Training and Education Material
FY 2019

Crystalline Silica Curriculum

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Revised curriculum from the School of Public Health, University of Washington.

Table of Contents

INTRODUCTION TO CURRICULUM

General materials

- Nametags (optional)
- Paper and pens for each participant
- Laptop with compatible projector, speaker and screen
- Session 1 PowerPoint files and site-specific photos for hazard recognition
- Copies of handouts for each classroom activities
- Equipment: power tools

Silica Training

UNIT 1 – TRAINING INTRODUCTION

Purpose

- Establish goals and work methods
- Class understanding that silica is a commonly found mineral
- Class understanding of the history of silica

Resources

Time: 30 minutes

Materials: Session, projector, computer, speaker, PPP, paper and pencils

Hand-outs: course outline and OSHA Susan Harwood sign-in sheet

DETAILED FACILITATOR NOTES

Activity 1:
Introduction of training (30 minutes).

- **Introduce training staff and facilitator (20 minutes)**
  - Introduce yourself and give your background experience and how long you have been working with your company. Introduce other facilitators that may be present or allow them to introduce themselves.
- **Introduce trainees.**
  - Have each trainee introduce themselves-who they work for and how long they have been employed and their favorite hobby. Allow as much time as the trainees need to introduce themselves.
- **OSHA Susan Harwood Sign-in sheets (1 minute)**
  - Explain to the class that sign-in sheets should be filled out legibly with name, position/job title, employer/school, years of experience and contact information to include email and/or phone number.
- **Introduce OSHA Susan Harwood Disclaimer (slide 2)**
  - This material was produced under Grant Program #SH-05058-SH8 from the OSHA, U.S. Department of Labor. It Does not necessarily reflect the views or policies of the U.S. Department of Labor, nor does mentioning of trade names, commercial products, or organizations imply endorsement by the U.S. Government. (note revised from previous grant material).
- **Classroom participation and breaks. (slide 3, 4) (2 minutes)**
  - Course outline
  - Explain to the class the schedule for the day to include subject materials to be covered.
  - Explain to the class that part of the learning process involves classroom participation.
  - Also, breaks will only be 10 minutes and trainees should be promptly seated when the breaks are over.
- **Discuss course evaluation. (slide 5) (2 minutes)**
  - Explain to the class by the end of the day, trainees will be asked to participate in an evaluation process. The purpose of the evaluation is to improve the training.

- **Training objectives (slide 6)**
    - Explain to the class the what to expect during the course of the training by the objectives given

Activity 2

Introduction to silica and its history

- **What is silica. (slide 7-8) (2 minutes)**
    - Explain to the class that silica is very common mineral found in most places including construction sites.
    - These examples are just some of the most common materials used in construction containing silica.
    - Be very descriptive-explain to the class that when silica enters our lungs its particles are tiny jagged shards of glass. These tiny particles are generated through high energy operations such as cutting, grinding and drilling operations.
- **Silica history (slide 9-10) (2 minutes)**
    - Explain to the class-the discovery of silica and its harmful health effects are dated back as early as the 1700's to the 1930's. Discoveries made by Dr. Ramazzini found evidence of silica in stone cutters and Dr. Hamilton discovered other silica related diseases in the early 1900's.
    - The most notable industrial exposure occurred when 764 out 1213 workers contracted silicosis and died while working underground in the Hawks Nest Tunnel in the 1930's.

Break!

Silica Training

UNIT 2 –Silica Standards and Definitions

Purpose

- Class understanding of the silica standards
- Class understanding of OSHA's PEL and AL
- Enable class to effectively use the silica tables

Resources

Time: 20 minutes

Materials: projector, computer, speaker, PPP, paper and pencils, one empty one-liter bottle, concrete cinder block, saw

Hand-outs: Classroom activity sheet

DETAILED FACILITATOR NOTES

Activity 3:

Introduction to the silica standards

- **Discuss the silica standard (slide 11) (2 minute)**
  - Explain to the class—The purpose of the standard is to limit exposure, increase awareness and ensure safe work practices are followed.
- **Discuss regulatory agencies (slide 12) (1minute)**
  - Explain to the class-aside from OSHA, and MSHA have regulations to limit silica exposure.
- **Discuss silica related OSHA standards (slide 13) (1 minute)**
  - Explain to the class-additional regulations cover operations that expose workers to silica.
- **Discuss OSHA's silica construction standard definitions (slide 14-16) (4 minutes)**
  - Explain to the class-OSHA defines the maximum amount of silica a worker can be exposed under the regulations. The standard defines this as permissible exposure limit or PEL.
  - PEL is the calculated amount of a hazardous substance a worker can be exposed to in an 8-hour work day.
  - OSHA also defines the action level is the harmful level of a hazardous substance that requires medical surveillance and or increased IH monitoring.
  - Explain to the class-this slide illustrates that a worker cannot exceed a PEL of 50 micrograms per cubic meter of air in an 8-hour day.
  - The AL a worker cannot exceed action level which is set to 25 $\mu g/m^3$, which means where the concentration of an airborne silica is at or above this level (25 $\mu g/m^3$) for an 8-hour time weighted average, it will trigger the requirements for the application of the standard.
  - Ask the class how much silica dust exposure is too much? The answer is zero.

Activity 4:

Introduction to PEL **(10 minutes)**

- **Classroom activity-PEL**
  - Instructor demonstrates by using a one-liter soda bottle, you can demonstrate how much air we breathe in an 8-hour work day and how that relates to how much dust we breathe for exposure.
  - For example: with moderate activity such as mowing a lawn we may breathe in 35 liters per minute. Multiply 35 liters by how much we breathe in one hour or 60 minutes. 35x60= 2100 liters of hour in one hour. Then multiply that number by the number of hours x8. 2100x8=16,800 liters of air we breathe in an 8-hour day. Then to convert 16,800 liters to cubic meters take 16,800/1000=16.8 cubic meters of air.
  - Explain to the class that you will come back to that number once you determine how much silica dust we breathe.
  - Now factor in how much silica dust we breathe.
  - For example: Let's assume that this masonry material is 145 pounds per cubic foot or 65770 grams, which then we convert to 38 grams per cubic inch.
  - Let's begin by assuming we are making a cut 2.36 inches deep, 4 inches long and factoring in the overcut of .125 inches.
  - Multiply 2.36x4x.125=1.18 cubic inches
  - Multiply the 1.18 cubic inches' x 38 grams = 45 grams of material released into the air.
  - Convert the 45 grams to micrograms = 45 million micrograms
  - Let's assume that only 20% of the materials actually contain silica. Therefore, multiply 45,000,000x .2= 9,000,000 micrograms.
  - Return to the OSHA PEL of 50 ug per cubic meter of air. Multiply 50x16.8=840 micrograms in an 8-hour day.
  - Compare the 840 micrograms to the current amount of dust released by the paver cut of 9,000,000 micrograms.
  - Explain to the class that the paver cut releases 9 million micrograms. That's enough silica to exceed over 10k days' worth of dust exposure or 29 years.
  - Explain to the class that by considering these numbers we should understand how dust is measured and how much is too much for workers being exposed.
- **Discuss how much silica dust is too much (slide 17) (2 minute)**
  - Explain to the class the safest amount of silica in the air is zero. However, due to the nature of the construction industry, it is sometimes inevitable to get exposed to silica dust; therefore, workers should be trained on how to protect themselves from unacceptable levels of silica exposure.
  - Explain to the class that employers are required to protect their employees in construction from the hazards associated with silica exposure when exposed over the AL.

Silica Training

Unit 3 – Introduction to Health Risk Associated from Silica Exposure

Purpose

- Class understanding of the health risk associated with silica exposure
- Class understanding on the types of silicosis
- Class understanding of the types of disease caused from silica exposure.

Resources

Time: 15 minutes
Materials: Projector, computer, speaker, PPP, paper and pencils
Hand-outs: classroom activity

