MODULE DESCRIPTION
This training module is to help you recognize and avoid potential health hazards in your work environment.

OBJECTIVES
After completing this module, students will be able to:

- List the four types of health hazards on construction sites.
- Distinguish between acute and chronic hazard exposure and illnesses.
- Describe the characteristics and effects of various chemical hazards.
- Describe the characteristics and effects of various physical hazards.
- Describe the characteristics and effects of various biological hazards.
- Describe the characteristics and effects of various ergonomic hazards.

MODULE OUTLINE
1. Introduction
   - Constantly changing job site environments and conditions
   - Multiple contractors and subcontractors
   - High turnover
   - High number of unskilled laborers
   - Ever-changing relationships with other work groups
   - Variety of work activities occurring simultaneously
   - Exposure to health hazards from own work as well as from nearby activities, known as bystander exposure

2. Types of Hazards
   **Chemical Hazard**- Can be present in dust, fumes, liquids, solids, mists, vapors, or gases of products used at a site or released during a construction job. Asbestos, silica, lead, carbon monoxide, spray paint, solvents, and welding fumes are examples of such hazards. They can be absorbed by touch, inhaled, or ingested.

   **Physical Hazard**- The most commonly thought of hazards for construction. This hazard includes radiation, extreme temperatures, noise, and vibration.

   **Biological Hazards**- Microorganisms, such as bacteria, fungus, mold, or viruses that can cause illness and may be present in soil, water, animal waste, insects, and structures.
**Ergonomic Hazard** - May cause the most injuries in the construction field. These hazards can lead to injuries to the joints or muscles by way of heavy, frequent lifting, repetitive tasks, irregular gripping and postures, intense work, and using tools improperly.

3. Types of Health Hazards (continued)

**Brickmasons** - Cement dermatitis, awkward postures, heavy loads
- Drywall installers - Plaster dust, heavy loads, awkward postures
- Electricians - Heavy metals in solder fumes, awkward posture, heavy loads, asbestos
- Painters - Solvent vapors, toxic metals in pigments, paint additives
- Pipefitters - Lead fumes and particles, welding fumes, asbestos dust
- Carpet layers - Knee trauma, awkward postures, glue and glue vapor
- Insulation workers - Asbestos, synthetic fibers, awkward postures
- Roofers - Roofing tar, heat
- Carpenters - Noise, awkward postures, repetitive motion drillers, earth, rock - Silica dust, whole-body vibration, noise
- Excavating machine operators - Silica dust, histoplasmosis, whole-body vibration, heat stress, noise
- Hazardous waste workers - Heat stress, toxic chemicals

4. Types of Exposure and Their Effects

**Acute** - Short term period between exposure and the onset of symptoms. Usually a one time or few times event that is also usually unexpected. Determination of exposure is almost always after the fact. An example of this type of exposure is a worker getting a headache and collapsing or dying from high levels of carbon monoxide.

**Chronic** - Long time period between exposure to an agent and the onset of symptoms. Usually ongoing or continuing for at least three months. Determining length of exposure, which factors into overall exposure, is more complex because it depends on memory or other records and their accuracy. An example of this type of exposure is a worker getting lung cancer from exposure to asbestos.

2. **Hot Work: Hidden Dangers (Part 1)**
- Most chemicals used in the workplace have some hazard potential. This includes both process chemicals and cleaning chemicals. Employees have a need and legal right to know the hazards and identities of the chemicals to which they are exposed. While employers have a responsibility to:
  - Identify the potential hazards of chemicals.
  - Train their employees.
  - Provide proper personal protective equipment.

  Hot work is any process that can be a source of ignition when flammable materials or chemicals are present or can be a fire hazard regardless of the presence of flammable material in the workplace. Common hot work processes are welding, soldering, cutting, and brazing.

