

Health Hazards in Construction



OSHAcademy Course 850 Study Guide

Health Hazards in Construction

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This study guide is designed to be reviewed off-line as a tool for preparation to successfully complete OSHAcademy Course 850.

Read each module, answer the quiz questions, and submit the quiz questions online through the course webpage. You can print the post-quiz response screen which will contain the correct answers to the questions.

The final exam will consist of questions developed from the course content and module quizzes.

We hope you enjoy the course and if you have any questions, feel free to email or call:

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Course Introduction

Construction workers are exposed to a variety of health hazards every day. These men and women have the potential for becoming sick, ill and disabled for life.

This course discusses these health hazards, such as dangerous dusts and other chemicals, on the job. It also takes a closer look at ways to protect yourself from ergonomic injuries on a construction site.



Course Components

Once you complete this course, you will have the knowledge of the following components.

-) chemical hazards
-) asbestos exposure
-) silica dangers
-) confined spaces
-) noise hazards
-) hand vibration
-) extreme temperatures
-) radiation exposure
-) biological health hazards
-) fungus & mold dangers
-) poisonous plants & animals
-) ergonomic injuries

Module 1: Construction Worker Health and Safety

Construction work is dynamic, diverse, and constantly changing. This leads to a great challenge in protecting the health and safety of construction workers. They are at risk of exposure to many different types of health hazards that can result in injury, illness, disability, or even death.



Risk Factors in Construction

Factors that increase the health risk of construction workers include the following components:

-) constantly changing job site environments and conditions
-) multiple contractors and subcontractors
-) high turnover and/or unskilled laborers
-) constantly changing relationships with other work groups
-) diversity of work activities that happen simultaneously
-) exposures to health hazards, both from their own work as well as from nearby activities

Construction Health Hazard Examples

Occupations	Potential Health Hazards
Brick masons	cement dermatitis, awkward postures, and heavy loads
Drywall installers	awkward postures, plaster dust, and heavy loads
Electricians	heavy metals in solder fumes, awkward postures, heavy loads, and asbestos
Painters	solvent vapors, toxic metals in pigments, and paint additives
Carpet layers	Knee trauma, awkward postures, glue and glue vapor
Insulation workers	asbestos, synthetic fibers, and awkward postures
Roofers	roofing tar and heat
Carpenters	noise, awkward postures, and repetitive motion

Drillers (earth and rock)	silica dust , whole-body vibration, noise
Excavating/loading machine operators	silica dust, whole-body vibration, heat stress, and noise
Hazardous waste workers	heat stress and toxic chemicals

Chemical Hazards

Chemicals are found in many products used at construction sites. Workers may be exposed to dangerous chemicals during construction activities. These include asbestos, lead, silica, carbon monoxide and spray paints. The chemicals can exist in several forms, including

-) dusts, fumes, and fibers (solids);
-) liquids and mists; and
-) gases and vapors.



These chemicals can enter the body in a variety of different ways. Let's take a closer look.

Inhalation (breathed in)-Inhalation is generally the most common way chemicals can enter the body in a work situation.

Ingestion-accidental swallowing through eating, drinking, or smoking.

Absorption-absorbed through contact with skin or eyes.

Injection-a chemical enters the body when the skin is punctured.

Health Effects from Chemical Exposure

There are two types of health effects from chemical exposure.

-) acute
-) chronic

Note: Some chemicals have both acute and chronic effects, such as carbon monoxide.

Acute Effects

These types of effects occur immediately or within a short time (minutes or hours) following exposure. Death is possible from some hazardous substances. Exposure to the chemical is typically sudden, short-term, and with a high concentration. For example, if a worker is exposed to carbon monoxide, they may quickly experience a headache, collapse, or even death.

Chronic Effects

Chronic effects usually develop after continual or repeated exposure to a dangerous chemical. This long-term exposure can sometimes occur over several years. For example, a worker could develop lung cancer from long-term exposure to asbestos.

Asbestos Exposure

Construction workers may be exposed to asbestos during demolition or remodeling of older buildings built before 1980. Most of these buildings contain asbestos insulation, or other asbestos-containing products.

Asbestos is well-recognized as a health hazard and is highly regulated. Although asbestos is no longer used as an insulation material, workers may still be exposed to asbestos during demolition or remodeling jobs.

Asbestos may also still be found in some taping compounds, asbestos cement, pipes and floor tiles. Vinyl asbestos floor tiles may be as much as 15% to 20% asbestos, which is released when old flooring is removed.

Asbestos removal can only be done by specially trained asbestos workers. Significant exposure to asbestos can cause breathing problems, lung cancer and cancer of the lung lining many years after exposure.

