types of power tools are determined by their power source: electric, pneumatic, liquid fuel, hydraulic, and powder-actuated.

Power tools must be fitted with guards and safety switches; they are extremely hazardous when used improperly.

To prevent hazards associated with the use of power tools, workers should observe the following general precautions:

- Never carry a tool by the cord or hose.

- Never yank the cord or the hose to disconnect it from the receptacle.
- Keep cords and hoses away from heat, oil, and sharp edges.
- Disconnect tools when not using them, before servicing and cleaning them, and when changing accessories such as blades, bits, and cutters.
- Keep all people not involved with the work at a safe distance from the work area.
- Secure work with clamps or a vise, freeing both hands to operate the tool.
- Avoid accidental starting. Do not hold fingers on the switch button while carrying a plugged-in tool.
- Maintain tools with care; keep them sharp and clean for best performance.
- Follow instructions in the user's manual for lubricating and changing accessories.
- Be sure to keep good footing and maintain good balance when operating power tools.
- Wear proper apparel for the task. Loose clothing, ties, or jewelry can become caught in moving parts.
- Remove all damaged portable electric tools from use and tag them: "Do Not Use."

Guards

The exposed moving parts of power tools need to be safe- guarded. Belts, gears, shafts, pulleys, sprockets, spindles, drums, flywheels, chains, or other reciprocating, rotating, or moving parts of equipment must be guarded.

Machine guards, as appropriate, must be provided to protect the operator and others from the following:

- Point of operation.
- In-running nip points.
- Rotating parts.
- Flying chips and sparks.

Safety guards must never be removed when a tool is being used.

Portable circular saws having a blade greater than 2 inches in diameter must be equipped at all times with guards. An upper guard must cover the entire blade of the saw. A retractable lower guard must cover the teeth of the saw, except where it makes contact with the work material. The lower guard must automatically return to the covering position when the tool is withdrawn from the work material.

Operating Controls and Switches

The following hand-held power tools must be equipped with a constant-pressure switch or control that shuts off the power when pressure is released:

- drills
- tappers
- fastener drivers;
- horizontal, vertical, and angle grinders with wheels more than 2 inches in diameter
- disc sanders with discs greater than 2 inches
- belt sanders
- reciprocating saws
- saber saws, scroll saws, and jigsaws with blade shanks greater than 1/4-inch wide
- other similar tools

These tools also may be equipped with a "lock-on" control, if it allows the worker to also shut off the control in a single motion using the same finger or fingers.

The following hand-held power tools must be equipped with either a positive "on-off" control switch, a constant pressure switch, or a "lock-on" control:

- disc sanders with discs 2 inches or less in diameter
- grinders with wheels 2 inches or less in diameter
- platen sanders, routers, planers, laminate trimmers, nibblers, shears, and scroll saws
- jigsaws, saber and scroll saws with blade shanks a nominal 1/4-inch or less in diameter

It is recommended that the constant-pressure control switch be regarded as the preferred device.

Other hand-held power tools such as circular saws having a blade diameter greater than 2 inches, chain saws, and percussion tools with no means of holding accessories securely must be equipped with a constant-pressure switch.

Electric Tools

Employees using electric tools must be aware of several dangers.

Among the most serious hazards are electrical burns and shocks.

Electrical shocks, which can lead to injuries such as heart failure and burns, are among the major hazards associated with electric-powered tools. Under certain conditions, even a small amount of electric current can result in fibrillation of the heart and death. An electric shock also can cause the user to fall off a ladder or other elevated work surface and be injured due to the fall.

To protect the user from shock and burns, electric tools must have a three-wire cord with a ground and be plugged into a grounded receptacle, be double insulated, or be powered by a low-voltage isolation transformer. Three-wire cords contain two current-carrying conductors and a grounding conductor. Any time an adapter is used to accommodate a two-hole receptacle, the adapter wire must be attached to a known ground. The third prong must never be removed from the plug.

Double-insulated tools are available that provide protection against electrical shock without third-wire grounding. On double- insulated tools, an internal layer of protective insulation completely isolates the external housing of the tool.

The following general practices should be followed when using electric tools:

- Operate electric tools within their design limitations.
- Use gloves and appropriate safety footwear when using electric tools.
- Store electric tools in a dry place when not in use.
- Do not use electric tools in damp or wet locations unless they are approved for that purpose.
- Keep work areas well lighted when operating electric tools.
- Ensure that cords from electric tools do not present a tripping hazard.

In the construction industry, workers who use electric tools must be protected by ground-fault circuit interrupters or an assured equipment-grounding conductor program.