3. **Understanding Chemical Hazards**
- Chemicals exist in many products workers use at construction sites and are generated during construction activities. Some common chemical hazards in construction include:
Asbestos  
Lead  
Silica  
Cadmium  
Carbon monoxide  
Welding fumes  
Spray Paints  
Cutting oil mists  
Solvents  
Hexavalent chromium  

Chemicals at work sites can cause headaches, eye irritation, dizziness, faintness, drowsiness, and affect judgment and coordination. They can also lead to severe health disorders, such as poisoning, asphyxiation, and cancer. Other injuries may include:  
- Severe burns  
- Disfigurement  
- Internal Organ Damage  
- Neurological Injury  
- Birth Defects  
- Respiratory problems  

- The dynamic nature of constantly changing construction sites brings many challenges, none as perilous as exposure to hazardous chemicals. These chemical hazards can be in the form of  
  - Dust  
  - Fumes  
  - Gases  
  - Vapors  
  - Fibers (solids)  
  - Liquids  
  - Mists  

- A chemical can cause injury in different ways depending on its form and how it enters a person's body.  
  - Inhalation - Breathing chemicals in is typically the most common way they enter the body in a work situation  
    - Ingestion - Accidental swallowing through eating, drinking, or smoking  
    - Absorption - Through contact with eyes or skin  

4. Hot Work: Hidden Dangers (Part 2)  
Chemicals have the ability to react when exposed to other chemicals or certain physical conditions. When chemical reactions are not properly managed, they can have harmful or even catastrophic consequences, such as toxic fumes, fires, and explosions. These reactions may result in death and injury to people, damage to physical property, and severe effects on the environment.  

5. Common Chemical Hazards  
The most common chemical hazards in construction are solvents and flammables. Solvents are substances, usually liquid, that dissolve other substances. Flammables are common chemicals. They are liquids and gases that burn, release vapors, or even explode under what seem to be safe conditions.
Construction workers use various solvents with different degrees of toxicity, such as paints, glues, epoxies and other products. Workers increase the possibility of exposure to excessive amounts of solvent vapors when handling solvents in enclosed or confined spaces. Exposure to solvent vapors can lead to:
- Irritation of the eyes, nose and throat
- Skin irritation
- Dizziness, drowsiness, headaches, and blackouts
- Affected judgment or coordination
- Damage to internal organs

6. Exposure to Chemicals from Construction Activities
In addition to the hazard from solvent and flammable chemicals, various construction activities and processes pose a great risk to workers from the materials involved and by-products they produce, such as:
- Asbestos
- Silica
- Lead
- Working in confined spaces

7. Dangers of Working with 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
- Acoustical products

Because very few asbestos-containing products are being installed today, most worker exposures occur during the removal of asbestos and the renovation and maintenance of buildings and structures containing asbestos, generally, those built before 1980. Asbestos fibers enter the body when a person inhales or ingests airborne particles that become embedded in the tissues of the respiratory or digestive systems. Exposure to asbestos can cause disabling or fatal diseases, whose symptoms generally do not appear for 20 or more years after initial exposure. These diseases include:
- Asbestosis, an emphysema-like condition
- Mesothelioma, a cancerous tumor that spreads rapidly in the cells of membranes covering the lungs and body organs
- Lung cancer
- Gastrointestinal cancer

According to the Occupational Safety and Health Administration (OSHA), employers must ensure that no employee is exposed to an airborne concentration of asbestos in excess of:
0.1 fiber per cubic centimeter as an 8-hour time-weighted average (TWA)
1 fiber per cubic centimeter as averaged over a sampling period of 30 minutes

To help ensure the safety and health of workers around asbestos, employers must:
- Assess all asbestos operations for the potential to generate airborne fibers.
- Use exposure monitoring data to assess employee exposures.
- Designate a competent person to identify asbestos hazards in the workplace and correct them when found.

