Module 5: Health Hazards in Construction Pages 173 - 213

- Foot injuries can be avoided by implementing proper housekeeping techniques to keep walkways clear of debris or tools. Depending on the working conditions, special footwear may also be required, such as shoes with steel toes.

Module 5: Health Hazards in Construction

Module Description

The Hazard Communication Standard (HCS) provides information to workers and employers about various chemical hazards that exist in the workplace, and what protective measures they can take to prevent the adverse effects of such hazards.

This module will give you a basic understanding of how to deal with hazardous chemicals and how workers can prevent and protect themselves from chemical hazards at a construction worksite.

Module Learning Objectives

At the conclusion of this module, students will be able to:

- Describe the purpose of The Hazard Communication Standard (HCS)
- Discuss labels and Safety Data Sheets
- Differentiate between physical and health hazards associated with hazardous chemicals
- Distinguish between symbols used to identify hazards
- State how to prepare and implement a written hazard communication program
- Explain the importance of proper training

Lesson 1: Introduction to Hazard Communication Standard

Lesson Focus

At the end of this lesson, students will be able to:

- Describe the Hazard Communication Standard (HCS or HazCom)
- Identify common hazardous materials
- Provide important definitions associated with the HCS

The Hazard Communication Standard (HCS or HazCom)

The Need of a Hazard Communication Standard

According to OSHA, over 650,000 hazardous chemical products exist, and hundreds of new ones are being introduced annually. More than 32 million workers are potentially exposed to one or more chemical hazards in more than 3 million American workplaces. It would be very difficult if not impossible for individual employers or local enforcement agencies to keep track of all of these chemicals and their associates' hazards. As a result, the HCS was developed to ensure all relevant information needed to protect workers is readily available. Chemical manufacturers and importers are required to evaluate the hazards of the chemicals they produce or import and prepare labels and safety data sheets to convey the hazard information to their downstream customers. Employers with hazardous chemicals in their workplaces are then responsible for having labels and safety data sheets for their exposed workers and training them to handle the chemicals appropriately.

The simple idea behind the Hazard Communication Standard (HCS) is that workers have both a need and a *right to know* about the hazards and identities of the chemicals they are exposed to when performing their tasks and duties.

The Hazard Communication Standard Coverage

Implementation of HCS for all those companies who import, produce, distribute, or use hazardous chemicals in the United States is mandatory. They must provide proper information and training to all of their affected employees. The HCS covers both physical (such as explosive, flammable) and health (acute and chronic) hazards.

The HCS is also aligned with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS). This update to the HCS will provide a common and coherent approach to classifying chemicals and communicating hazard information on labels and safety data sheets. This update will also help reduce trade barriers and result in productivity improvements for American businesses that regularly handle, store, and use hazardous chemicals while providing cost savings for American businesses that periodically update safety data sheets and labels for chemicals covered under the hazard communication standard.

OSHA® QUICK CARD™

Hazard Communication Standard Pictogram

The Hazard Communication Standard (HCS) requires pictograms on labels to alert users of the chemical hazards to which they may be exposed. Each pictogram consists of a symbol on a white background framed within a red border and represents a distinct hazard(s). The pictogram on the label is determined by the chemical hazard classification.

HCS Pictograms and Hazards

Health Hazard  • Carcinogen • Mutagenicity • Reproductive Toxicity • Respiratory Sensitizer • Target Organ Toxicity • Aspiration Toxicity	**Flame**  • Flammables • Pyrophorics • Self-Heating • Emits Flammable Gas • Self-Reactives • Organic Peroxides	**Exclamation Mark**  • Irritant (skin and eye) • Skin Sensitizer • Acute Toxicity (harmful) • Narcotic Effects • Respiratory Tract Irritant • Hazardous to Ozone Layer (Non-Mandatory)
Gas Cylinder  • Gases Under Pressure	**Corrosion**  • Skin Corrosion/ Burns • Eye Damage • Corrosive to Metals	**Exploding Bomb**  • Explosives • Self-Reactives • Organic Peroxides
Flame Over Circle  • Oxidizers	**Environment** (Non-Mandatory)  • Aquatic Toxicity	**Skull and Crossbones**  • Acute Toxicity (fatal or toxic)

Hazardous Materials

Hazardous and toxic materials are those chemicals that may be present in a workplace and have the capacity to cause harm. Mixtures, fuels, solvents, paints, and dusts may all be considered hazardous substances or materials.

Recognition of Hazardous Chemicals

Before working with or using chemicals, it is important to recognize those that may be physically hazardous or are capable of posing health problems to you. Recognition of hazardous chemicals prior to work can reduce the risk of chemical accidents. Depending on exposure, chemicals can cause many serious health effects such as cancer, nervous system damage, lung damage, liver damage, kidney damage, and reproductive system effects.

Important Definitions

- Personal Protective Equipment: The devices or clothing used by workers to protect against hazards in the environment are called personal protective equipment (PPE). Some common examples of PPE are respirators, gloves, and chemical splash goggles.
- Toxicity: The term toxicity is used to describe the ability of a substance to cause a harmful effect.
- Flashpoint: This is the minimum temperature at which a liquid produces enough vapor within a test vessel to form a flammable mixture with air near the surface of the liquid. The factor that determines whether a liquid is flammable or not is its flashpoint.
- Flammable Liquids: Liquids that have a flashpoint below 100 °F (37.8 °C). Flammable materials require more care than combustible materials because they ignite at lower temperatures.
- Combustible Liquids: Liquids that have a flashpoint at or above 100 °F (37.8 °C).
- Container: Any bag, barrel, bottle, box, can, cylinder, drum, reaction vessel, storage tank, or the like that contains a hazardous chemical. For the purposes of this section, pipes or piping systems, and engines, fuel tanks, or other operating systems in a vehicle, are not considered to be containers.
- Exposure or Exposed: Exposure (or exposed) means that an employee is subjected, as a condition of employment, to a chemical that is a physical or health hazard, including potential (accidental or possible) exposure. "Subjected" in terms of health hazards includes any route of entry (such as inhalation, ingestion, skin contact, absorption, or injection).
- Hazard Warning: Any pictograms, words, pictures, symbols, or combination thereof appearing on a label or other appropriate form of warning which conveys the specific physical and health hazard(s), including target organ effects of the chemical(s) in the container(s).



- Immediate Use: Immediate use means that the hazardous chemical will be under the control of and used only by the person who transfers it from a labeled container and only within the work shift in which it is transferred. Any hazardous material decanted—transferred from a primary to a secondary container—should have the labeling information transferred to the secondary container also.
- Organic Peroxide: Any carbon-containing compound with two oxygen atoms joined together. Organic peroxides can be severe fire and explosion hazards.
- Oxidizer: A chemical other than a blasting or explosive agent that initiates or promotes combustion in other materials, thereby causing fire either by itself or through the release of oxygen or other gases.
- Pyrophoric: Pyrophoric means a chemical will ignite spontaneously in air at a temperature of 130 °F (54.4 °C) or below.
- Unstable (Reactive): Unstable (reactive) means a chemical that in its pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or become self-reactive under conditions of shocks, pressure, or temperature.
- Water-Reactive: Water-reactive means a chemical that reacts with water to release a gas that is either flammable or presents a health hazard.

Lesson Summary

- The simple idea behind the Hazard Communication Standard (HCS or HazCom) is that workers have both a need and a right to know about the hazards and identities of the chemicals they are exposed to when performing their tasks and duties. The standard covers both physical and health hazards.
- Hazardous materials are those substances, often chemicals, found on a worksite that pose a danger to workers.

Lesson 2: Labels, SDSs, Symbols, Hazards, and Training

Lesson Focus

At the end of this lesson, students will be able to:

- Describe the importance and contents of labels
- Describe Safety Data Sheets (SDSs)
- Recognize the symbols found on SDSs
- Describe the physical and health hazards found on a construction site
- Explain how to control physical and health hazards
- Describe a proper Hazard Communication Program (HCP or HazCom)
- Describe the proper training necessary

Labels

The HazCom standard requires that information about chemical hazards is provided on labels using quick visual notations, providing immediate recognition of the hazards. Labels must also provide instructions on how to handle the chemical so that users are informed about how to protect themselves. Labels are considered the most immediate source of information about chemicals and their hazard potential. All hazardous chemical containers must be labeled.

