Occupational Health and Environmental Controls

Module Purpose

The purpose of this module is to explain occupational health and environmental controls that impact site activities. It includes processes for anticipating, recognizing, evaluating, and controlling road construction-related health hazards. The module contains an overview of 29 CFR Part 1926, Subpart D, Occupational Health and Environmental Controls, with emphasis on OSHA's Hazard Communication standard (HazCom).

Time

60 minutes (2:30 - 3:30 p.m.)
(A 10-minute break follows this module)

Objectives

Show slides 11.1 – 11.3.

Upon completion of this module, participants will be able to:

- Explain the short- and long-term effects on the human body resulting from exposure to hazards materials
- Identify measures for preventing, controlling, and abating exposures to chemical hazards
- Recognize processes for evaluating and controlling lead and silica exposure on the job site
- Utilize a process for anticipating, recognizing, evaluating, and controlling road construction-related health hazards
- Recognize other types of health hazards that may exist on the job site, such as noise

	▪ Recognize occupational health and environmental controls from Subpart D that impact roadway construction site activities ▪ Recognize the key elements of a Hazard Communication (HazCom) program ▪ Recognize the general requirements of relevant OSHA standards
Materials and Resources	PowerPoint Slides: Module 11 Activity: Appendix 11-A HazCom Checklist: Appendix 11-B

Module 11: Occupational Health and Environmental Controls
Instructional Strategy and Course Content

Instructor Notes	Lesson
Lecture  1. How do chemicals affect the human body?	**1. How do chemicals affect the human body?** Some work place chemicals and substances can create adverse health effects when workers are exposed to them, leaving both *short-* and *long*-term problems. Short-term problems may go away once the worker is removed from the harmful substance. Long-term effects involve serious health problems that may lead to death.
2. What are the typical short-term effects? *Show slides 11.4 – 11.5.* 	**2. What are typical short-term effects?** Short term health effects can include, but are not limited to problems that: ▪ Develop soon after exposure ▪ Usually last a short time ▪ Serve as a warning sign of overexposure ▪ Vary, depending on the type of chemical ***Typical examples include:*** ▪ Coughing ▪ Skin and eye irritation ▪ "Drunk" feeling ▪ Irritation of nose, throat & lungs ▪ Impaired senses
3. What are typical long-term effects? *Show Slides 11.6 – 11.7.* 	**3. What are typical long-term effects?** Unlike short term affects, health problems resulting from some exposures may: ▪ Take time to appear, sometimes years ▪ Are often the result of low levels of chemical exposure over extended time periods ▪ Are sometimes not easy to identify as chemical-related ***Typical examples include:*** ▪ Damage to major organs: brain, liver, kidneys, heart, lungs ▪ Damage to the blood and the nervous system ▪ Cancer ▪ Death
4. How do you prevent, control, or abate the chemical hazards? Show slides 11.8 – 11.13. 	**4. When contact with hazardous chemicals is unavoidable, how do you prevent, control, or abate the chemical hazards?** Preventing, controlling and/or abating health hazards may be achieved through administrative/engineering controls, information, training, maintenance and housekeeping, and use of protective clothing and personal protective equipment.

Instructor Notes

Lesson

Administrative /Engineering Controls—
- Enclose the process or isolate the worker
- Provide proper ventilation in confined spaces
- Provide eyewash stations & deluge showers

Information—
- Label hazardous materials
- Provide easy access to Material Safety Data Sheets (MSDSs)

Training—
- Inform workers of the health effects of exposure to hazardous chemicals
- Teach workers safe handling procedures and work practices, particularly those listed on MSDSs
- Comply with the OSHA Hazard Communication training requirements under 1926.21 & 1926.59

Maintenance & Housekeeping—
- Store chemicals in proper containers
- Handle chemical spills properly
  - — mark the location
  - — leave the area
  - — prevent others from entering the area
  - — have a trained worker respond to the spill as soon as possible
- Properly store & dispose of chemical wastes
- Provide wash-up facilities for workers

PPE & Clothing—
- Require the use of gloves & clothing designed to protect against chemical hazards to which workers are exposed
- Provide barrier creams
- Require the use of face shields, safety goggles or goggles
- Have respirators available for those workers who are capable of wearing them: get proper type, make sure they fit properly, provide employees training on their use & oversee employee use

5. What are the major health risks commonly faced by highway construction workers? *Show Slide 11.14.*

5. What are the major health hazards commonly faced by highway construction workers?
While there are various substances that can adversely affect road construction workers, two of the most common substances are *silica* and *lead*.