Welding Fumes

Welding fumes contain a variety of chemicals depending on what is being welded on, chemical makeup of welding rods, fluxes and shielding gases.

Generally, welding in confined spaces, or welding on stainless steel which generates hexavalent chromium, are the most hazardous welding activities.



Solvents

A variety of solvents with varying degrees of toxicity are used in construction. They are in paints, glues, epoxies and other products.

Generally, the possibility of exposure to excessive amounts of solvent vapors is greater when solvents are handled in enclosed or confined spaces.



Solvents can

-) irritate your eyes, nose or throat;
-) make you dizzy, sleepy, give you a headache or cause you to pass out;
-) affect your judgment or coordination;
-) cause internal damage to your body; and
-) dry out or irritate your skin.

Silica

About 2.3 million workers are exposed to respirable crystalline silica in their workplaces, including 2 million construction workers who drill, cut, crush, or grind silica-containing materials such as concrete and stone, and 300,000 workers in general industry operations such as brick manufacturing, foundries, and hydraulic fracturing, also known as fracking.

Quartz is the most common form of crystalline silica. In fact, it is the second most common surface material accounting for almost 12% by volume of the earth's crust. Quartz is present in many materials in the construction industry, such as brick and mortar, concrete, slate, dimensional stone (granite, sandstone), stone aggregate, tile, and sand used for blasting. Other construction materials that contain crystalline silica are asphalt filler, roofing granules, plastic composites, soils, and to a lesser extent, some wallboard joint compounds, paint, plaster, caulking and putty.

Exposure to excessive silica dust causes lung scarring and disease over time. The size of the airborne silica particles determines the amount of risk. Smaller particles can be inhaled deep

into the lungs where they can cause damage. Larger particles, such as beach sand, are not as great a concern because they are too large to inhale.



Compressed Air



Brick Cutting



Concrete Cutting

Lead

Lead is very toxic and can cause several long-term health problems. Construction workers can be exposed to lead on bridge repair work, lead paint removal on metal structures or buildings or demolition of old buildings with lead paint, or using lead solder.

The frequency and severity of medical symptoms increases with the concentration of lead in the blood. Common symptoms of acute lead poisoning are:

-) loss of appetite
-) nausea
-) vomiting
-) stomach cramps
-) constipation
-) difficulty in sleeping
-) fatigue
-) moodiness
-) headache
-) joint or muscle aches
-) anemia



Acute health poisoning from uncontrolled occupational exposures has resulted in fatalities. Chronic overexposure to lead may result in severe damage to the central nervous system and reproductive systems.

Confined Spaces

Exposure to chemicals or lack of oxygen in confined spaces can be deadly. Airborne chemicals can quickly reach dangerous levels in confined spaces that are not ventilated. Carbon monoxide, hydrogen sulfide, welding fumes and solvent vapors are typical confined space chemical hazards. In some confined spaces, oxygen deficiency will cause the person entering to instantly collapse.

Confined spaces include manholes, sewers, vaults, tanks, and boilers in new construction or in repair and maintenance work.

For more information on confined spaces, please see OSHAcademy course [713 Confined Space Program](#).



Module 1 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

1. Which of the following is the most common way chemicals can enter your body on a work site?

- a. Ingestion
- b. Inhalation
- c. Absorption
- d. Injection

2. _____ effects occur immediately following chemical exposure.

- a. Acute
- b. Chronic
- c. Immediate
- d. Various

3. Which of the following is/are symptoms of acute lead poisoning?

- a. Increased appetite
- b. Excitability
- c. Headache
- d. Diarrhea

4. In some confined spaces, _____ will cause the person entering to instantly collapse.

- a. water
- b. oxygen deficiency
- c. carbon dioxide
- d. helium

5. Solvents can cause which of the following?

- a. Make you lightheaded
- b. Make you sweaty
- c. Affect your judgment
- d. Cause death

Module 2: Physical Hazards in Construction

Physical hazards are different types of energy which may be hazardous to construction workers. They include noise, vibration, temperature extremes, and radiation.

This module will take a closer look at these hazards and how to protect yourself.

Noise Hazards

Prolonged exposure to excessive noise levels can cause noise-induced hearing loss. Noise levels above 85 decibels can cause hearing loss.

When you are exposed to excessive noise levels, the first stage is temporary hearing loss. Over time, the hearing loss becomes permanent.

Several factors influence the noise levels that workers are exposed to. For example, the type of equipment being operated, condition and maintenance of the equipment, and enclosed or partially enclosed spaces.