Portable Abrasive Wheel Tools

Portable abrasive grinding, cutting, polishing, and wire buffing wheels create special safety problems because they may throw off flying fragments. Abrasive wheel tools must be equipped with guards that:

- cover the spindle end, nut, and flange projections
- maintain proper alignment with the wheel
- do not exceed the strength of the fastenings

Before an abrasive wheel is mounted, it must be inspected closely for damage and should be sound, or ring, tested to ensure that it is free from cracks or defects. To be tested, wheels should be tapped gently with a light, non-metallic instrument. If the wheels sound cracked or dead, they must not be used because they could fly apart in operation. A stable and undamaged wheel, when tapped, will give a clear metallic tone or "ring."

To prevent an abrasive wheel from cracking, it must fit freely on the spindle. The spindle nut must be tightened enough to hold the wheel in place without distorting the flange. Always follow the manufacturer's recommendations. Take care to ensure that the spindle speed of the machine will not exceed the maximum operating speed marked on the wheel.

An abrasive wheel may disintegrate or explode during start-up. Allow the tool to come up to operating speed prior to grinding or cutting. The employee should never stand in the plane of rotation of the wheel as it accelerates to full operating speed. Portable grinding tools need to be equipped with safety guards to protect workers not only from the moving wheel surface, but also from flying fragments in case of wheel breakage.

When using a powered grinder:

- Always use eye or face protection.
- Turn off the power when not in use.
- Never clamp a hand-held grinder in a vise.

Pneumatic Tools

Pneumatic tools are powered by compressed air and include:

- chippers
- drills
- hammers
- sanders

There are several dangers associated with the use of pneumatic tools. First and foremost is the danger of getting hit by one of the tool's attachments or by some kind of fastener the worker is using with the tool.

Pneumatic tools must be checked to see that the tools are fastened securely to the air hose to prevent them from becoming disconnected. A short wire or positive locking device attaching the air hose to the tool must also be used and will serve as an added safeguard.

If an air hose is more than 1/2-inch in diameter, a safety excess flow valve must be installed at the source of the air supply to reduce pressure in case of hose failure.

In general, the same precautions should be taken with an air hose that are recommended for electric cords, because the hose is subject to the same kind of damage or accidental striking, and because it also presents tripping hazards.

When using pneumatic tools, a safety clip or retainer must be installed to prevent attachments such as chisels on a chipping hammer from being ejected during tool operation.

Pneumatic tools that shoot nails, rivets, staples, or similar fasteners and operate at pressures more than 100 pounds per square inch, must be equipped with a special device to keep fasteners from being ejected, unless the muzzle is pressed against the work surface.

Airless spray guns that atomize paints and fluids at pressures of 1,000 pounds or more per square inch, must be equipped with automatic or visible manual safety devices that will prevent pulling the trigger until the safety device is manually released.

Eye protection is required, and head and face protection is recommended for employees working with pneumatic tools.

Screens must also be set up to protect nearby workers from being struck by flying fragments around chippers, riveting guns, staplers, or air drills.

Compressed air guns should never be pointed toward anyone.

Workers should never "dead-end" them against themselves or anyone else. A chip guard must be used when compressed air is used for cleaning.

Use of heavy jackhammers can cause fatigue and strains. Heavy rubber grips reduce these effects by providing a secure handhold. Workers operating a jackhammer must wear safety glasses and safety shoes that protect them against injury if the jackhammer slips or falls. A face shield also should be used.

Noise is another hazard associated with pneumatic tools. Working with noisy tools such as jackhammers requires proper, effective use of appropriate hearing protection.

Liquid Fuel Tools

Fuel-powered tools are usually operated with gasoline. The most serious hazard associated with the use of fuel-powered tools comes from fuel vapors that can burn or explode and also give off dangerous exhaust fumes. The worker must be careful to handle, transport, and store gas or fuel only in approved flammable liquid containers, according to proper procedures for flammable liquids.

Before refilling a fuel-powered tool tank, the user must shut down the engine and allow it to cool to prevent accidental ignition of hazardous vapors. When a fuel-powered tool is used inside a closed area, effective ventilation and/or proper respirators such as atmosphere-supplying respirators must be utilized to avoid breathing carbon monoxide. Fire extinguishers must also be available in the area.

Power-Actuated Tools

Powder-actuated tools operate like a loaded gun and must be treated with extreme caution. In fact, they are so dangerous that they must be operated only by specially trained workers.

When using powder-actuated tools, a worker must wear suitable ear, eye, and face protection. The user must select a powder level—high or low velocity—that is appropriate for the powder-actuated tool and necessary to do the work without excessive force.