6. What are silica and silicosis? *Show Slides 11.15 – 11.16*

6. What are silica and silicosis?
Silica is a common mineral found in most forms of sand, rock and concrete. One form of silica, *Crystalline*, has been determined to be most hazardous to human health. Silicosis is the disease that is caused by overexposure to certain types of silica.

Instructor Notes	Lesson
	Silicosis first received widespread public attention in 1936 when as many as 1,500 men died near the town of Gauley Bridge, West Virginia, as a result of breathing in silica dust. The incident has been called "America's worst industrial disaster." These men were asked to tunnel through a mountain of almost pure silica, even though the health effects of silica exposure had been documented for decades. In this element of extreme risk, no safety precautions were taken. Nearly six decades after the catastrophic happenings at Gauley Bridge, OSHA estimates two million American workers remain at risk for developing silicosis.
7. Which work operations are most dangerous? *Show slides 11.17 – 11.21.* 	**7. Which work operations are most dangerous?** Workers who drill into rock, blast, or cut material containing silica, or remove silica-containing debris, are at risk for developing silicosis. Silica is the most abundant mineral on the earth's surface; consequently, there is a high probability of exposure. Silicosis has been diagnosed in rock drillers employed in caisson construction, metal mining, slate and rock quarries, tunnel construction, and highway and dam construction. Drilling, cutting and blasting processes can create large quantities of silica dust. During these operations, the silica present in the rock or concrete is fractured into very fine particles that can then be inhaled by the worker. The smallest particles, once inhaled, deposit deep in the lungs, where they can cause severe damage. Once silica particles enter the lungs and become trapped, the lung tissue scars and forms nodules. As the condition worsens, the nodules become progressively larger. The nodules make breathing increasingly difficult, and eventually the worker may die of respiratory failure. The symptoms of silicosis include shortness of breath, cough, and difficulty in breathing with physical exertion. Because of the common nature of these symptoms, the disease is frequently misdiagnosed or proceeds undetected. The disease is diagnosed on the basis of its symptoms in conjunction with work history and X-ray assessments of dust-induced lung damage.
8. How can roadway construction workers be protected from silica overexposure? *Show slides 11.22 - 24.* 	**8. How can roadway construction workers be protected from silica overexposure?** NIOSH recommends the following measures to reduce crystalline silica exposures and prevent silicosis and silicosis-related deaths: ▪ Before drilling, cutting or blasting begins, assess the material for potential worker exposure to crystalline silica. ▪ Use control measures, such as wet cutting/drilling and exhaust ventilation, to minimize exposures.

Instructor Notes	Lesson
	▪ Conduct air monitoring to measure worker exposures.
	▪ Provide workers with training that includes information about health effects, work practices, and protective equipment for crystalline silica.
	▪ Practice good personal hygiene to avoid unnecessary exposure to silica dust.
	▪ Wear washable or disposable protective clothes at the work site.
	▪ Shower and change into clean clothes before leaving the work site to prevent contamination of cars, homes, and other work areas.
Show slide 11.25. 	▪ Use respiratory protection when source controls cannot keep silica exposures below the NIOSH recommended exposure limit (REL).
	▪ Provide periodic medical examinations for all workers who may be exposed to crystalline silica.
	▪ Post signs to warn workers about the hazard and to inform them about required protective equipment.