8. Dangers of Working with Silica

Crystalline silica is a basic component of soil, sand, granite, and many other minerals whose particles can be inhaled by workers chipping, cutting, drilling, or grinding objects that contain silica. There are three types of crystalline silica:
- Quartz is the most common form of crystalline silica
- Cristobalite
- Tridymite

Dust Types

- **Respirable** - Fine dust that workers inhale deeply into the lungs where it causes the most damage
- **Coarse** - Caught in the nose and throat before reaching the lungs

Crystalline silica is classified as a human lung carcinogen that, when inhaled, can cause silicosis, which can be disabling, or even fatal. Respirable silica dust enters the lungs and causes the formation of scar tissue, thus reducing the lungs ability to take in oxygen. Because the effects of silica are irreversible, it is considered a serious health hazard on many construction sites.

The legal limit for silica in the air is 100 micrograms per cubic meter. A general rule of thumb is that if you can see dust containing silica in the air, it is almost always over the permissible limit.

To help ensure you StartSafe and StaySafe when working around silica dust, you should:
- Be aware that smoking increases the damage from crystalline silica.
- Know the work operations where exposure to crystalline silica may occur.
- Participate in any air monitoring or training programs offered by an employer.
- Wear a respirator approved for protection against crystalline silica-containing dust, when necessary.
- Use Type CE positive pressure abrasive blasting respirators when sandblasting.
- Change into disposable or washable work clothes at the work site, if possible.
- Shower and change into clean clothing before leaving the work site, if possible.
- Avoid eating, drinking, using tobacco products, or applying cosmetics in areas crystalline silica dust.
- Wash hands and face before eating, drinking, smoking, or applying cosmetics outside of the exposure area.

9. Dangers of Working with Lead
Lead has been poisoning workers for thousands of years and is most commonly absorbed into the body by inhalation. When workers breathe in lead as a dust, fume, or mist, their lungs and upper respiratory tract absorb it into the body. They can also absorb lead through the digestive system if it enters the mouth and is ingested.

When absorbed into the body in high enough doses, lead can be toxic. Lead can damage the central nervous system, cardiovascular system, reproductive system, hematological system, and kidneys. In addition, workers lead exposure can harm their children's development.

There are two types of lead exposure:

- **Short-term (acute) overexposure**, as short as days, can cause acute encephalopathy, a condition affecting the brain that develops quickly into seizures, coma, and death from cardio-respiratory arrest. Short-term occupational exposures of this type are highly unusual but not impossible.

- **Long-term (chronic) overexposure** can result in severe damage to the central nervous system, particularly the brain. It can also damage the blood-forming, urinary, and reproductive systems. There is no sharp dividing line between rapidly developing acute effects of lead and chronic effects that take longer to develop.

Because lead is a cumulative and persistent toxic substance and health effects may result from exposure over prolonged periods, employers must take precautions to minimize employee exposure to lead. Employers of construction workers exposed to lead above the PEL are responsible for developing and implementing a worker protection program that includes:

- Hazard determination, including exposure assessment
- Medical surveillance and provisions for medical removal
- Job-specific compliance programs
- Engineering and work practice controls
- Respiratory protection
- Protective clothing and equipment
- Housekeeping
- Hygiene facilities and practices
- Signs
- Employee information and training
- Recordkeeping

### 10. Dangers of Working in Confined Spaces

OSHA uses the term "permit-required confined space" (permit space) to describe a confined space with one or more of the following characteristics:

- Contains or has the potential to contain a hazardous atmosphere
- Contains a material with the potential to engulf an entrant
- Has walls that converge inward or floors that slope downward and taper into a smaller area which could trap or asphyxiate an entrant
- Contains any other recognized safety or health hazard, such as unguarded machinery, exposed live wires, or heat stress

Airborne chemicals can quickly reach dangerous levels in unventilated confined spaces. Typical chemical hazards in confined spaces include:

- Carbon monoxide
- Hydrogen sulfide
- Welding fumes
Solvent vapors
Welding in confined spaces or on stainless steel, which generates hexavalent chromium, are the most hazardous welding activities. Welding fumes contain a variety of chemicals depending on what is being welded on and the chemical makeup of the welding rods, fluxes, and shielding gases.