The muzzle end of the tool must have a protective shield or guard centered perpendicular to and concentric with the barrel to confine any fragments or particles that are projected when the tool is fired. A tool containing a high-velocity load must be designed not to fire unless it has this kind of safety device.

To prevent the tool from firing accidentally, two separate motions are required for firing. The first motion is to bring the tool into the firing position, and the second motion is to pull the trigger. The tool must not be able to operate until it is pressed against the work surface with a force of at least 5 pounds greater than the total weight of the tool.

Safety precautions that must be followed when using powder- actuated tools include the following:

- Do not use a tool in an explosive or flammable atmosphere.
- Inspect the tool before using it to determine that it is clean, that all moving parts operate freely, and that the barrel is free from obstructions and has the proper shield, guard, and attachments recommended by the manufacturer.
- Do not load the tool unless it is to be used immediately.
- Do not leave a loaded tool unattended, especially where it would be available to unauthorized persons.
- Keep hands clear of the barrel end.
- Never point the tool at anyone.
- When using powder-actuated tools to apply fasteners, several additional procedures must be followed:
- Do not fire fasteners into material that would allow the fasteners to pass through to the other side.
- Do not drive fasteners into very hard or brittle material that might chip or splatter or make the fasteners ricochet.
- Always use an alignment guide when shooting fasteners into existing holes.
- When using a high-velocity tool, do not drive

fasteners more than 3 inches from an unsupported edge or corner of material such as brick or concrete.

- When using a high velocity tool, do not place fasteners in steel any closer than 1/2-inch from an unsupported corner edge unless a special guard, fixture, or jig is used.

Hydraulic Power Tools

The fluid used in hydraulic power tools must be an approved fire-resistant fluid and must retain its operating characteristics at the most extreme temperatures to which it will be exposed. The exception to fire-resistant fluid involves all hydraulic fluids used for the insulated sections of derrick trucks, aerial lifts, and hydraulic tools that are used on or around energized lines. This hydraulic fluid shall be of the insulating type.

The manufacturer's recommended safe operating pressure for hoses, valves, pipes, filters, and other fittings must not be exceeded.

All jacks—including lever and ratchet jacks, screw jacks, and hydraulic jacks—must have a stop indicator, and the stop limit must not be exceeded. Also, the manufacturer's load limit must be permanently marked in a prominent place on the jack, and the load limit must not be exceeded.

A jack should never be used to support a lifted load. Once the load has been lifted, it must immediately be blocked up. Put a block under the base of the jack when the foundation is not firm, and place a block between the jack cap and load if the cap might slip.

To set up a jack, make certain of the following:

- The base of the jack rests on a firm, level surface;
- The jack is correctly centered;
- The jack head bears against a level surface; and
- The lift force is applied evenly.

Proper maintenance of jacks is essential for safety. All jacks must be lubricated regularly. In addition, each jack must be inspected according to the following schedule: (1) for jacks used continuously or intermittently at one site—inspected at least once every 6 months, (2) for jacks sent out of the shop for special work— inspected when sent out and inspected when returned, and (3) for jacks subjected to abnormal loads or shock—inspected before use and immediately thereafter.

CHAPTER 3 - LEAD SAFETY

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 cardio respiratory 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 follow-up--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 appropriate 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 permissible **exposure limits (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 time weighted average 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 developing 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 onsite 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, 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 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 non-occupational), personal habits (smoking and hygiene), and past gastrointestinal, 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 NO EMPLOYEE EXPOSURES ABOVE THE ACTION LEVEL

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 follow-up 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 monitor-ing, 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 onsite 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 offsite 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 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 work shift.
- 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 face pieces 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 environments 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 engineering 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 face piece 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 face piece 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 face piece-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
- Record-keeping 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 face-piece supplied-air respirator operated in a positive-pressure mode, APF 2,000.

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.

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.

CHAPTER 4 – DANGERS OF ASBESTOS

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 activities does this chapter cover?

The OSHA asbestos standard for the construction industry 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 and an abbreviated standardized

questionnaire with annual exams;

- 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.

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.

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.*** 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 selfhelp 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.

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. 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. 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 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 heeting 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-face piece 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.

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 face piece respirator pass an appropriate qualitative fit

test (QLFT) or quantitative fit test (QNFT);

- Ensure that an employee using a tight-fitting face piece respirator is fit tested prior to initial use of the respirator, whenever a different size, style, model or make of respirator face piece 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.

The *competent person* must examine employee work suits at least once per work shift for rips or tears. Rips or tears found while an employee is working must be mended or the work suit 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.

This chapter addresses aspects of working safely with asbestos. It does not address environmental regulations regarding the handling of asbestos. In Oregon, visit: http://www.deq.state.or.us/aq/asbestos/business.htm for information.

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