The following information must be included on all labels:

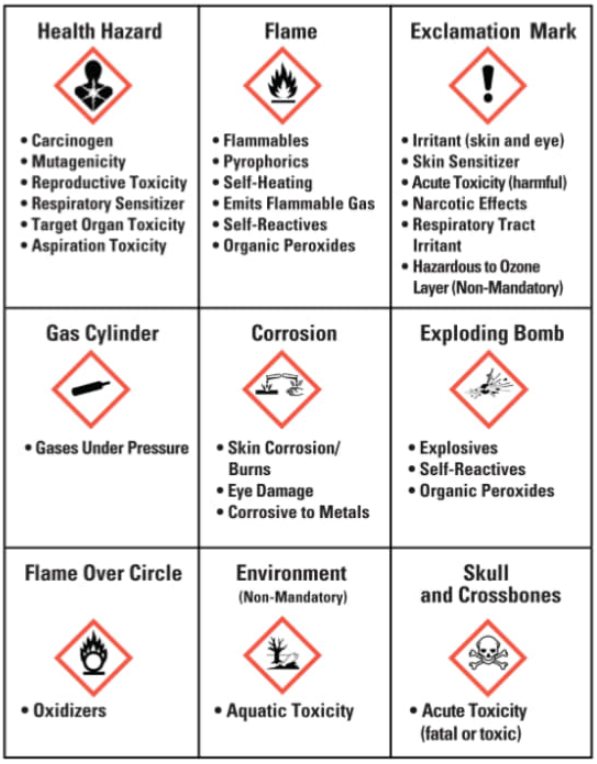
- **Contact Information:** Name, address, and telephone number of the chemical manufacturer, importer, or other responsible party.
- **Product Identifier:** This can be (but is not limited to) the chemical name, code number or batch number. Complete chemical name or names, no abbreviations; formula may be used as an option.
- **Signal Word:** This word is used to indicate the relative level of severity of the hazard and to alert the reader to a potential hazard. There are only two signal words: “Danger” and “Warning.”
- **Hazard Statement(s):** Describe the nature of the chemical’s hazards, including, where appropriate, the degree of hazard. For example: “Causes damage to kidneys through prolonged or repeated exposure when absorbed through the skin.” All of the applicable hazard statements must appear on the label.
- **Precautionary Statement(s):** Describe recommended measures that should be taken to minimize or prevent adverse effects resulting from exposure to the hazardous chemical or improper storage or handling.
- **Pictogram(s):** Graphic symbols used to communicate specific information about the hazards of a chemical.

Labels must appear on each container and must be legible and written in English, although other languages can also be used if required. Many manufacturers of chemicals also include safe handling procedures on labels.

Pictograms

Pictograms are graphic symbols used to communicate specific information about the hazards of a chemical. Pictograms on labels alert users to the chemical hazards to which they may be exposed. The pictograms on a label are determined by the chemical hazard classification. The pictograms OSHA has adopted improve worker safety and health, conform with the Globally Harmonized System (GHS) for chemical information, and are used worldwide. Each pictogram consists of a symbol on a white background framed within a red border and represents a distinct hazard.





It is important to note that the OSHA pictograms do not replace the diamond shaped labels that the U.S. Department of Transportation (DOT) requires for the transport of chemicals, including chemical drums, totes, tanks, or other containers. Those labels must be on the external part of a shipped container and must meet DOT requirements.

Safety Data Sheet (SDS)

A safety data sheet (SDS) provides detailed information about a specific hazardous material. Although labels are a good way to provide information about hazardous chemicals, sometimes you need more information than can be included on a label. The SDS includes information such as the properties of each chemical; the physical, health, and environmental health hazards; required protective measures; and safety precautions for handling, storing, and transporting the chemical. The information contained in the SDS must be in English (although it may be in other languages as well).

The SDS must be maintained in the facility for use by personnel while the material is in the facility and must be retained for a period of at least 30 years. As you've seen, SDSs are required to be presented in a consistent, user-friendly, 16-section format.

Note: It is the employer's responsibility to translate the information contained on the SDS into an understandable format and convey that information about the hazards associated with working with any of the hazardous materials in the facility before an

employee is ever exposed to the hazard. The SDS must always be immediately available to all affected employees for review; however, they can be stored electronically.

Click here for a sample SDS.

Section 1: Identification

This section identifies the chemical on the SDS as well as the recommended uses. It also provides the essential contact information of the supplier. The required information consists of:

- Product identifier used on the label and any other common names or synonyms by which the substance is known
- Name, address, phone number of the manufacturer, importer, or other responsible party, and emergency phone number
- Recommended use of the chemical (e.g., a brief description of what it actually does, such as flame retardant) and any restrictions on use (including recommendations given by the supplier)

Section 2: Hazard(s) Identification

This section identifies the hazards of the chemical presented on the SDS and the appropriate warning information associated with those hazards. The required information consists of:

- The hazard classification of the chemical (e.g., flammable liquid, category1)
- Signal word
- Hazard statement(s)
- Pictograms
- Precautionary statement(s)
- Description of any hazards not otherwise classified

Section 3: Composition/Information on Ingredients

This section identifies the ingredient(s) contained in the product indicated on the SDS, including impurities and stabilizing additives. The required information consists of:

- Chemical name(s)
- Common name and synonyms
- Chemical Abstracts Service (CAS) number and other unique identifiers
- Impurities and stabilizing additives, which are themselves classified and which contribute to the classification of the chemical

Section 4: First-Aid Measures

This section describes the initial care that should be given by untrained responders to an individual who has been exposed to the chemical. The required information consists of:

- Necessary first-aid instructions for relevant routes of exposure (inhalation, skin and eye contact, and ingestion)
- Description of the most important symptoms or effects, and any symptoms that are acute or delayed
- Recommendations for immediate medical care and special treatment needed, when necessary

Section 5: Fire-Fighting Measures

This section provides recommendations for fighting a fire caused by the chemical. The required information consists of:

- Recommendations of suitable extinguishing equipment, and information about extinguishing equipment that is not appropriate for a particular situation
- Advice on specific hazards that develop from the chemical during the fire, such as any hazardous combustion products created when the chemical burns
- Recommendations on special protective equipment or precautions for firefighters

Section 6: Accidental Release Measures

This section provides recommendations on the appropriate response to spills, leaks, or releases, including containment and cleanup practices to prevent or minimize exposure to people, properties, or the environment. The required information may consist of recommendations for:

- Use of personal precautions (such as removal of ignition sources or providing sufficient ventilation) and protective equipment to prevent the contamination of skin, eyes, and clothing
- Emergency procedures, including instructions for evacuations, consulting experts when needed, and appropriate protective clothing.
- Methods and materials used for containment (e.g., covering the drains and capping procedures)
- Cleanup procedures (e.g., appropriate techniques for neutralization, decontamination, cleaning, or vacuuming; adsorbent materials; and/or equipment required for containment/clean up)

Section 7: Handling and Storage

This section provides guidance on the safe handling practices and conditions for safe storage of chemicals. The required information consists of:

- Precautions for safe handling, including recommendations for handling incompatible chemicals, minimizing the release of the chemical into the environment, and providing advice on general hygiene practices (e.g., eating, drinking, and smoking in work areas is prohibited)
- Recommendations on the conditions for safe storage, including any incompatibilities. Provide advice on specific storage requirements (e.g., ventilation requirements)

Section 8: Exposure Controls/Personal Protection

This section indicates the exposure limits, engineering controls, and personal protective measures that can be used to minimize worker exposure. The required information consists of:

- OSHA Permissible Exposure Limits (PELs), and American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs)
- Appropriate engineering controls (e.g., use local exhaust ventilation, or use only in an enclosed system)
- Recommendations for personal protective measures to prevent illness or injury from exposure to chemicals, such as personal protective equipment (PPE) (e.g., appropriate types of eye, face, skin or respiratory protection needed based on hazards and potential exposure)
- Any special requirements for PPE, protective clothing or respirators (e.g., type of glove material, such as PVC or nitrile rubber gloves; and breakthrough time of the glove material)

Section 9: Physical and Chemical Properties

This section identifies physical and chemical properties associated with the substance or mixture. The minimum required information consists of:

- Appearance (physical state, color, etc.)
- Upper/lower flammability or explosive limits
- Odor and odor threshold
- Vapor pressure and density
- pH level
- Relative density
- Melting point/freezing point
- Solubility(ies)
- Initial boiling point and boiling range



- Partition coefficient: n-octanol/water
- Flash point and auto-ignition temperature
- Evaporation rate
- Decomposition temperature
- Flammability (solid, gas)
- Viscosity

NOTE: The SDS may not contain every item on the above list because information may not be relevant or is not available.

Section 10: Stability and Reactivity

This section describes the reactivity hazards of the chemical and the chemical stability information. This section is broken into three parts: reactivity, chemical stability, and other. The required information consists of:

- Reactivity: a description of the specific test data for the chemical(s).
- Chemical stability: an indication of whether the chemical is stable or unstable under normal ambient temperature and conditions while in storage and being handled.
- An indication of the possibility of hazardous reactions, including a statement whether the chemical will react or polymerize, which could release excess pressure or heat, or create other hazardous conditions
- A list of all conditions that should be avoided
- A list of all classes of incompatible materials with which the chemical could react to produce a hazardous situation
- A list of any known or anticipated hazardous decomposition products that could be produced because of use, storage, or heating

Section 11: Toxicological Information

This section identifies toxicological and health effects information or indicates that such data are not available. The required information consists of:

- Information on the likely routes of exposure (inhalation, ingestion, skin and eye contact). The SDS should indicate if the information is unknown.
- Description of the delayed, immediate, or chronic effects from short- and long-term exposure.
- The numerical measures of toxicity (e.g., acute toxicity estimates such as the LD50; the estimated amount [of a substance] expected to kill 50% of test animals in a single dose.
- Description of the symptoms. This description includes the symptoms associated with exposure to the chemical including symptoms from the lowest to the most severe exposure.
- Indication of whether the chemical is listed in the National Toxicology Program (NTP) Report on Carcinogens (latest edition) or has been

found to be a potential carcinogen in the International Agency for Research on Cancer (IARC) Monographs (latest editions) or found to be a potential carcinogen by OSHA.