11. Recognizing Physical Hazards
To learn more about common physical hazards in construction, review the terms and images below.

**Noise** - Prolonged exposure to noise levels above 85 decibels can cause noise-induced temporary and permanent hearing loss. High noise levels can be sporadic in construction. Damage to hearing is cumulative and PELs are based on 8-hour averages. Workers not using or operating equipment are often exposed to excessive noise as much as the operators.

**Vibration** - Whole-body vibration occurs from operating large mobile equipment, such as drillers, air hammers, pile drivers, earth-moving equipment, and other large machinery. Hand-arm vibration can result from using hand-held power tools, such as pneumatic drills and hammers. Hand-arm vibration may cause carpal tunnel syndrome, a disease that affects the fingers and hands. In the long term, permanent damages to the nerves result in a loss of the sense of touch and dexterity.

**Temperature Extremes** - Changes in body temperature due to extreme work conditions can lead to stress or illness from heat or cold. If left untreated, stress from heat or cold can lead to life-threatening situations, such as dehydration, sudden collapse, unconsciousness, irregular breathing, or hypothermia.

**Radiation Exposure** - Prolonged exposure to ionizing radiation from X-rays and gamma rays from different construction equipment can lead to an increased risk of developing cancer and genetic diseases. Exposure to non-ionizing radiation, such as ultraviolet light, infrared radiation, radio waves, and lasers, can result in skin cancer, eye damage, premature skin aging, and burns.

12. Recognizing Biological Hazards
Various biological hazards may be present on a construction site, any of which can lead to disease if precautions are not taken to reduce the risks. Some of these diseases can be serious or fatal. Not all sites have biological hazards. However, those where groundwork, refurbishment, or demolition work is taking place are more likely to be affected. To learn more about common hazards with the potential for exposure to biological hazards, review the terms and images below.

**Bird Droppings** - Inhalation of dust or water droplets containing contaminated bird droppings can lead to several diseases, including Psittacosis, which is a flu-like illness that can lead to pneumonia.

**Discarded Needles** - Needlestick injuries from discarded needles used for recreational drug use can lead to exposure to bloodborne viruses, including Hepatitis B and C and HIV.

**Rats** - Exposure to rat urine or water contaminated with it can cause Leptospirosis or Weil's disease if it enters a cut or gets into the eyes, nose, or mouth.

**Sewage Contamination** - Contamination of the site with sewage or animal feces can lead to infection with E. coli or Hepatitis A.
**Stagnant Water** - Water systems that are not drained or disinfected can contain stagnant water which may have bacteria. If workers inhale fine droplets contaminated with the bacteria they can contract Legionnaires disease.

13. Recognizing Ergonomic Hazards

Ergonomic hazards are the most frequently occurring health hazards in construction and the cause of most injuries. Common examples of ergonomic risk factors are found in jobs that require:

- Repetitive, forceful, or prolonged exertions of the hands
- Frequent or heavy lifting, pushing, pulling, or carrying of heavy objects
- Prolonged awkward postures
- Exposure to vibration and cold which may add risk to these work conditions

Jobs or working conditions presenting multiple risk factors have a higher probability of causing an MSD. The level of risk depends on the intensity, frequency, and duration of the exposure to these conditions.

Ergonomic hazards can lead to MSDs and injuries, such as:

- Strains and sprains
- Tendonitis
- Carpal tunnel syndrome
- Low back pain
- Fatigue

The purpose of this training module was to help you recognize and avoid potential health hazards in your work environment.

You should now be able to:

- List the four types of health hazards on construction sites.
- Distinguish between acute and chronic hazard exposure and illnesses.
- Describe the characteristics and effects of various chemical hazards.
- Describe the characteristics and effects of various physical hazards.
- Describe the characteristics and effects of various biological hazards.
- Describe the characteristics and effects of various ergonomic hazards.