High noise levels can also be sporadic on construction sites. Damage to your hearing is cumulative and exposure limits are based on 8-hour averages. Workers who are not operating equipment are often also exposed to the excessive noise at the site.



Probable Noise Levels of Construction Equipment

Equipment and daily activities at construction job sites can expose workers to high levels of noise. Sound levels on the chart below are listed in decibels (dBA) – the larger the number, the higher the volume or decibel level. How loud the noise is (volume), how long the noise lasts, and how close you are to the noise are all important in determining the hazard.

The table below takes a look at the sound levels of common equipment and tools on a construction site.

Equipment or Tool	Noise Level May Exceed (decibels)
Backhoe	85
Bulldozer	87
Chopsaw	92
Grader/Scraper	107
Front End Loader	90
Jackhammer	102
Nail Gun	97
Router	90
Welding Equipment	92

Source: University of Washington Department of Environmental & Occupation Health Service- July 2005.

For more useful information on hearing conservation, please see OSHAcademy course [751 Hearing Conservation Program](#).

Whole Body Vibration

Whole-body vibration can occur from operating large mobile equipment, such as the following:

-) drillers
-) air hammers
-) pile drivers
-) tractors
-) graders
-) excavators
-) earth-moving equipment
-) other large equipment



Hand Vibration

Hand and arm vibration can result from using hand-held power tools, such as pneumatic drills and hammers, and disc grinders.

Hand-arm vibration may cause carpal tunnel syndrome. This is a disease that affects the fingers and hands. In the long run, permanent damage to the nerves will cause a loss of the sense of touch and dexterity.

Working in a cold and damp environment can also aggravate the harmful effects of hand-arm vibration.

Temperature Extremes

A change in body temperatures due to extreme work environmental conditions can lead to stress or illness from heat and cold. If not treated in time, both heat and cold stress can develop into life-threatening situations.

Heavy work in high temperatures can cause muscle cramps, dehydration, sudden collapse, and unconsciousness.

Cold temperatures can lead to fatigue, irregular breathing, confusion, and loss of consciousness (hypothermia).

The table below takes a look at some common heat and cold injuries on a construction site.



Heat Illnesses	Cold Illnesses/Injuries
Heat rash	Frost nip
Fainting	Immersion injury (trench foot)
Heat exhaustion	Frostbite
Heat stroke	Hypothermia
Heat cramps	

Hot Working Conditions

Hot working conditions can occur in a variety of different instances. For example:

-) prolonged work under direct sunlight in summer (i.e.: asphalt paving or roofing in summer)
-) wearable impermeable protective clothing when doing heavy work
-) working in an enclosed area with a strong heat source, poor ventilation, and high humidity (i.e.: heavy equipment operators in an enclosed cab without sufficient ventilation)



Cold Working Conditions

Cold working conditions can also cause problems for construction workers. For example, rain, snow, sleet and other wet and windy conditions can be unbearable for extended periods of time. Below are some other examples of cold conditions:

-) cold air temperatures
-) underground construction work
-) working over water and falling in