Section 12: Ecological Information (non-mandatory by OSHA)

This section provides information to evaluate the environmental impact of the chemical(s) if it were released to the environment. The information may include:

- Data from toxicity tests performed on aquatic and/or terrestrial organisms, where available
- Whether there is a potential for the chemical to persist and degrade in the environment
- Results of tests of bioaccumulation potential
- The potential for a substance to move from the soil to the groundwater
- Other adverse effects (e.g., environmental fate, ozone layer depletion potential, and/or global warming potential)

Section 13: Disposal Considerations (non-mandatory by OSHA)

This section provides guidance on proper disposal practices, recycling or reclamation of the chemical(s) or its container, and safe handling practices. The information may include:

- Description of appropriate disposal containers to use
- Recommendations of appropriate disposal methods to employ
- Description of the physical and chemical properties that may affect disposal activities
- Any special precautions for landfills or incineration activities

Section 14: Transport Information (non-mandatory by OSHA)

This section provides guidance on classification information for shipping and transporting of hazardous chemical(s) by road, air, rail, or sea. The information may include:

- UN number (i.e., four-figure identification number of the substance)
- UN proper shipping name
- Transport hazard class(es)
- Environmental hazards
- Maritime Dangerous Goods Code (IMDG Code)
- Guidance on transport in bulk
- Any special precautions which an employee should be aware of or needs to comply with, in connection with transport or conveyance either within or outside their premises



Section 15: Regulatory Information (non-mandatory by OSHA)

This section identifies the safety, health, and environmental regulations specific for the product that is not indicated anywhere else on the SDS. The information may include any national and/or regional regulatory information of the chemical or mixtures (including any OSHA, Department of Transportation, Environmental Protection Agency, or Consumer Product Safety Commission regulations).

Section 16: Other Information

This section indicates when the SDS was prepared or when the last known revision was made. The SDS may also state where the changes have been made to the previous version. You may wish to contact the supplier for an explanation of the changes. Other useful information also may be included here.

Availability of SDSs

Every employer must train every affected employee in the information derived from the SDS for each hazardous material in the facility, before exposing the employee to the hazard. An employee should ideally only need to consult an SDS on an infrequent or emergency basis.

Note: Remember, it is the employer's responsibility to ensure that each employee who handles or uses any hazardous material knows where SDSs are located and how to read and understand them.

Symbols

Whenever you are working with materials that have a Department of Transportation (DOT) hazard class shipping label, you should be aware that this represents a specific hazard. Information regarding specific hazards denoted by DOT labels is contained on the material's SDS.

Explosive symbols (DOT hazard class labels) are used with those materials which release a great amount of energy in the form of light, expanding pressure, and heat within a short passage of time. Water reactive materials react with water and can explode. Furthermore, unstable reactive materials can react or become self-reactive subject to pressure, temperature, or shock.

Compressed gas cylinder symbols were created by the Compressed Gas Association and adopted by OSHA, and should appear on every cylinder of compressed hazardous gas.

Gases are used in various manufacturing processes. Because these gases are bottled under great pressure, misuse or unsafe handling could lead to an accident.

Note: Do not expose flammable or combustible materials to fire, heat, sparks, flames or any other source of heat or ignition.

Physical Hazards

There are frequently two types of hazards (physical and health) present in a workplace where hazardous chemicals or materials are present. Physical hazards refer to dangers presented by physical objects or forces on the worksite, as opposed to biological dangers. Falls, falling objects, caught-in-between accidents, and electrical hazards are examples of physical hazards. They are responsible for hundreds of deaths and injuries each year in the United States. Accidents involving physical hazards are often the consequence of a lack of training or neglect concerning the flammability of chemicals. Fire and explosion are common physical hazards.

Health Hazards

Hazardous chemicals can affect our health in different ways. Generally, two terms—acute and chronic—are used in order to understand the nature of the health hazards. Acute effects indicate that symptoms have arisen rapidly compared to chronic effects, which means symptoms have manifested themselves over a longer period of time.

Example: If you accidentally spill a strong acid on your hand and the acid begins to burn your skin, this is an acute effect as opposed to a chronic effect.

Determination of Health Hazards

Determining whether a hazard is affecting the health of a worker or not can be very difficult. Often, the signs and symptoms associated with the acute or chronic health effects of working are already present in the same workers as a result of non-occupational sources. For example, lung cancer, kidney failures, and nervous system breakdowns are some common health problems that may occur in occupationally exposed persons but, of course, can also be found in non-occupationally exposed persons.

Chronic Health Hazards

Chronic effects develop as a result of long-term exposures. Some examples of chronic health hazards include:

- Silicosis
- Some dermatitis (others may be from an acute exposure)
- Lung Cancer (from occupational exposure to carcinogens)

Note: Asbestos is a good example of a chronic health hazard. Those people who are exposed to asbestos may take several years to develop serious lung diseases.

Health Hazard Symbols

The following symbols are used to identify various kinds of health hazards:

- The skull and crossbones symbol represents a poisonous material.
- The hand and test tubes symbols are used to identify corrosive materials.
- The radiating fan symbol is used to represent radioactive materials.

Routes of Exposure-Health Hazards

Health hazards can affect a body through four routes of entry:

- Absorption
- Inhalation
- Ingestion
- Injection

The last of these, injection, is unlikely to occur on a worksite, but the other three are common hazards in construction:

- Skin Absorption: Some chemicals enter into the body by absorption through the skin. Always use personal protective equipment or clothing in order to protect your body from skin contact with hazardous material. If you are exposed, the proper response should be initiated, based on the chemical involved and the nature of the exposure.
- Inhalation: Inhalation is the most common route of entry into the body. It normally occurs when you inhale fumes, vapors, hazardous gasses, or dust. It is the employer's responsibility to be aware of such hazards in the workplace and to protect employees from inhalation hazards.
- Ingestion: Do not eat or smoke immediately after handling any hazardous material. When working with hazardous materials, wear appropriate PPE, and then always wash your hands properly before eating, drinking, or smoking.

Controlling Physical and Health Hazards

There are a number of ways to control the physical and health hazards associated with chemicals in a workplace. The following measures can protect you from physical and health hazards:

- **Safe work practices** help assure that you are using chemicals safely and correctly.
- **Product Substitution:** There are many chemicals that perform similar jobs. One of the many responsibilities an employer has is to attempt to find a chemical that is less toxic but able to accomplish the same job.



- **Engineering Controls:** An orderly and well-designed workplace can minimize exposure to hazardous chemicals. Some engineering controls, like exhaust systems and wetting systems used to control dust, are good examples of hazard control.
- **Training and communication** play an essential role in every field of life. It is vital to know how to work safely with hazardous chemicals.
- **Environmental monitoring** is a component in keeping an environment free from a buildup of hazardous chemicals that could lead to an unsafe working environment.
- **Personal Monitoring:** Monitor yourself and coworkers for symptoms (such as dizziness, eye or throat irritation, skin rashes) that would indicate that you or your coworkers have been exposed to a hazardous material or chemical. If these or other symptoms appear, report them to your supervisor immediately.
- **Personal Protective Equipment:** Always use gloves, aprons, masks, or other PPE whenever called for on a label or SDS.

Basic First Aid

First aid should be provided only by individuals who are properly trained and provided with the proper protective equipment. The employer must ensure prompt first aid treatment for injured employees, either by providing a trained first aid provider at the worksite, or by ensuring that emergency treatment services are within reasonable proximity of the worksite. Adequate first aid must be available in the critical minutes between the occurrence of an injury and the availability of physician or hospital care for the injured employee.

While OSHA does not prescribe a number of minutes, they have long interpreted the term 'near proximity' to mean that emergency care must be available within no more than 3-4 minutes' travel from the workplace. Medical literature establishes that, for serious injuries such as those involving stopped breathing, cardiac arrest, or uncontrolled bleeding, first aid treatment must be provided within the first few minutes to avoid permanent medical impairment or death. Accordingly, in workplaces where serious accidents such as those involving falls, suffocation, electrocution, or amputation are possible, emergency medical services must be available within 3-4 minutes if there is no employee on the site who is trained to render first aid.

OSHA does exercise discretion in enforcing the first aid requirements in particular cases. For example, they recognize that in workplaces such as offices, where such serious work-related injuries are less likely, a longer response time of up to 15 minutes may be reasonable.

Blood-borne Pathogens

Bloodborne pathogens are pathogenic microorganisms that are found in human blood, tissue, and organs. These pathogens include the Human Immunodeficiency Virus (HIV) and the Hepatitis B virus (HBV).



Employees must make sure that they never come in contact with any blood or body fluids without proper safeguards in place. Treat all human blood and certain human body fluids as if they were known to be infectious for HIV, HBV, and other bloodborne pathogens. This is known as taking “universal precautions.” If they have to handle any such fluids, workers must wear all appropriate personal protective equipment, especially gloves and safety glasses. Employees must handle and dispose of all sharps—such as needles and syringes—carefully in order to avoid suffering a puncture wound or laceration.

Appropriate use of personal protective equipment (PPE) is required by the Bloodborne Pathogens Standard (if exposure to blood and other potentially infectious materials is anticipated, meaning where occupational exposure remains even after engineering and work practice controls have been implemented). Wear appropriate gloves and other required PPE when hand contact with blood, mucous membranes, other potentially infectious materials (OPIM) or non-intact skin is anticipated; when performing vascular access procedures; or when handling contaminated items or surfaces.