Silica Damage

Healthy Lung

Close-up of Fine Air-Borne Silica

Silicosis Diseased Lung

Instructor Notes	Lesson
9. Where do roadway construction workers get overexposed to lead? *Show slides 11.26 – 11.28.* 	**9. Where do roadway construction workers get overexposed to lead?** Each year, 58,000 persons work in bridge, tunnel, and elevated highway construction and demolition jobs. In the U.S., approximately 90,000 bridges are coated with paint containing lead, creating the potential for dangerously high worker lead exposure. Overexposure to lead is commonly encountered in: ▪ Torch cutting on bridge structures that are finished with lead containing paints/coatings ▪ Scraping or abrasive blasting to remove lead paint/coatings from bridges Lead may be released as dust or fumes by doing the following types of work where lead products are present: ▪ Soldering ▪ Grinding ▪ Welding ▪ Abrasive blasting ▪ Torch burning
10. Why is lead dangerous? *Show slide 11.29.* 	**10. Why is lead dangerous?** Lead presents a severe hazard since it is readily absorbed and distributed throughout the body and accumulates in the body, especially in the bones. It can also be inhaled as well as ingested.
11. How can workers be protected? *Show slides 11.30 – 11.31.* 	**11. How can workers be protected?** When conducting work operations that may expose workers to lead, a system must be implement that includes: ▪ Exposure assessment ▪ Engineering and workplace controls ▪ PPE ***Key Elements of a Lead Program—*** ▪ Frequent and regular inspection of the job site, materials, and equipment by a "Competent Person" ▪ Housekeeping and hygiene ▪ Medical surveillance (and provisions for medical removal) ▪ Training Part 1926.62 of the OSHA standards contains the following provisions: ▪ The maximum limits of exposure (PEL) ▪ Exposure monitoring and medical surveillance ▪ Information and Training ▪ Prescribes Methods of Compliance

Instructor Notes	Lesson
12. What type of training should workers receive? *Show slide 11.32.* 	**12. What type of training should workers receive?** In accordance with 1926.21, workers should receive training that includes the following: ▪ Information about the potential adverse health effects of lead exposure. ▪ Information about the early recognition of lead intoxication. ▪ Information in material safety data sheets for new paints or coatings that contain lead or other hazardous materials (1926.59) ▪ Instruction about heeding signs that mark the boundaries of lead-contaminated work areas. ▪ Discussion of the importance of personal hygiene practices in reducing lead exposure.
13. Are overexposures to hazardous substances the only health concerns for roadway construction workers? *Show slides 11.33 – 11.38.* 	**13. Are overexposures to hazardous substances the only health concerns for roadway construction workers?** ***Noise***—As in all construction operations, noise is a common hazard on road construction sites. Road construction operations are compounded, however, by the addition of traffic noise to that of construction equipment and vehicles. The danger of noise is two-fold. It is dangerous because it can hide sounds, such as back-up alarms, that may warn of impending danger. Nevertheless, for the purposes of this module, noise hazards are discussed as a health hazard leading hearing loss. The standard for noise exposure set by OSHA is *a time-weighted-average* of 90 dBA over an 8-hour day. *Impact noise* which occurs over a much shorter time frame (sometimes instantaneous, 15 minute dose) is also a serious problem in construction Heavy equipment (pavers, concrete saws, power tools, compressors, and generators) creates high sound levels throughout highway construction operations. OSHA's 1926.52: Noise Exposure, addresses: ▪ Overexposures ▪ Feasible administrative & engineering controls ▪ PPE (ear protective devices) ▪ A Hearing Conservation Program