Radiation Exposure

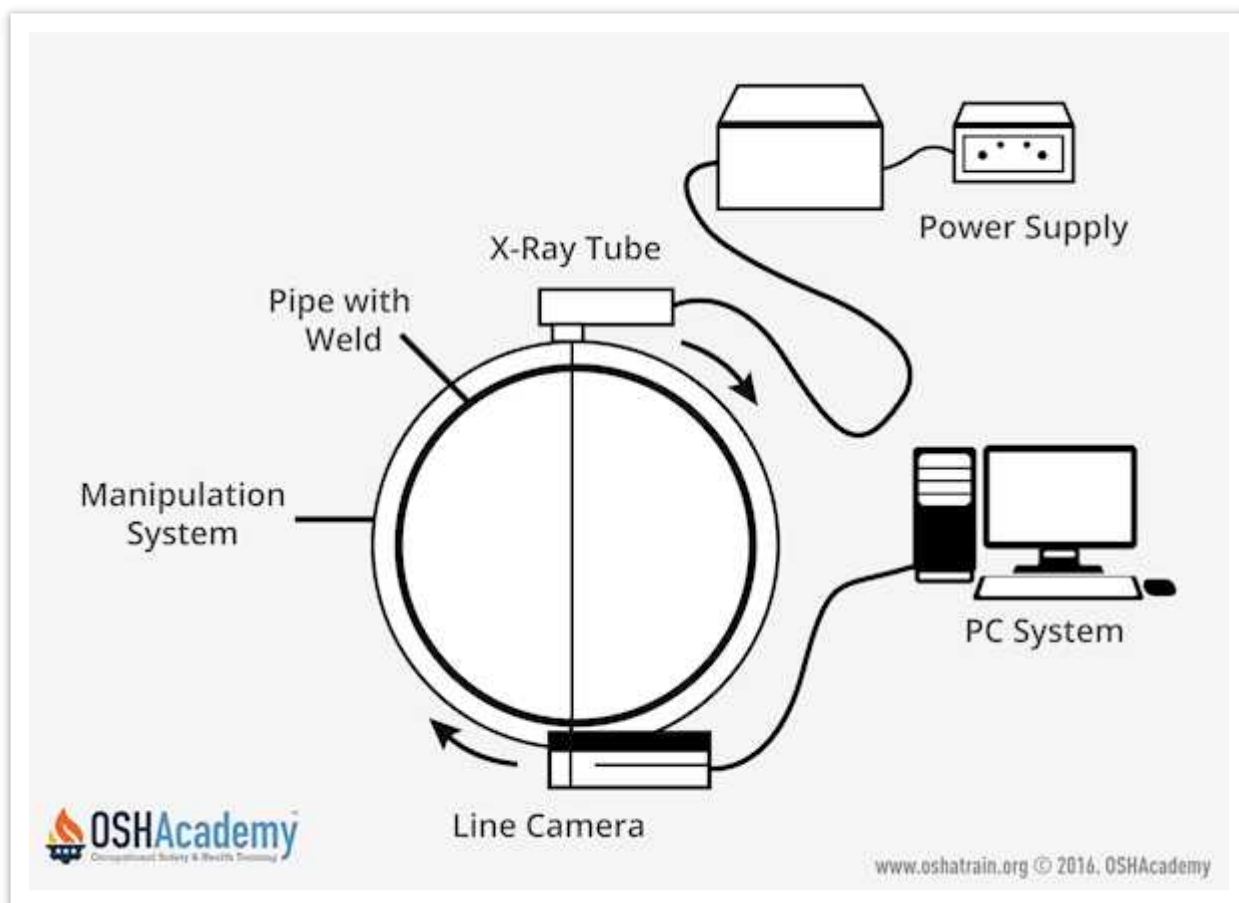
Any release of radioactive material is a potential source of radiation exposure to the population. In addition to exposure from external sources, radiation exposure can occur internally from ingesting, inhaling, injecting, or absorbing radioactive materials. Both external and internal sources may irradiate the whole body or a portion of the body.

Radiation affects people by depositing energy in body tissue, which can cause cell damage or cell death. In some cases there may be no noticeable effect. In other cases, the cell may survive but become abnormal, either temporarily or permanently. Additionally, an abnormal cell may become malignant. Both large and small doses of radiation can cause cellular damage.

The extent of the damage depends upon the total amount of energy absorbed, the time period and dose rate of the exposure, and the particular organs exposed. By damaging the genetic material (DNA) contained in the body's cells, radiation can cause cancer. Damage to genetic material in reproductive cells can cause genetic mutations that can be passed on to future generations. In rare occurrences where there is a large amount of radiation exposure, sickness or even death can occur in a limited amount of hours or days.

Ionizing Radiation

Ionizing radiation is energy in the form of waves or particles that has enough force to remove electrons from atoms. One source of radiation is the nuclei of unstable atoms. As these radioactive atoms seek to become more stable, their nuclei eject or emit particles and high-



energy waves. This process is known as radioactive decay.

Some radioactive materials, such as radium, uranium, and thorium, have existed since the formation of the earth. The radioactive gas radon is one type of radioactive material produced as these naturally-occurring radioisotopes decay. Human activities, such as the splitting of atoms in a nuclear reactor, can also create radioactive materials.

Non-Ionizing Radiation

Non-ionizing radiation refers to any type of electromagnetic radiation that does not carry enough energy to ionize atoms or molecules—that is, to completely remove an electron from an atom or molecule.

Non-ionizing radiation includes the spectrum of infrared (IR), microwave (MW), radio frequency (RF), and extremely low frequency (ELF) and ultraviolet (UV). Lasers commonly operate in the UV, visible, and IR frequencies. Non-ionizing radiation is found in a wide range of occupational

settings and can pose a considerable health risk to potentially exposed workers if not properly controlled, including skin cancer, eye damage, premature skin aging, and burns.

Module 2 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

1. Noise levels above _____ decibels can cause hearing loss.

- a. 85
- b. 50
- c. 10
- d. 75

2. When you are first exposed to excessive noise levels, what is the first problem you may experience?

- a. Deafness
- b. Temporary hearing loss
- c. Ringing in the ears
- d. Complete loss of hearing

3. _____ may cause carpal tunnel syndrome.