The employer must ensure that employees wash hands and any other exposed skin with soap and water and flush mucous membranes with water as soon as feasible after contact with blood or OPIM. They should provide readily accessible hand washing facilities and ensure PPE is properly disposed of. Protective clothing must be removed before leaving the work area and placed in an appropriately designated area or container for storage, washing, decontamination, or disposal.

Temperature Stress

Extremely hot or cold temperatures at the work site can cause various disorders. Employees must make sure to take protective measures against heat and cold stresses.

Heat stress is one of the most common occurrences in the workplace. It can cause various disorders, including heat exhaustion, heat cramps, and heat stroke. The symptoms of heat stress may include headaches, thirst, nausea, muscle cramps, dizziness, and weakness. Due to the severity of the consequences of heat stress, employers must regularly monitor all potentially affected employees and their workplaces and take appropriate preventive measures.

Sunburns can be avoided by keeping the skin covered with sun blocking material. If an employee experiences heat cramps, she or he should first be taken to an air-conditioned or fanned area, provided water to drink, and monitored appropriately.

Heat exhaustion is caused by excessive exposure to heat and/or physical activity. Medical attention should immediately be sought for any employee suffering from heat exhaustion.

If left untreated, **heat stroke** can be fatal. Therefore, heat stroke should be considered a medical emergency. Until the paramedics arrive, the employee must be kept cool. Frostbite and hypothermia are two disorders that can be caused by **cold exposure**. If there is a risk of cold exposure, employees must always dress warmly and there should

be limited exposure to the skin. Cold temperatures that result in inadequate circulation of the blood to the extremities, such as the fingers and toes, may cause **frostbite**. Employees with frostbite must not move or rub the affected area, but must instead seek medical attention immediately and warm the affected areas slowly to avoid causing irreversible tissue damage.

Hypothermia is characterized by lowered body temperature. If an employee experiences hypothermia, he must immediately receive appropriate medical attention.

Hazard Communication Program

It is required that all chemical manufacturers, importers, and distributors convey complete information about a chemical and its hazards in the form of labels and SDSs. It is also mandatory that employers conduct hazard communication training programs in order to provide complete information to their employees through SDSs, labels, and training sessions.

Written Hazard Communication Program

A written program must be established in all workplaces where employees are exposed to hazardous chemicals. It should include a list of all hazardous chemicals that are present in the workplace and indicate where employees can get copies of written information about safe chemical handling procedures. A written program also indicates the person in the facility who is responsible for the various aspects of the program. The written program must also describe requirements and information about labels, SDSs, and employee training.

Click here for the OHSA fact sheet on HazCom standards and the written hazard communication program.

Note: Written programs may not be required in laboratories and those workplaces where employees are dealing with sealed containers.

Sample Hazard Communication Program

The following is a sample HazCom template developed by the Washington State Department of Labor and Industries (https://lni.wa.gov/safety-health/_docs/HT9-CR.doc). It provides a good example of how a proper HazCom written program could be organized.

A. Company Policy

(Add Name of Employer) is committed to the prevention of exposures that result in injury and/or illness; and to comply with all applicable state health and safety rules. To make sure that all affected employees know about information concerning the dangers of all hazardous chemicals used by *(Add Name of Employer)*, the following hazard communication program has been established. This written program will be available in *(Specify the location)* for review by any interested employee.



All work units of *(Add Name of Employer)* will participate in the hazard communication program.

B. Container Labeling

(Add name of person and title) is responsible for container labeling procedures, reviewing, and updating. The labeling system used at *(Add Name of Employer)* is as follows:

(Describe the labeling system, including the labels or other forms of warning used, and written alternatives to labeling, if any.)

The procedures for proper labeling of all containers, and reviewing and updating label warnings are as follows:

(Describe the procedure for labeling, including:

- *a description of the procedures for labeling of secondary containers used, including making sure that they have the appropriate identification and hazard warning, etc.;*
- *a description of procedures for reviewing and updating label warnings, how often the review is conducted; and the*
- *the name of the person and position who is responsible for reviewing and updating label warnings.)*

It is the policy of *(Add Name of Employer)* that no container will be released for use until the above procedures are followed.

C. Safety Data Sheets (SDS)

(Add name of person and title) is responsible for establishing and monitoring *(Add Name of Employer)'s* SDS program. This person will make sure procedures are developed to obtain the necessary SDSs and will review incoming SDSs for new or significant health and safety information. This person will make certain that any new information is passed on to affected employees.

The procedures to obtain SDSs and review incoming SDSs for new or significant health and safety information are as follows:

(Describe the procedure for obtaining and updating SDSs, including:

- *procedures on how to make sure copies are current and updated;*
- *how any new information is passed on to affected employees; and*
- *the procedures for employee access in work areas.)*

Copies of SDSs for all hazardous chemicals in use will be kept in *(Specify the location)*. SDSs will be available to all employees during each work shift. If an SDS is not available or a new chemical in use does not have an SDS, immediately contact:

(Add name of person and title)

Note: If an alternative to printed Material Safety Data Sheets is used (such as computer data), provide a description of the format.

D. Employee Information and Training



(Add name of person and title) is responsible for the employee training program.
The procedures for how employees will be informed and trained are as follows:

(Describe the procedure for employee training, including:

- *the methods used for general and site-specific training;*
- *how employees will be informed when non-routine tasks arise.*

If your employees work at other employers' job sites, then specify where and how these employees will have access to SDSs and labels, and how they will be informed of precautionary measures to take during normal or emergency operations, if any.)

(Add name of person and title) will make sure that before starting work, each new employee of *(Add Name of Employer)* will attend a health and safety orientation that includes information and training on the following:

- An overview of the requirements contained in the Hazard Communication Standard.
- Hazardous chemicals present at his or her work places.
- Physical and health risks of the hazardous chemical.
- The symptoms of overexposure.
- How to determine the presence or release of hazardous chemicals in his or her work area.
- How to reduce or prevent exposure to hazardous chemicals through use of control procedures, work practices, and personal protective equipment.
- Steps *(Add name of Employer)* has taken to reduce or prevent exposure to hazardous chemicals.
- Procedures to follow if employees are overexposed to hazardous chemicals.
- How to read labels and review SDSs to obtain hazard information.
- Location of the SDS file and written hazard communication program.
- An overview of the requirements contained in the Hazard Communication Standard.

Before introducing a new chemical hazard into any section of this employer, each employee in that section will be given information and training as outlined above for the new chemical.

E. Hazardous non-routine tasks

Periodically, employees are required to perform hazardous non-routine tasks. (Some examples of non-routine tasks are confined space entry, tank cleaning, and painting reactor vessels.) Non-routine tasks that are performed at *(Add Name of Employer)* include:

1. *(Add any non-routine tasks performed by employees)*
2. *(Add any non-routine tasks performed by employees)*
3. *(Add any non-routine tasks performed by employees)*

Prior to starting work on such projects, each affected employee will be given information by *(Add name of person and title)* about the hazardous chemicals he or she may encounter during these activities:

(For each non-routine task identified above:

- *list the specific chemical hazards;*



- *protective and safety measures the employee can use; and the*
- *steps the employer has taken to reduce the hazards, including ventilation, respirators, presence of another employee, and emergency procedures.)*

F. Multi-employer work places

It is the responsibility of *(Add name of person and title)* to provide employers of any other employees at the work site with the following information:

- Copies of SDSs (or make them available at a central location) for any hazardous chemicals that the other employer(s)' employee may be exposed to while working.
- Inform other employers of any precautionary measures that need to be taken to protect employees during normal operating conditions or in foreseeable emergencies.
- Provide other employers with an explanation of the labeling system that is used at the work site.

It is also the responsibility of *(Add name of person and title)* to identify and obtain SDSs for the chemicals the contractor is bringing into the work place.

G. List of hazardous chemicals

The following table lists all known hazardous chemicals used by our employees. Further information on each chemical may be obtained by reviewing SDSs located at *(Specify location)*.

The criteria (e.g., label warnings, SDS information, etc.) used to evaluate the chemicals are:
(Include a description of a plan for how you will update the list.)

List of Chemicals / SDS identity:
(Here is where you put the chemical list developed during the inventory. Arrange this list so that you are able to cross-reference it with your SDS file and the labels on your containers.)

Chemical Name	Manufacturer	Location Used
(Insert information here)	*(Insert information here)*	*(Insert information here)*
(Insert information here)	*(Insert information here)*	*(Insert information here)*
(Insert information here)	*(Insert information here)*	*(Insert information here)*

Training

Training must be provided to all employees exposed to hazardous chemicals. It must include information on how to handle chemicals safely, how to read and understand labels, SDSs, and other warning information, and what PPE is required before handling or using the hazardous material. It is required, and critical, that employees be trained before working with materials that represent a hazard.

Note: Remember, it is not sufficient to just provide SDSs to read. These documents can be long and technical and contain a great deal of information that may not be directly relevant to all workers. It is the employer's responsibility to provide, in addition to the SDSs, an easily understood version of the relevant safety information.