Instructor Notes	Lesson
	Hazard Communication—OSHA has estimated that more than 32 million workers are exposed to 650,000 hazardous chemical products in more than 3 million American workplaces. The basic goal of a Hazard Communication program is to ensure employers and employees know about work hazards, and how to protect themselves. An effective HazCom program will help to reduce the incidence of chemical source illness and injuries. A written HazCom program ensures that: ▪ All employers receive the information they need to inform and train their employees properly and to design and put in place employee protection programs ▪ Provides necessary hazard information to employees so they can participate in, and support, the protective job site measures
14. What are the elements of an effective HazCom Program? *Show slides 11.39 – 11.45.*	**14. What are the elements of an effective HazCom program? (*See Checklist, Appendix 11-B*)** The employer's HazCom program must include: ▪ Provisions for container labeling, collection and availability of material safety data sheets, and an employee training program. ▪ A list of the hazardous chemicals, the means the employer will use to inform employees of the hazards of non-routine tasks (such as the cleaning of reactor vessels), and the hazards associated with chemicals in unlabeled pipes.
 **Group Activity**  15. Communications Exercise: *Slide 11.46; see Appendix 11-A*	▪ If the workplace has multiple employers onsite (as most road construction sites), the rule requires these employers to ensure that information regarding hazards and protective measures be made available to the other employers onsite, where appropriate. ▪ In addition, all covered employers must have a written hazard communication program to get hazard information to their employees through labels on containers, MSDSs, and training. **15. Group Activity—Communications Activity**
16. Are the products used in road construction dangerous? *See slide 11.47.*	**16. Are the products used in road construction dangerous?** Workers should be trained to recognize the physical hazards related to asphalt and concrete. **Asphalt hazards** may include burns, particles, and fumes. **Concrete hazards** include chemical burns and splashing wet concrete (in eyes).

Instructor Notes

Group Activity

Question and Answer: Using a flipchart or white board, lead a group discussion with participants concerning health hazards in roadway construction. *Slide 11.48.*

17. What other health issues should be taken into consideration for roadway construction? *Show slide 11.49.*

18. Elicit additional questions and summarize. *Slide 11.50.*

19. Transition to prepare participants for conclusion.

Lesson

Such hazards can be prevented, controlled or abated by:

- Providing a water source to flush skin & eyes
- Providing supplies for treating burns (water, gel, fire blankets or pads)
- Providing proper PPE (gloves & rubber boots, face shields, safety glasses/goggles)
- Providing training & information (warning labels, MSDSs)

17. What other health issues should be taken into consideration for roadway construction?

Emergency Action Plan—Employers must have an emergency action plan in place that is specific to highway construction operations. This plan must include site-specific information for contacting applicable hospitals, emergency medical services, fire departments, utility companies, and company officers and safety personnel. Consult OSHA's 1926.35 standard for more information in developing an emergency action plan

First Aid—Each worker should have immediate access to first aid materials, commensurate with the hazards he/she will encounter while performing their duties. The products contained in the kit should reflect the proximity (or remoteness) of off-site medical facilities and the amount of time that will be required for EMS services to arrive at the site.

Sanitation and Hygiene—Road construction often takes place in remote areas where access to commodes and potable water is not available. While specific OSHA standards may not require employers to provide adequate, gender-sensitive facilities for sanitation and hygiene, it should be incumbent upon employers to ensure that all workers have access to clean restrooms, and a means to wash their hands after using them, and before eating.

18. Question and summary period.

19. Transition to Conclusion.

Effective Communications

Objective: This activity is designed to emphasize the importance, and difficulties, of effective communications in a multi-employer environment. (This is the principle behind the HazCom standard, and all safety and health program activities.) The goal of the exercise is to help participants understand that effective communications take planning, clarity, and development of a common basis of understanding.

Materials:
- Two screens (cardboard)
- Two sets of identical "Lego-type" assembly blocks (10 multi-colored blocks per set)
- Awards (candy bars, stickers, pens, etc.)
- Four members per team
  - *Looker*
  - *Listener*
  - *Communicator*
  - *Builder*

  and
  - *Judge (generally course instructor)*

Time: 12 minutes

Activity: Using ***verbal*** communications, participants will convey instructions to build identical block units. "*Looker*" and "*Builder*" will sit at opposite ends of a long table (or two, separated tables.) Screens will hide *Looker* and *Builder* from each other. *Looker* will hold a pre-assembled unit of blocks of various colors in an abstract pattern. *Builder* will possess an identical assortment of unassembled blocks.