- a. Hand-arm vibration
- b. Full body vibration
- c. Lifting heavy objects
- d. Twisting and turning

4. Heavy work in _____ temperatures can cause muscle cramps and sudden collapse.

- a. cold
- b. high
- c. humid
- d. mild

5. A large amount of radiation exposure can cause death _____.

- a. immediately after exposure
- b. weeks after exposure
- c. in hours or days
- d. months after exposure

Module 3: Biological Health Hazards

Biological agents include bacteria, viruses, fungi (mold), other microorganisms and their associated toxins. They have the ability to adversely affect human health in a variety of ways, ranging from relatively mild, allergic reactions to serious medical conditions, even death.

These organisms are widespread in the natural environment; they are found in air, water, soil, plants, and animals. Because many microbes reproduce rapidly and require minimal resources for survival, they are a potential danger in a wide variety of occupational settings.



Pigeon droppings in an abandoned building

Exposure to Biological Hazards

Exposure to biological hazards may occur during demolition, renovation, sewer work, work on air handling systems, or other construction work from contact with contaminated or disease-carrying materials, such as:

-) soil
-) water
-) insects (mosquitoes, ticks)
-) bird or bat droppings
-) animals
-) structures

In the construction industry, biological health hazards are most commonly found:

-) working in health care facilities
-) an accumulation of animal waste and the presence of rodents, insects and birds
-) during demolition and remodeling of old structures and buildings where there is likely the presence of mold
-) during clearing operations and the removal of plants, trees and other foliage
-) landscaping

Fungi (Mold) Hazards

Fungi (mold) are found everywhere—both indoors and outdoors, all year round. The terms fungi and mold are often used interchangeably, but mold is actually a type of fungi. There are many thousands of species of mold and most, if not all, of the mold found indoors comes from outdoor sources.

Mold seems likely to grow and become a problem only when there is water damage, high humidity, or dampness. Molds are organized into three groups according to human responses: Allergenic, Pathogenic and Toxigenic.



Allergenic Molds

Allergenic molds do not usually produce life-threatening health effects and are most likely to affect those who are already allergic or asthmatic. The human system responses to allergenic molds tend to be relatively mild, depending on individual sensitivities, typically producing scratchy throats, eye and nose irritations, and rashes.

Pathogenic Molds

Pathogenic molds usually produce some type of infection. They can cause serious health effects in persons with suppressed immune systems. Healthy people can usually resist infection by these organisms regardless of dose. In some cases, high exposure may cause hypersensitivity pneumonitis (an acute response to exposure to an organism).

Toxigenic Molds

Mycotoxins can cause serious health effects in almost anybody. These agents have toxic effects ranging from short-term irritation to immuno-suppression and possibly cancer. Therefore, when toxigenic molds are found, further evaluation is recommended.

Molds Affect on the Body

Molds produce and release millions of spores small enough to be airborne. They can also produce toxicagents known as mycotoxins. Spores and mycotoxins can have negative effects on human health. The most common route of entry into the body is through inhalation; mold has a characteristic smell—if you smell mold, you could be inhaling mold. Mold is generally visible; however, some of the most toxic mold spores are small enough to be considered respirable [less than 10 micrometers (10 μm) in diameter].

Ten Things You Should Know About Mold

1. Potential health effects and symptoms associated with mold exposures include allergic reactions, asthma, and other respiratory complaints.
2. There is no practical way to eliminate all molds and mold spores in the indoor environment; the way to control indoor mold growth is to control moisture.
3. If mold is a problem in your workplace, you must clean up the mold and eliminate sources of moisture.
4. Fix the source of the water problem or leak to prevent mold growth.
5. Reduce indoor humidity (to 30-60%) to decrease mold growth.
6. Clean and dry any damp or wet building materials and furnishings to prevent mold growth.
7. Clean mold off hard surfaces with water and detergent, and dry completely.
8. Absorbent materials, such as ceiling tiles, that are moldy may need to be replaced.
9. Prevent condensation on cold surfaces by adding insulation.
10. In areas where there is a perpetual moisture problem, do not install carpeting.



Remember, molds can be found almost anywhere; they can grow on virtually any substance, providing moisture is present.

Mold Cleanup

There are several things to be aware while cleaning up mold on a construction site. Here are a few things to remember.

-) Make sure the working area is well ventilated.
-) Place mold damaged materials in a plastic bag and discard.
-) Clean mold off hard surfaces and other non-porous materials with detergent and water. Make sure you dry it completely.
-) Disinfect these cleaned surfaces with one of the following household bleach solutions:
 - o Use $\frac{1}{4}$ cup household bleach per 1 gallon of clean water for light contamination
 - o Use $1\frac{1}{2}$ cups household bleach per 1 gallon of clean water for heavy contamination.