Lesson Summary

- The HazCom standard requires that information about chemical hazards is provided on labels using quick visual notations, providing immediate recognition of the hazards.
- Labels must include the manufacturer's contact information, the product identifier, a signal word ("danger" or "warning"), a hazard statement, a precautionary statement, and the relevant pictograms, which describe the specific hazards associated with the chemical.
- A safety data sheet (SDS) provides detailed information about a specific hazardous material. Although labels are a good way to provide information about hazardous chemicals, sometimes you need more information than can be included on a label. The SDS includes information such as the properties of each chemical; the physical, health, and environmental health hazards; required protective measures; and safety precautions for handling, storing, and transporting the chemical.
- Explosive symbols (DOT hazard class labels) are used with those materials which release a great amount of energy in the form of light, expanding pressure, and heat within a short passage of time.
- Physical Hazards refer to dangers presented by physical objects or forces on the worksite, including electrical hazards.
- Health hazards are commonly the result of hazardous chemicals, which can affect our health in different ways. Generally, two terms—acute and chronic—are used in order to understand the nature of the health hazards. Acute effects indicate that symptoms have arisen rapidly compared to chronic effects, which means symptoms have manifested themselves over a longer period of time.
- It is required that all chemical manufacturers, importers, and distributors convey complete information about a chemical and its hazards in the form of labels and SDSs. It is also mandatory that employers conduct hazard communication training programs in order to provide complete information to their employees through SDSs, labels, and training sessions.
- Training must be provided to all employees exposed to hazardous chemicals. It must include information on how to handle chemicals safely, how to read and understand labels, SDSs, and other warning information, and what PPE is required before handling or using the hazardous material.

Lesson 3: Hazardous Materials

Lesson Focus

At the end of this lesson, students will be able to:

- Describe the hazards and controls associated with crystalline silica
- Describe the hazards and controls associated with asbestos
- Describe the hazards and controls associated with Methylenedianiline (MDA)
- Describe the hazards and controls associated with lead
- Describe the hazards and controls associated with cadmium

Crystalline Silica

Permissible Exposure Limit for Silica Dust

Respirable (breathable) crystalline silica, consisting of very small particles (typically at least 100 times smaller than ordinary sand found on beaches or playgrounds) is generated by high-energy operations like cutting, sawing, grinding, drilling, and crushing stone, rock, concrete, brick, block, and mortar, or when abrasive blasting with sand. Employee exposure to respirable silica dust must not exceed 50 (µg/m3) micrograms per cubic meter of air averaged over an 8-hour work shift. The action level for respirable silica dust is an airborne concentration of 25 µg/m3 calculated as an 8-hour TWA. Exposures at or above the action level may trigger requirements for exposure assessment.

Silica can be found in construction materials (bricks, tile, concrete, sand, and masonry products), on demolition sites, and is commonly generated by such tasks as:

- Sand blasting, abrasive work that can create respirable crystalline silica
- Transportation or dumping of sand, crushed rock, and blocks
- Drilling operations
- Sanding, sawing, cutting, or grinding of masonry materials

Preventing exposure to silica dust can be achieved by using engineering and administrative controls, like wetting down soil at a construction site, having workers use respirators, monitoring dust levels, and using drill systems and grinding tools that apply water to minimize the creation of dust at the point of generation.

Silicosis

Silicosis can disable a person by making breathing difficult and painful. Other symptoms associated with silicosis include loss of appetite, fevers, and loss of body weight. Silicosis may also cause lung cancer or death.

There are two types or degrees of silicosis:

- **Acute silicosis** develops after a few months or as long as 2 years following exposures to extremely high concentrations of respirable crystalline silica.
- **Chronic silicosis** usually occurs when exposed at moderate to low concentrations of respirable crystalline silica for 15-20 years.

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 during the renovation and maintenance of buildings and structures containing asbestos.

Exposure by inhaling loose asbestos fibers can cause disabling or fatal diseases such as gastrointestinal cancer, cancers of the lung or lung-cavity lining, and severe lung impairment asbestosis. The symptoms of these diseases often do not appear for 20 or more years after initial exposure.

Classification of Asbestos Work

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 made of asbestos-containing materials (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.

Quick Reference of Provisions by Work Class*

	Class I	Class II	Class III	Class IV
Definition	Removal of thermal system insulation (TSI) and surfacing material (SM) containing > 1% asbestos	Removal of material other than TSI or SM containing > 1% asbestos	Maintenance and repair operations disturbing material containing > 1% asbestos	Housekeeping and custodial cleanup of dust, waste, and debris from Class I, II, or III activities
Regulated Areas	Required (warning signs mandatory)	Required (warning signs mandatory)	Required (warning signs mandatory)	Required (warning signs mandatory)
Competent Person	▪ Must be onsite ▪ Must inspect each workshift ▪ Must attend supervisory training	▪ Must be onsite ▪ Must inspect often ▪ Must attend supervisory training	▪ Must be onsite ▪ Must inspect often ▪ Must attend operational and maintenance training	▪ Must be onsite ▪ Must inspect often ▪ Must attend operational and maintenance training
Air Monitoring	▪ Initial if no negative exposure assessment (NEA) ▪ Daily unless positive pressure mode respirator is used ▪ Additional if conditions change *Note*: Terminate if < permissible exposure limits (PELs)	▪ Initial if no NEA ▪ Daily unless positive pressure mode respirator is used ▪ Additional if conditions change *Note*: Terminate if < PELs	▪ Initial if no NEA ▪ Periodic to accurately predict if > PELs ▪ Additional if conditions change *Note*: Terminate if < PELs	▪ Initial if no NEA ▪ Periodic to accurately predict if > PELs ▪ Additional if conditions change *Note*: Terminate if < PELs

*This is an overview of the standards' requirements. You must consult the standard for the specifics of the requirements for each class.

Quick Reference of Provisions by Work Class* *(continued)*

	Class I	Class II	Class III	Class IV
Medical Surveillance	Required if ▪ Wearing negative-pressure respirator, or ▪ > 30 days of work/year	Required if ▪ Wearing negative-pressure respirator, or ▪ > 30 days of work/year	Required if ▪ Wearing negative-pressure respirator, or ▪ > 30 days of work/year	Required if ▪ Wearing negative-pressure respirator, or ▪ > PEL for more than 30 days/year
Respirators	Mandatory for all Class I jobs	Mandatory if ▪ Non-intact removal, or ▪ No NEA, or ▪ > PEL, or ▪ Dry removal (except for roofing), or ▪ In emergencies	Mandatory if ▪ No NEA, or ▪ TSI or SM disturbed, or ▪ > PEL, or ▪ Dry removal (except for roofing), or ▪ In emergencies	Mandatory ▪ In regulated area where required, or ▪ If > PEL, or ▪ In emergencies
Protective Clothing and Equipment	Required for all jobs if ▪ > 25 linear or 10 square feet of TSI or ▪ SM removal, or ▪ No NEA, or ▪ > PEL	Required for all jobs if ▪ No NEA, or ▪ > PEL	Required for all jobs if ▪ No NEA, or ▪ > PEL	Required for all jobs if ▪ No NEA, or ▪ > PEL
Training	Equivalent to EPA Model Accreditation Plan (MAP) asbestos abatement workers course	Equivalent to MAP course if critical barriers required; otherwise, train on specific work practices and engineering controls that must be used	Equivalent to AHERA course for maintenance and custodial staff	Equivalent to AHERA course for maintenance and custodial staff

*This is an overview of the standards' requirements. You must consult the standard for the specifics of the requirements for each class.

Quick Reference of Provisions by Work Class* *(continued)*

	Class I	Class II	Class III	Class IV
Employee and Equipment Decontamination	Required if > 25 linear or 10 square feet TSI or SM removal ▪ Full decon unit ▪ Equipment room, shower, and clean room in series connected to the regulated area; other decon facility arrangements are acceptable if the specified series arrangement is not feasible (see 29 *CFR* Part 1926.1101, Subpart Z) ▪ Lunch areas *Note:* Must follow detailed decontamination procedures (see 29 *CFR* Part 1926.1101(j)(1)(iii) If < 25 linear or 10 square feet TSI or SM removal ▪ Equipment room/area required ▪ Impermeable dropcloths required ▪ Area must accommodate cleanup ▪ Must decontaminate all personal protective equipment (PPE) ▪ Must enter regulated area through equipment room/decon area No smoking in work area	If > PEL or no NEA ▪ Equipment room/area required ▪ Impermeable dropcloths required ▪ Area must accommodate cleanup ▪ Must clean work clothes with HEPA vacuum before removal ▪ Must Decontaminate all PPE ▪ Must enter regulated area through equipment room/decon area ▪ Must enter regulated area through equipment room/decon area No smoking in work area	If > PEL or no NEA ▪ Equipment room/area required ▪ Impermeable dropcloths required ▪ Area must accommodate cleanup ▪ Must clean work clothes with HEPA vacuum before removal ▪ Must Decontaminate all PPE ▪ Must enter regulated area through equipment room/decon area ▪ Must enter regulated area through equipment room/decon area If NEA must vacuum No smoking in work area	If cleaning up asbestos containing surfacing material or thermal system insulation debris from a Class I or III activity after the activity is finished ▪ Equipment room/area required ▪ Dropcloths required ▪ Area must accommodate cleanup ▪ Must clean work clothes with HEPA vacuum before removal ▪ Must decontaminate all PPE ▪ Must enter regulated area through equipment room/decon area No smoking in work area *Note:* If cleaning up dust, waste, and debris while a Class I, II, or III activity is still in progress, the requirements of that activity apply.