Without looking over the screen, *Looker* will quietly describe his unit to *Listener*. (*Listener* may ***not*** take notes.) After receiving instructions, *Listener* will walk to a halfway-point between *Looker* and *Builder* and convey the description to *Communicator*. *Communicator* will then walk to *Builder* and provide him/her with the description. *Builder* will attempt to follow *Communicator's* instructions to build a unit identical to Lookers. (*Communicator* may not look at *Builder's* work.) Listener and Communicator may convey questions, answers, instructions, etc. as often as they wish.

Looker may only communicate with *Listener*.
Listener may only communicate with *Looker* and *Communicator*.
Communicator may only communicate with *Listener* and *Builder*.
Builder may only communicate with *Communicator*.

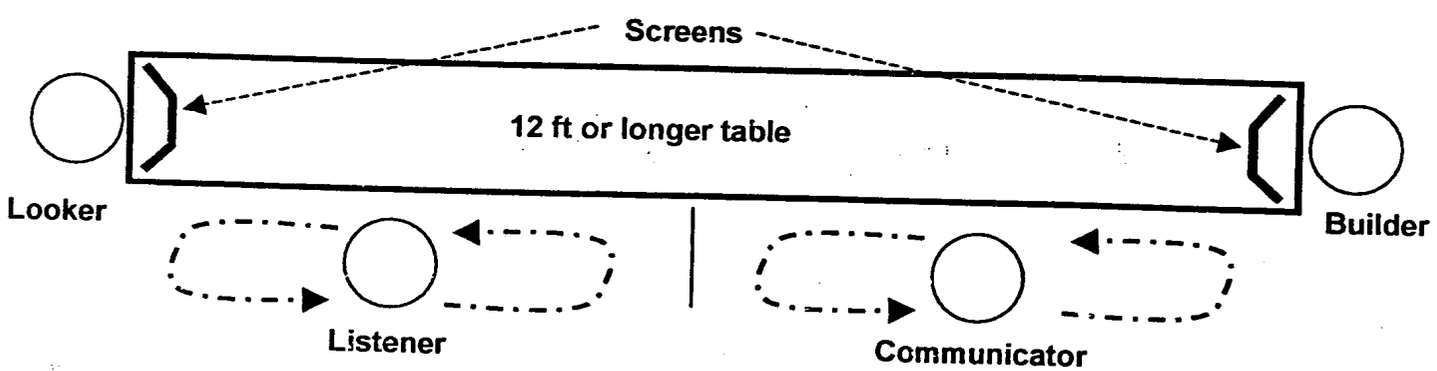
The class should be divided into teams to compete in finishing the unit. If a team believes that they have successfully completed the unit before time runs out, they may summon Judge (generally the instructor) to evaluate their work.

Instructor should be prepared to "reward" the winning team.

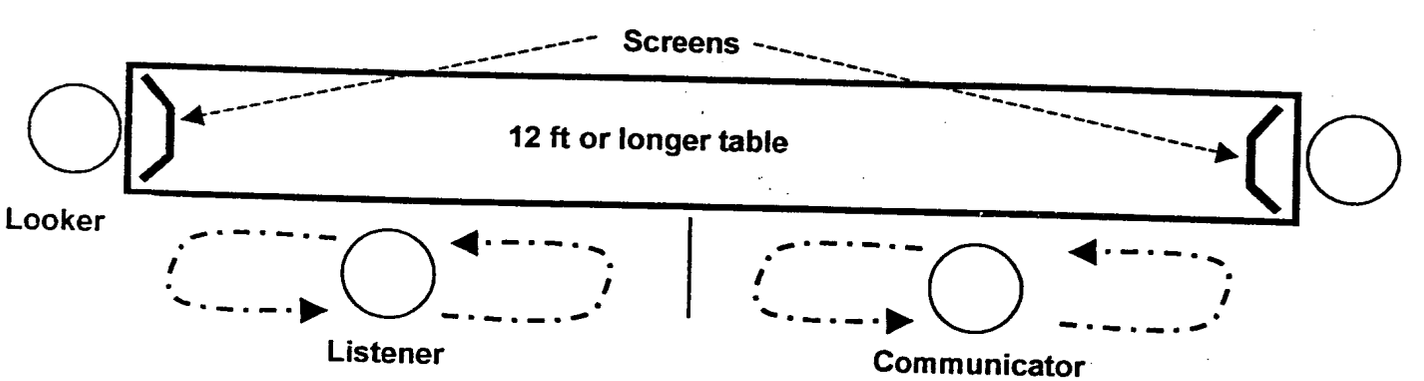
Important points to identify are:

- Communications is difficult, even for simple matters, if all team members do not have a common reference point
- Instructions may be lost, changed between multiple team members (multiple employers)
- Successful communication takes team work
- To communicate effectively, the team must create a plan.

Activity Diagram



Team One



Team Two

Teams Three, Four, etc.

Communications Activity Instructions

To be copied and provide to each team member.

Looker – You will be provided with an assembled unit of Lego-type building blocks. You must not let anyone else on your team see the unit. You will attempt to convey instructions to Builder so that he/she can assemble an identical unit. You may only communicate directly with Listener. Other team members should not hear your communications with Listener. *Only verbal communications are allowed.*

Listener – Without looking at the unit held by Looker, you will listen to instructions and descriptions given by Looker about his unit in an attempt to convey information to Builder to assemble an identical unit. You may only have **verbal** communications with Looker and Communicator. You cannot talk directly to Builder and should not hear his discussions with Communicator. You are only a conduit for information. You may convey as much information, and as many questions as you like during the time period.

Communicator – You will listen to instructions provided to you by Listener and convey those instructions directly to Builder in an attempt to assist Builder assemble a unit of blocks identical to the unit possessed by Looker. You may not look at the units of either Looker or Builder. You may convey as many questions and instructions as you like **verbally**. You are a conduit of information, but you must not listen to communications between Looker and Listener.

Builder - You will be provided an assortment of Lego-type building blocks. Through Listener and Communicator, you will receive instructions from Looker on how to assemble the unit. You may ask as many questions as you like, but may only communicate with Communicator. All communications must be **verbal**. You should not listen to, or communicate directly with Looker or Listener.

The team goal is to be the first to complete identical units.

When you believe that you have completed the task, Listener or Communicator may summon the Judge to evaluate your work.

HAZARD COMMUNICATION PROGRAM CHECKLIST

YES	NO	ISSUE
		1. Is there a list of hazardous substances used in your workplace ?
		2. Is there a written hazard communication program dealing with Material Safety Data Sheets (MSDS), labeling, and employee training ?
		3. Is each container for a hazardous substance (i.e., vats, bottles, storage tanks, etc.) labeled with product identity and a hazard warning (communication of the specific health hazards and physical hazards) ? Protective measures to be used ?
		4. Is there a Material Safety Data Sheet readily available for each hazardous substance used ?
		5. Is there an employee training program for hazardous substances?
		6. Does this program include:
		6a. An explanation of what an MSDS is and how to use and obtain one ?
		6b. MSDS contents for each hazardous substance or class of substances ?
		6c. Explanation of "Right to Know ?"
		6d. Identification of where an employee can see the employers written hazard communication program and where hazardous substances are present in their work areas ?
		6e. The physical and health hazards of substances in the work area, and specific protective measures to be used ?
		6f. Details of the hazard communication program, including how to use the labeling system and MSDS's ?
		7. Are employees trained in the following:
		7a. How to recognize tasks that might result in occupational exposure ?
		7b. How to use work practice and engineering controls and personal protective equipment and to know their limitations ?
		7c. How to obtain information on the types selection, proper use, location, removal handling, decontamination, and disposal of personal protective equipment ?
		7d. Who to contact and what to do in an emergency?