Respiratory Protection for Exposures to Mold

Respiratory protection for exposure to mold will depend on the size of the particle and its level of toxicity. Whenever you smell or see the presence of mold, it is important to take precautions to limit your exposure to mold and mold spores. In order to limit your exposure to airborne mold, you need to wear, at a minimum, an N-95 respirator. If oil is present in the air, make sure to use either an R or a P designed filter.



Poisonous Plants

Many native and exotic plants are poisonous to humans when ingested or if there is skin contact with plant chemicals. However, the most common problems with poisonous plants arise from contact with the sap oil of several ever-present native plants that cause an allergic skin reaction—poison ivy, poison oak, and poison sumac.

Poison ivy, poison oak, and poison sumac release oil when the leaf or other plant parts are bruised, damaged, or burned. When the oil gets on the skin, an allergic reaction, referred to as contact dermatitis, occurs in most exposed people as an itchy red rash with bumps or blisters.

Plant Identification

You might have heard the old saying "Leaves of three, Let it be!" It is a helpful reminder for identifying poison ivy and oak, but not poison sumac which usually has clusters of 7-13 leaves. Even poison ivy and poison oak may have more than three leaves and their form may vary greatly depending upon the exact species encountered, the local environment, and the season. Being able to identify local varieties of these poisonous plants throughout the seasons and differentiating them from common non-poisonous look-a-likes are the major keys to avoiding exposure.

Poison Ivy

If you are working in a wooded area, you want to be on the lookout for poison ivy. Here are a few things to remember about poison ivy.

-) Eastern poison ivy is typically a hairy, ropelike vine with three shiny green (or red in the fall) leaves budding from one small stem.
-) Western poison ivy is typically a low shrub with three leaves that do not form a climbing vine. May have yellow or green flowers and white to green-yellow or amber berries.



Poison Ivy

Poison Oak

Poison oak is usually a shrub with leaves of three, similar to poison ivy. Here are some other components of poison oak:

-) Pacific poison oak may be vine-like.
-) It may have yellow or green flowers and clusters of green-yellow or white berries.



Poison Oak

Poisonous and Infectious Animals

Many different poisonous and infectious animals are found throughout the United States and workers should be aware of these health hazards before starting work in a specific location.

Rabies

Rabies is a viral disease caused by infection of the central nervous systems of wild and domestic animals and humans. The initial symptoms of human rabies resemble those of other systemic viral infections, including fever, headache and disorders of the upper respiratory and gastrointestinal tracts. Recognizing that a person has been exposed to the virus and prompt treatment are essential for preventing rabies. Once clinical symptoms have begun, there is no treatment for rabies and almost all patients will die from the disease or its complications within a few weeks of onset.



Raccoons, skunks, foxes, and coyotes are the terrestrial animals most often infected with rabies in the United States. All bites by such wildlife must be considered a possible exposure to the rabies virus.

The most sensible way to avoid contact with rodents is to prevent rodents from infesting your work site. You must also follow safety precautions if you do come across a rodent infested area.

Safe Disposal

Safe disposal of rodents and proper cleaning and disinfection of rodent-inhabited areas are keys to minimizing exposure to the virus.

The Center for Disease Control specifically recommends following these steps for safe disposal and clean-up of dead rodents and/or rodent droppings:

-) Wear rubber gloves.
-) Thoroughly spray dead rodents, traps, droppings, and contaminated areas with a general household disinfectant.
-) Place disinfectant-soaked rodents into a plastic bag and seal it. Then place it into a second plastic bag and seal. If possible, burn or bury the bag or contact your local or state health department about other appropriate disposal methods.
-) Disinfect floors, countertops and other surfaces with a general household disinfectant.
-) Before removing the gloves, wash gloved hands in disinfectant, and then in soap and water. Thoroughly wash hands with soap and water after removing the gloves.
-) Disinfect all used traps, and then set them again or replace them.
-) Eliminate possible rodent nesting sites such as junk cars, old tires and trash piles. Do not leave animal food and water in feeding dishes overnight, and keep all food in rodent-proof containers.
-) Cut grass, brush and dense shrubbery within the immediate area of buildings.