*This is an overview of the standards' requirements. You must consult the standard for the specifics of the requirements for each class.

Quick Reference of Provisions by Work Class* *(continued)*

	Class I	Class II	Class III	Class IV
Generally Required Work Practices and Engineering Controls	▪ Wet methods ▪ HEPA vacuum ▪ Prompt cleanup/disposal	▪ Wet methods ▪ HEPA vacuum ▪ Prompt cleanup/disposal	▪ Wet methods ▪ HEPA vacuum ▪ Prompt cleanup/disposal	▪ Wet methods ▪ HEPA vacuum ▪ Prompt cleanup/disposal
Required Work Practices and Engineering Controls to Comply with PELs	▪ HEPA local exhaust ▪ Enclosure or isolation ▪ Directed ventilation ▪ Other work practices ▪ Respirators	▪ HEPA local exhaust ▪ Enclosure ▪ Directed ventilation ▪ Other work practices ▪ Respirators	▪ HEPA local exhaust ▪ Enclosure ▪ Directed ventilation ▪ Other work practices ▪ Respirators	▪ HEPA local exhaust ▪ Enclosure ▪ Directed ventilation ▪ Other work practices ▪ Respirators
Prohibited Work Practices and Administrative Controls	▪ High-speed abrasive disc saws without HEPA ▪ Compressed air without capture device ▪ Dry sweeping/shoveling	▪ High-speed abrasive disc saws without HEPA ▪ Compressed air without capture device ▪ Dry sweeping/shoveling	▪ High-speed abrasive disc saws without HEPA ▪ Compressed air without capture device ▪ Dry sweeping/shoveling	▪ High-speed abrasive disc saws without HEPA ▪ Compressed air without capture device ▪ Employee rotation
Controls and Work Practices	▪ Critical barriers/isolation methods required if • > 25 linear or 10 square feet of TSI or SM removal • < 25 linear or 10 square feet of TSI or SM removal only if no NEA or there are adjacent workers ▪ HVAC isolation required	For indoor work only ▪ Critical barriers/isolation methods required if • no NEA • likely > a PEL • non-intact removal ▪ Impermeable dropcloths required	▪ Critical barriers required • If no NEA • > Pel via monitoring ▪ Impermeable dropcloths required ▪ Local HEPA exhaust required	See *Generally Required Work Practices and Engineering Controls* in this table

*This is an overview of the standards' requirements. You must consult the standard for the specifics of the requirements for each class.

Quick Reference of Provisions byWork Class* *(continued)*

	Class I	Class II	Class III	Class IV
Controls and Work Practices *(continued)*	▪ Impermeable dropcloths required ▪ Directed ventilation required if no NEA or > a PEL ▪ Objects must be covered One or more of the following controls must be used: ▪ Negative-pressure enclosure ▪ Glove bag ▪ Negative-pressure glove bag ▪ Negative pressure glove box ▪ Water spray process ▪ Mini enclosure	For removal of vinyl and asphalt flooring materials ▪ No sanding ▪ HEPA vacuum ▪ Wet methods ▪ No dry sweeping ▪ Any mechanical chipping must be done in negative-pressure enclosure ▪ Intact removal if possible ▪ Dry heat removal allowed ▪ Assume contains asbestos without an analysis For removal of roofing materials ▪ Intact removal if possible ▪ Wet methods if feasible ▪ Cutting machine misting ▪ HEPA-vacuum debris ▪ Lower to ground as soon as possible but no later than day's end ▪ Control dust of unbagged material ▪ Prevent intake of airborne asbestos through roof vent system	*Note*: Enclosure or isolation of operation required if TSI or SM is drilled, cut, abraded, sanded, sawed, or chipped	

*This is an overview of the standards' requirements. You must consult the standard for the specifics of the requirements for each class.

Quick Reference of Provisions by Work Class* *(continued)*

Class I	Class II	Class III	Class IV
Controls and Work Practices *(continued)*	For removal of cement-like siding, shingles, or transite panels ■ Intact removal if possible ■ Wet Methods ■ Lower to ground via dust-tight chute, crane, or hoist immediately or place in an impervious waste bag or wrap in plastic sheeting and lower to ground by day's end ■ Cut nail heads For removal of gaskets ■ Use glove bags if not intact ■ Wet removal ■ Prompt disposal ■ Wet scraping Additional requirements ■ Wet methods ■ Intact removal if possible ■ Cutting, abrading, or breaking prohibited		

*This is an overview of the standards' requirements. You must consult the standard for the specifics of the requirements for each class.

PEL—Permissible Exposure Limit

Employee exposure to asbestos must not exceed 0.1 fibers per cubic centimeter (f/cc) of air, averaged over an 8-hour work shift. Short-term exposure must also be limited to not more than 1 f/cc, averaged over 30 minutes. Rotation of employees to achieve compliance with either permissible exposure limit (PEL) is prohibited.

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
- 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.



Asbestos and Smoking

Studies show that smokers who are exposed to asbestos have a greatly increased risk of lung cancer. Quitting smoking will reduce the risk of lung cancer. People who were exposed to asbestos on the job at any time during their life, or who suspect they may have been exposed, should not smoke. If they smoke, they should stop.

General Compliance Requirements

For any employee exposed to airborne concentrations of asbestos beyond the allowable limits, the employer must provide and ensure the use of protective clothing, such as coveralls or similar full-body clothing, head coverings, gloves, foot coverings, face shields, vented goggles, or other appropriate protective equipment wherever the possibility of eye irritation exists. The employer must also provide and ensure the use of respirators where necessary. The employer must provide medical examinations for workers who, for 30 or more days per year, engage in Class I, II, or III work or experience related to asbestos.

Recordkeeping

The employer must keep an accurate record of all measurements taken to monitor employee exposure to asbestos. This record must include: the date of measurement, operation involving exposure, sampling and analytical methods used, and evidence of their accuracy; number, duration, and results of samples taken; types of protective devices worn; name, social security number, and the results of all employee exposure measurements. This record must be kept for 30 years.

What Kinds of Building Materials May Contain Asbestos?

Exposure to asbestos dust can occur at major construction job sites, in shipyards, in industry, and during construction or renovation of buildings. Even workers' families and friends can be at risk, as asbestos can often be carried on clothing.

There are many products containing asbestos. The following list gives an idea of the widespread use of asbestos, even though more products than those listed here may contain asbestos.

More Information:

Product	Location Includes	Approximate Range of % of Asbestos	Primary Dates of Use
Roofing tiles	Roofs	20 – 30	1930 – present
Roofing shingles	Roofs	20 – 32	1930 – present
Sprayed coating	Ceilings, walls, and Steelwork	1 – 95	1935 – 1978

Troweled coating	Ceilings, walls	1 – 95	1936 – 1978
Asbestos—cement sheet	Fireplaces, boilers	20 – 50	1930 – present
Millboard, rollboard	Walls, commercial buildings	80 – 85	1925 – present
Asphalt—asbestos tile	Floor	26 – 30	1920 – 1980
Preformed pipe wrap	Pipes	50	1926 – 1975
Paper tape	Furnaces, steam valves, flanges, electrical wiring	80	1901 – 1980
Putty (mudding)	Plumbing joints	20 – 100	1900 – 1973
Gaskets/Packing	Pipe flanges, boiler doors, valves, pipes	10 – 80	1900 – 1989
Hot tops	Used with ingot molds in the steel pouring process	10 – 80	1960 – 1980

MDA—Methylenedianiline

Introduction

Methylenedianiline (MDA) is a light-brown crystalline solid with a faint odor that is soluble in alcohol and benzene and slightly soluble in water. It is used for making polyurethane foams, which have a variety of uses including as insulating materials. It is also used for making coating materials, epoxy glues, dyes, and rubber.

Routes of exposure to MDA include skin absorption, inhalation, and ingestion. Short-term (acute) overexposure to MDA may produce symptoms such as fever, chills, loss of appetite, vomiting, and/or jaundice. Short-term contact with MDA may irritate the skin, eyes, and mucous membranes, and sensitization to MDA may also occur. Long-term (chronic) overexposure may cause cancer as well as damage to the liver, kidneys, blood, and spleen.

In the construction industry, MDA is used to coat exterior surfaces, such as concrete structures, pipes, and floors. These surfaces, located inside or outside of buildings, are often coated by spray application. The standard, however, covers both spray and roll-on applications.

Permissible Exposure Limits

No employee may be exposed to MDA above the permissible exposure limit (PEL) of 10 parts per billion (ppb) as an 8-hour time-weighted average (TWA), or above a short-term exposure limit (STEL) of 100 ppb over a 15-minute sampling period.

Action Level

The action level for a concentration of airborne MDA is 5 ppb as an 8-hour TWA. When the action level is reached, an employer must begin compliance activities such as exposure monitoring, medical surveillance, or temporary removal. The employer shall repeat such monitoring for each such employee at least every six months.

Regulated Areas

Regulated areas must be established where airborne concentrations exceed or are expected to exceed the PEL, and where employees handle or use non-airborne MDA liquids or mixtures. These areas must be marked off from the rest of the workplace to minimize the number of persons potentially exposed.