Module 3 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

1. In the construction industry, where are biological hazards usually found?

- a. On rock and masonry structures
- b. Under building foundations
- c. In a riverbed
- d. Landscaping and cleanup operations

2. Which type of molds do not usually produce life-threatening health effects?

- a. Pathogenic molds
- b. Allergenic molds
- c. Toxigenic molds
- d. Household mold

3. When cleaning up mold at a construction site, what is the correct bleach solution for light contamination?

- a. ½ cup household bleach per 2 gallons of clean water
- b. ¼ cup household bleach per 1 gallon of clean water
- c. 1 ½ cups household bleach per 1 gallon of clean water
- d. 2 cups household bleach per 1 gallon of clean water

4. What are the indications that you may be exposed to poison ivy, poison oak, or poison sumac?

- a. An itchy red rash with bumps or blisters
- b. The appearance of a chemical burn on the arm
- c. Shortness of breath and wheezing
- d. Dizziness and hallucinations

5. Once clinical symptoms have started, almost all patients will die from rabies within ____.

- a. Days of onset
- b. Hours of onset
- c. Weeks of onset
- d. Months of onset

Module 4: Ergonomic Hazards in Construction

Ergonomic hazards can cause painful and disabling injuries to joints and muscles on a construction site. According to the Occupational Safety and Health Administration (OSHA), ergonomic hazards are the most frequently occurring health hazards in construction and the cause of most injuries.

In a recent survey, 40 percent of construction workers said "working hurt" is a major problem. Working hurt reduces productivity, but continuing to work hurt can result in disabling injuries that end a career. Many laborers retire by age 55 because they just can't do the work anymore. Many can't enjoy their retirement because of their disabilities.



Ergonomics

Ergonomics means finding ways to work easier and just as productive. It means working smarter, not harder. Ergonomic changes, generally, are not expensive and can be very simple. They include:

-) planning
-) tools and equipment
-) cooperation
-) materials
-) training



Let's take a closer look at each of these components.

Planning

-) Plan the job to minimize manual handling of heavy materials. Make sure crane time is available, forklifts are used maximally and materials are delivered and stored close to where they will be used.
-) Store materials so they are accessible (e.g., not above shoulder height or at ground level) but not in the way of on-going work.
-) Make sure walkways are even and clear so carts and dollies can be easily employed.



Tools and Equipment

-) Use better, ergonomically-designed tools which may be lighter weight, require less force to operate, fit the hand better and more comfortable to use.
-) Use carts, dollies and hoists rather than your own strength to move materials.
-) Use handles when carrying loads.
-) Use protective equipment like knee pads and shoulder pads to reduce the contact stresses of kneeling or carrying materials.

Cooperation

-) Get help when needed to handle heavy loads—some companies set weight limits (like 50 pounds) above which a helper is required.
-) Organize stretching programs before work begins each day.



Materials

-) Use lighter materials, such as lighter weight block.

Training

-) Construction workers need to be trained on the proper techniques for lifting, bending, and carrying at the job site. For example:
 - o Don't twist when lifting.
 - o Keep the load close to the body. If possible, arrange for work to be done in the power zone. The power zone for lifting is close to the body, between mid-thigh and mid-chest height.
 - o Grip the load firmly with your whole hand, not just your fingers.
 - o Lift in a smooth motion and don't jerk.
 - o Use two people to handle loads heavier than about 40 to 50 pounds. If the load looks like more than you can handle, get help either from another person or by using a mechanical/moving aid.

You might want to set up a regular time, maybe during safety meetings, to talk about ergonomic issues, get ideas about improving job, and try out suggestions.

Ergonomic Injuries

Injuries can occur in several ways, such as the following.

-) heavy, frequent, or awkward lifting
-) repetitive tasks
-) awkward grips and/or postures
-) using excessive force and/or overexertion

-) using wrong tools for the job or using tools improperly
-) using improperly maintained tools
-) hand-intensive work

Musculoskeletal Disorders

Ergonomic hazards can lead to musculoskeletal disorders (MSDs) and injuries. Strains and sprains are one of the most common injuries among construction workers. Here are some other MSDs common in construction.

-) tendonitis
-) carpal tunnel syndrome
-) low back pain
-) fatigue

Work-Related MSDS

Work-related musculoskeletal disorders (WMSDs) are caused by job activities and conditions, like lifting, repetitive motions, and work in confined areas. All of these are a part of construction work. They can become long-term and disabling health problems that keep you from working and enjoying life.

Construction workers have an increased risk of these injuries in the following instances:

-) when carrying heavy loads
-) twisting hands or wrist
-) stretching to work overhead
-) using certain types of tools
-) using vibrating tools or equipment

Reducing WMSDs

The best way to reduce WMSDs is to use the principles of ergonomics to redesign tools, equipment, materials, or work processes. Simple changes can make a big difference. Using ergonomic ideas to improve tools, equipment, and jobs reduces workers' contact with factors that can result in injuries. When ergonomic changes are introduced on the job site, they should always be accompanied by worker training on how to use the new methods and equipment, as well as how to work safely to prevent injuries.