No eating, drinking, smoking, chewing of tobacco or gum, or applying of cosmetics is permitted in regulated areas. Access to regulated areas must be limited to authorized persons only, and employees working in these areas must be required to wear appropriate personal protective equipment and protective clothing which will prevent or minimize exposure.

Decontamination Areas

Decontamination areas, located outside of but as near as practical to the regulated area, must also be established for decontaminating workers, materials, and equipment contaminated with MDA. The decontamination area must include an equipment storage area, wash area, and clean change area.

Exposure Monitoring

Breathing-zone air samples that are representative of each employee's exposure to airborne MDA over an 8-hour period will determine employee exposure. Determination of employee exposure to the STEL must be made from breathing zone air samples collected over a 15-minute sampling period. The MDA standard requires that initial monitoring be performed for employees exposed to MDA unless objective or historical monitoring data prove that exposures are below the action level. MDA operations within a regulated area need not be monitored periodically if all employees are wearing supplied-air respirators while working in that regulated area.

Medical Surveillance

A medical surveillance program is required under the supervision of a licensed physician, without cost, for those employees who are:

- Exposed at or above the action level for more than 30 days per year
- Subject to 15 or more days of dermal exposure
- Exposed in an emergency
- Showing signs and symptoms of MDA exposure

The employer must conduct exams at least annually following the initial exam, as well as following emergency situations or when the employees develop any signs and symptoms associated with MDA exposure. The examining physician must provide in writing the results of these exams to the employer or employee.

The employer must provide the examining physician(s) with:

- A copy of the MDA standard and its appendices
- A description of the affected employee's duties related to potential MDA exposure
- The employer's current actual or representative MDA exposure level
- A description of the protective equipment or clothing used
- Information from previous employment-related medical exams

An employer must temporarily remove an employee from work when occupational exposure to MDA is at or above the action level, or where dermal exposure to MDA may occur, in the following circumstances:

- Following an emergency situation
- When an employee has signs/symptoms indicative of acute MDA exposure
- When the examining physician determines that an employee's abnormal liver function tests are not associated with MDA exposure but may be exacerbated as a result of occupational exposure to MDA

An employee may return to her or his former job status when:

- The employee no longer shows signs or symptoms of MDA exposure
- The physician so advises
- A subsequent medical determination shows the employee no longer has a detected medical condition that poses an increased health risk from MDA exposure

Respiratory Protection

Employers must provide respirators at no cost to the employees and ensure that they are used when engineering and work practice controls are being installed; when engineering and work practice controls are not sufficient to reduce exposure to or below the PEL; when engineering controls are not feasible in repair or maintenance and spray



application processes; and during emergencies. Keep in mind that engineering controls MUST BE USED to the fullest extent feasible.

Protective Clothing and Equipment

The employer must provide personal protective equipment and clothing, at no cost to the employee, and ensure the proper use of such equipment when the employee is subject to dermal exposure to MDA; where liquids containing MDA can be splashed into the eyes; or where airborne concentrations of MDA are in excess of the PEL.

Recommended protective clothing and equipment may include, but are not limited to, aprons, coveralls, gloves, foot coverings, face-shields, and/or goggles. It is the employer's responsibility to determine the appropriate PPE and ensure it is used. However, employees informed of the possibility of their exposure to MDA should take precautions including reading of the standard associated with it.

Recordkeeping

The employer must keep an accurate record of all measurements taken to monitor employee MDA exposure for at least 30 years. This record must include:

- The date of measurement.
- The operation involving MDA exposure.
- The sampling and analytical methods used and evidence of their accuracy.
- The number, duration, and results of samples taken.
- The description of the type of respiratory protective devices used.
- The name, social security number, and exposure of the employees whose exposures are represented through the information.

Lead

Lead is a very corrosion-resistant, dense, ductile, and malleable blue-gray metal that has been used for at least 5,000 years. Early uses of lead included building materials, pigments for glazing ceramics, and pipes for transporting water. The castles and cathedrals of Europe contain considerable quantities of lead in decorative fixtures, roofs, pipes, and windows. Prior to the early 1900s, uses of lead in the United States were primarily for ammunition, brass, burial vault liners, ceramic glazes, leaded glass and crystal, paints or other protective coatings, pewter, and water lines and pipes.

The advent of the electrical age and communications, which were accelerated by technological developments in World War I, resulted in the addition of bearing metals, cable covering, caulking lead, solders, and type metal to the list of lead uses. With the growth in production of public and private motorized vehicles and the associated use of starting-lighting-ignition (SLI) lead-acid storage batteries and terne metal for gas tanks after World War I, demand for lead increased. Most of these uses for lead continued to increase with the growth in population and the national economy. Contributing to the

increase in demand for lead was the use of lead as radiation shielding in medical analysis and video display equipment and as an additive in gasoline.

By the mid-1980s, a significant shift in lead end-use patterns had taken place. Much of this shift was a result of the U.S. lead consumers compliance with environmental regulations that significantly reduced or eliminated the use of lead in nonbattery products, including gasoline, paints, solders, and water systems. More recently, as the use of lead in nonbattery products has continued to decline, the demand for lead in SLI-type batteries has continued to grow. In addition, the demand for lead in non-SLI battery applications also has continued to grow. Non-SLI battery applications include motive sources of power for industrial forklifts, airport ground equipment, mining equipment, and a variety of nonroad utility vehicles, as well as stationary sources of power in uninterruptible electric power systems for hospitals, computer and telecommunications networks, and load-leveling equipment for electric utility companies.

By the early 2000s, the total demand for lead in all types of lead-acid storage batteries represented 88% of apparent U.S. lead consumption. Other significant uses included ammunition (3%), oxides in glass and ceramics (3%), casting metals (2%), and sheet lead (1%). The remainder was consumed in solders, bearing metals, brass and bronze billets, covering for cable, caulking lead, and extruded products.

Reproductive Risks

Lead may impair the reproductive systems of both men and women. It can result in decreased sex drive, impotency, and sterility in men. Lead can also alter the structure of sperm cell to raise the risk of birth defects. There is evidence of miscarriage and stillbirth in women whose husbands were exposed to lead or who were exposed to lead themselves. Lead exposure also may result in decreased fertility, and abnormal menstrual cycles in women. The course of pregnancy may be adversely affected by exposure to lead since lead crosses the placental barrier and poses risks to developing fetuses. Children born of parents either one of whom were exposed to excess lead levels are more likely to have birth defects, mental retardation, behavioral disorders or die during the first year of childhood.

Worker Exposure

In construction, lead is used for roofs, cornices, paints, and tank linings. In plumbing, soft solder, used chiefly for soldering tinplate and copper pipe joints, is often an alloy of lead and tin. Lead is most commonly taken into the body by inhalation. When workers breathe in lead as a dust, fume, or mist, their lungs and upper respiratory tract deliver the lead into the body. They can also absorb lead through the digestive system if it enters the mouth and is ingested.

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, carpentry, renovation, and remodeling work. Plumbers, welders, demolition workers, and painters are among those workers most often exposed to lead. Workers at the highest risk of lead exposure are

often those involved in abrasive blasting, as well as 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
- Spray painting with lead-based paint

Symptoms of Chronic Overexposure

Chronic overexposure to lead may result in severe damage to blood-forming, nervous, kidney, and reproductive systems. Some common symptoms of chronic overexposure include:

- Loss of appetite, metallic taste in the mouth, anxiety, constipation, and nausea.
- Symptoms of pallor, excessive tiredness, weakness, insomnia, headache, and nervous irritability.
- Muscle and joint pain or soreness, fine tremors, numbness, dizziness, hyperactivity, and colic (n lead colic, there may be severe abdominal pain)

Damage to the central nervous system in general and to the brain (encephalopathy) in particular is one of the most severe forms of lead poisoning. The most severe, often fatal, form of encephalopathy may be preceded by vomiting, a feeling of dullness progressing to drowsiness and stupor, poor memory, restlessness, irritability, tremor, and convulsions. It may arise suddenly with the onset of seizures, followed by coma and death. There is a tendency for muscular weakness to develop at the same time. This weakness may progress to paralysis often observed as a characteristic "wrist drop" or "foot drop" and is a manifestation of a disease to the nervous system called peripheral neuropathy.

Chronic overexposures to lead also results in kidney disease with few, if any, symptoms appearing until extensive and most likely permanent kidney damage has occurred. Routine laboratory tests reveal the presence of this kidney disease only after about two-thirds of kidney function is lost. When overt symptoms of urinary dysfunction arise, it is often too late to correct or prevent worsening conditions, and progression to kidney dialysis or death is possible.

Click here for more information from health guide for lead published by the Michigan Department of Labor and Economic Opportunity.

Worker Protection

The most effective means of protecting workers is to minimize their exposure through engineering controls, good work practices, proper training, and the use of personal protective clothing and equipment, including respirators where required. The employer should, as needed, consult a qualified safety and health professional to develop and implement an effective worker protection program. Some measures employers can use to protect workers include the following:

- Survey the workplace for lead-containing items. Conduct exposure monitoring as required by the OSHA standard. This requires air samples to be taken.
- Replace lead-containing products with lead-free or lower lead content products when possible. Where lead-containing products cannot be replaced, train workers on hazards and safe work practices.
- Use proper engineering controls to ensure the work area is well-ventilated.
- Ensure workers have appropriate personal protective equipment, such as goggles, proper respiratory protection, coveralls, gloves, et cetera as required by the OSHA standard.
- Conduct routine Blood Lead Level testing for workers who are potentially exposed to lead.
- Make a lead monitoring program available for workers. The program should consist of biological monitoring and medical surveillance. Such monitoring programs are required by OSHA if employees are found to be exposed at or above the lead action level.
- Provide workers with effective lead removal products. Hand washing with standard soap and water is not effective at removing lead residue from hands.
- If you have concerns that your workers are being exposed to lead, you may contact NIOSH to have the work environment assessed for free. For more details visit the NIOSH Health Hazard Evaluation website.
- You may also contact the OSHA Consultation Program, a free consultation service funded by OSHA to find out about potential hazards at your worksites and improve your occupational safety and health management systems: OSHA Fact Sheet: The OSHA Consultation Program.
- Refer to OSHA's lead standard for actions required to ensure your workers are safe. Contact your state OSHA office to see if your state has additional requirements.

Protective Clothing and Equipment

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
- Respirators

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.

Recordkeeping

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 properly the employee's health.

More Information

- Equip power tools used to remove lead-based paint with dust collection shrouds or other attachments.
- For abrasive blasting operations, build a containment structure that is designed to optimize the flow of clean ventilation air past the workers' breathing zones.
- 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.
- Choose materials and chemicals that do not contain lead for construction projects.
- Replace lead-based painted building components such as windows, doors, and trim with new components free of lead-containing paint.
- When applying lead paints or other lead-containing coatings, use a brush or roller rather than a sprayer.
- Use non-silica-containing abrasives, such as steel or iron shot/grit sand, instead of sand in abrasive blasting operations when practical.
- Put all lead-containing debris and contaminated items accumulated for disposal into sealed, impermeable bags or other closed impermeable containers.

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.

Cadmium

Cadmium is a naturally occurring element found in the earth's crust. This soft, silver-white metal was first used commercially in paint pigments and as a substitute for tin in World War I. Today, about three-fourths of cadmium is used as an electrode component in alkaline batteries, with the remainder used in pigments, coatings, and plating, and as a stabilizer for plastics.

Workers in many industries face potential exposure to cadmium. The potential for exposure is highest among workers in electroplating, metal machining, plastics, ceramics, paint, and welding operations. The main exposure routes are through inhalation of dust and fumes and the incidental ingestion of dust from contaminated hands, food, or cigarettes.

Occupational exposure to cadmium can lead to a variety of adverse health effects including cancer. Acute inhalation exposure (high levels over a short period of time) to cadmium can result in flu-like symptoms (chills, fever, and muscle pain) and can damage the lungs. Chronic exposure (low level over an extended period of time) can result in kidney, bone, and lung disease.

Symptoms of Chronic Overexposure

The onset of symptoms of cadmium overexposure may be delayed for two to four hours after exposure. Overexposure may cause fatigue, headaches, nausea, vomiting, abdominal cramps, diarrhea, and fever. In addition, continued exposure can lead to progressive loss of lung function (emphysema), abnormal buildup of fluid within the lungs (pulmonary edema), and breathlessness (dyspnea). In some cases, affected individuals may exhibit increased salivation, yellowing of the teeth, an unusually rapid heartbeat (tachycardia), or low levels of iron within the red blood cells (anemia). Individuals with cadmium poisoning may also experience improper kidney function, abnormally high levels of protein in the urine (proteinuria), minor changes in liver function, and/or softening of certain bones (osteomalacia).

Worker Protection

There are exposure limits an employer must observe under the OSHA cadmium standard. The first is the action level, or AL, which is defined as the airborne level of cadmium that creates a need for airborne exposure monitoring. A medical surveillance program should be instituted for employees who are at or above the AL for 30 or more days per year and a respirator should be provided to any employee who requests one. The action level for workplace exposure to cadmium is 2.5 micrograms per cubic meter of air (2.5 µg/m3) calculated as an 8-hour time-weighted average (TWA) exposure.

The second limit is the Permissible Exposure Limit, or PEL, which defines the limit to which an employee may be exposed to cadmium in the workplace. The PEL is a time-weighted average concentration that must not be exceeded during any 8-hour work shift of a 40-hour work week. The standard sets a PEL of 5 micrograms of cadmium per cubic meter of air (5 µg/m3) for all cadmium compounds, dust, and fumes.

There also is an additional limit known as a Separate Engineering Control Air Limit, or SECAL, which applies to select and defined industries and processes.

Warning Signs

Employees must be made aware of the dangers associated with exposure to cadmium in the workplace. Warning signs must be displayed in regulated areas and in all approaches to regulated areas. (A regulated area is defined as the area in which an employee may face exposure to cadmium at levels above the PEL.) The signs must be illuminated, cleaned, and maintained so that the legend is readily visible, and they must include the following words:

- Danger
- Cadmium
- Cancer hazard
- Can cause lung and kidney disease
- Authorized personnel only
- Respirators required in this area

Compliance Program

In any workplace with exposure levels above the PEL or SECAL, a written compliance program must be established and implemented to reduce employee exposure to or below the PEL by means of engineering and work practice controls. If engineering and work practice controls cannot reduce exposure to or below the PEL, the employer must include the use of appropriate respiratory protection in the written compliance program to achieve compliance with the PEL.

Employee Training

Employees must receive training prior to or at the time of their initial assignment to a position that involves potential exposure to cadmium and at least annually thereafter. Required training elements include:

- Explanation of the health hazards associated with cadmium exposure
- Information about where and how cadmium is used, stored, and released at the worksite
- Explanation of engineering controls and work practices to control exposure to cadmium exposure
- Description of measures employees can take to protect themselves from cadmium exposure, such as modification of smoking, personal hygiene precautions, and appropriate work practices

- Information on the purpose, selection, fitting, use, and limitations of personal protective equipment used to protect from cadmium exposure
- Explanation of the medical surveillance program and informing employees of their rights of access to records

Lesson Summary

- Respirable crystalline silica refers to very small particles of silica, often created during high-energy operations like cutting, sawing, grinding, and drilling, that are breathable and can cause severe health problems, including silicosis.
- There are two types of silicosis:
  - **Acute silicosis** develops after a few months or as long as 2 years following exposures to extremely high concentrations of respirable crystalline silica.
  - **Chronic silicosis** usually occurs when exposed at moderate to low concentrations of respirable crystalline silica for 15-20 years.
- 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.
- Asbestos is rarely installed today so most exposure results from renovation or demolition work. Inhaling asbestos can cause various kinds of cancer as well as asbestosis, which affects the lungs. Smoking greatly increases your chance of developing asbestosis.
- Methylenedianiline (MDA) is a light-brown crystalline solid with a faint odor that is soluble in alcohol and benzene and slightly soluble in water. It is used for making polyurethane foams, which have a variety of uses including as insulating materials. It is also used for making coating materials, epoxy glues, dyes, and rubber.
- Short-term (acute) overexposure to MDA may produce symptoms such as fever, chills, loss of appetite, vomiting, and/or jaundice. Short-term contact with MDA may irritate the skin, eyes, and mucous membranes, and sensitization to MDA may also occur. Long-term (chronic) overexposure may cause cancer as well as damage to the liver, kidneys, blood, and spleen. Employers must provide workers with respiratory protection if they will be working with MDA.
- Lead is a very corrosion-resistant, dense, ductile, and malleable blue-gray metal that has been used for at least 5,000 years. However, chronic overexposure to lead may result in severe damage to blood-forming, nervous, kidney, and reproductive systems.
- In construction, lead is used for roofs, cornices, paints, and tank linings. In plumbing, soft solder, used chiefly for soldering tinplate and copper pipe joints, is often an alloy of lead and tin.



- The most effective means of protecting workers is to minimize their exposure through engineering controls, good work practices, proper training, and the use of personal protective clothing and equipment, including respirators where required.
- Workers in many industries face potential exposure to cadmium. The potential for exposure is highest among workers in electroplating, metal machining, plastics, ceramics, paint, and welding operations. The main exposure routes are through inhalation of dust and fumes and the incidental ingestion of dust from contaminated hands, food, or cigarettes.
- Overexposure to cadmium may cause fatigue, headaches, nausea, vomiting, abdominal cramps, diarrhea, and fever.

Module 6: Stairways and Ladders

Module Description

Stairways and ladders are the major sources of workplace injuries and fatalities for construction workers. According to Bureau of Labor statistics, 24% of the 645 construction fatalities in 2009 resulted from falls from ladders and on stairs. Additionally, tens of thousands of workers were injured in these types of accidents with almost half of these injuries being serious in nature.

This module gives you a basic understanding of OSHA standards and the role they play in the prevention and elimination of work-related injuries and fatalities due to stairways and ladders.

Module Learning Objectives

At the conclusion of this module, students will be able to:

- Discuss OSHA standards related to stairways and ladders
- Discover methods of protection concerning stairways and ladder hazards
- Explore safety guidelines and requirements of stairways and ladders used at construction sites
- Explain training and other essential factors associated with stairways and ladders

Lesson 1: OSHA Standards and Stairways

Lesson Focus

At the end of this lesson, students will be able to:

- Describe the OSHA standards pertaining to stairways



Revision #1
Created 2024-04-24 20:19:01 UTC by Dale Bergman
Updated 2024-04-24 20:20:30 UTC by Dale Bergman