Work Fixtures and Tools

Workers should not have to use their hands or bodies as a vise to hold objects; mechanical devices do this much better. Tooling fixtures and jigs should be set up to avoid awkward postures and excessive forces.

Improper hand tool selection or improper use of tools can cause carpal tunnel disorders. (CTDs) Hand tools should fit the employee's hand; employees with small hands or who are left-handed may need tools designed specifically for these situations. Hand and wrist posture are important because they affect how much force the muscles must produce to hold objects. When selecting and purchasing hand tools, the guidelines listed below should be followed.

Select tools that allow the wrist to be held straight and that minimize twisting of the arm and wrist. Good working posture can be maintained when properly designed tools are used.

Proper Tool Selection

Select tools that allow the operator to use a power grip, not a pinch grip. Minimal muscle force is required to hold objects in a power grip posture. The pinch grip requires excessive fingertip pressure, and can lead to a CTD.

Avoid tools that put excessive pressure on any one spot of the hand (i.e., sides of fingers, palm of the hand).

For power or pneumatic tools, select tools with vibration dampening built in whenever possible. Provide personal protective equipment such as gel-padded gloves to reduce exposure to vibration.



Posture

Posture is the position of the body while performing work activities. Awkward posture is a deviation from the ideal working posture of arms at the side of the torso, elbows bent, with the wrists straight. Awkward postures typically include reaching behind, twisting, working overhead, kneeling, forward or backward bending, and squatting. If the posture is awkward during work, there is an increased risk for injury. The more the joint departs from the neutral position, the greater the likelihood of injury.



Listed below are some specific postures that may be associated with increased risk of injury:

-) Wrist flexion or extension that occurs regularly is associated with a greater risk of carpal tunnel syndrome.
-) Ulnar deviation of the wrist of greater than 20 degrees increases the risk of pain and other disease.

-) Shoulder abduction or flexion of greater than 60 degrees for more than one hour a day increases the risk of acute neck and shoulder pain.
-) Hands working at or above shoulder level can result in increased risk of tendinitis and various shoulder diseases.
-) The greater the angle of flexion of the neck, the more quickly potentially severe neck and shoulder pain results.
-) Bending at the lower back while working increases the likelihood of low back disorders.

Twisting and Force

Twisting in the middle of a lift amplifies the forces on the lower back. Imagine placing a tomato between the palms of your hands and applying direct pressure. It might take a great deal of force to burst the tomato. However, give the motion a twist while applying the pressure and it will take far less pressure to burst the tomato.

Twisting while lifting, pushing, pulling, lowering, or raising may have the same effect on the back. Consequently, twisting while taking any of these actions exposes the back to a much greater risk of injury.

For more information on general ergonomic factors in the workplace, please see OSHAcademy [Course 711 Introduction to Ergonomics](#).

Module 4 Quiz

Use this quiz to self-check your understanding of the module content. You can also go online and take this quiz within the module. The online quiz provides the correct answer once submitted.

1. What percentage of construction workers say “working hurt” is a major problem?

- a. 50%
- b. 40%
- c. 25%
- d. 15%

2. Ergonomics means working _____, not _____.

- a. harder, smarter
- b. smarter, harder
- c. easier, longer
- d. longer, easier

3. Select hand tools that allow the operator to use a _____.

- a. pinch grip
- b. power grip
- c. tough grip
- d. loose grip

4. What is one of the most common injuries among construction workers?

- a. Back injuries
- b. Sprains and strains
- c. Ankle twists
- d. Wrist pain

5. You should use two people to handle loads heavier than about _____ pounds.

- a. 40-50
- b. 20-25
- c. 10-15
- d. 75-80

Endnotes

1. Occupational Safety and Health Administration. (2014). Solutions to Control Hazards. Retrieved from: <https://www.osha.gov/SLTC/ergonomics/controlhazards.html>
2. Occupational Safety and Health Administration. (2012). Health Hazards in Construction. Retrieved from: https://www.osha.gov/dte/grant_materials/fy09/sh-19495-09/health_hazards_workbook.pdf
3. Occupational Safety and Health Administration. (2010). Strains, Sprains, and Material Handling Safety Tips for Employers. Retrieved from: http://www.workzonesafety.org/files/documents/training/toolbox_talks/osha_alliance/strain_sprain_tips.pdf
4. Washington State Department of Labor & Industries. (2011). Health Hazards in Construction. Retrieved from: <http://wisha.training.lni.wa.gov/training/presentations/HealthHaz.pps>