DETAILED FACILITATOR NOTES

Activity 5

Introduction to the health risk associated from silica exposure

- **Introduction to health risk associated with silica exposure (slide 18) (1 minute)**
    - It should be understood that the higher the cumulative exposure of a worker, the higher the risk of health effects
- **Discuss the types of silicosis (slide 19) (2 minutes)**
    - Acute silicosis is a rare disease caused by inhalation of extremely high levels of silica particles and is almost always fatal.
    - Accelerated silicosis generally occurs within 5-15 years of exposure and results from heavy levels of exposure to silica.
    - Chronic silicosis is the most common form of silicosis, which can result from less intense exposure; it occurs usually after more than 20 years of exposure to silica.
- **Discuss the signs and symptoms of silica exposure (slide 20) (2 minutes)**
    - There are several stages of silicosis. Early stages may go completely unnoticed. Continued exposure may result in the exposed person noticing a shortness of breath upon exercising, possibly having fever and occasionally bluish skin at the ear lobes or lips. Silicosis makes a person more susceptible to infectious diseases of the lungs, like tuberculosis. Progression of the disease leads to fatigue, extreme shortness of breath, loss of appetite, pain in the chest, and respiratory failure, which all may lead eventually to death. Employees with these symptoms should immediately receive further evaluation and treatment.
- **Activity 6:**

Introduction to the silica tables Classroom activity **(10 minutes) (slide 21-22)**

- **Classroom activity**
    - Divide classrooms into small groups. Ensure there is 2-3 trainees per group.
    - Distribute the table list that includes industry, occupation and materials
    - Explain to the class that each group will select and circle items from each list and discuss their findings in class.
    - Ask the trainees share their work experiences and whether controls were put in place to prevent exposure to silica dust.
    - Ask the trainees if they have ever received silica training.
    - Ask the trainees if they have ever had a family member diagnosed with silicosis or other related diseases from exposure to silica.

Break!

Silica Training

UNIT 4 –Silica exposure control methods for construction

Purpose

- Class understanding of exposure control methods
- Class understanding of how to use engineering controls

Resources

Time: 15 minutes

Materials: Projector, computer, speaker, PPP, paper and pencils.

Hand-outs: classroom activity table 1

DETAILED FACILITATOR NOTES

Activity 7:

Introduction to silica control methods (10 minutes)

- **Discuss silica control methods for construction (slides 23) (3 minutes)**
  - Explain to the class- The first step for an employer is to determine if the standard applies to his/her work. If an employer answers "no" to the question "Could employees be exposed to silica at or above 25 µg/m3 as an 8-hour TWA under any foreseeable conditions, including the failure of engineering controls, while performing construction activities?" no further action is required under the new silica standard. However, if the answer is "yes", then that work is covered by the standard and must comply with its requirements.
  - Specified exposure control methods which requires employers to fully and properly implement protections for the tasks or equipment listed in Table 1 of the standard
  - Alternative exposure control methods. An employer who chooses this option must determine the levels of silica that employees are exposed to, and must further independently decide on and use engineering and work practice controls to limit employee exposures to a PEL of 50 micrograms per cubic meter of air (50 µg/m3) as an 8-hour time-weighted average (TWA). This employer must also supplement the controls with respiratory protection when necessary.
- **Discuss control methods for construction (slide 24) (2 minutes)**
  - The specified exposure control method of the standard is essentially covered in Table 1. This table lists 18 common tasks/equipment using various types of tools or equipment found on construction sites. It specifies the engineering controls for the tasks based on the location and the duration of the exposure.
  - Employers who choose to follow Table 1 for any given task are required to fully and properly implement the engineering controls for each employee engaged in tasks which are creating silica exposures.
  - It should be noted that employers who comply with Table 1 by fully and properly implementing its recommendations, are not required to conduct exposure assessments or comply with a PEL requirement for their employees.

- **Discuss engineering controls (slide 25) (2 minutes)**
  - Explain to the class that there are two main engineering controls that are used to eliminate exposure to silica dust. We will discuss the integrated water delivery system and the vacuum dust collection system.
- **Integrated water delivery equipment (slides 26-28) (4 minutes)**
  - Integrated Water Delivery Systems (IWDS): This is commonly known as the wet method. In this method, water is supplied to the equipment by a pressurized container or a constant water source (e.g., a hose connected to a faucet). The water delivery system usually includes a nozzle for spraying water. Using water will usually reduce dust levels to below the PEL in construction activities. Wet cutting is the most effective method for controlling silica dust generated during certain tasks because it controls the exposure at its source.
  - Integrated water systems (IWDS) are required for several types of equipment. IWDS must be developed specifically for the type of tool in use so they will apply water at the appropriate dust emission points based on tool configuration, and do not interfere with other tool components or safety devices. To effectively minimize dust emissions for tasks with the wet method an adequate supply of water for dust suppression is needed (at the flow rates specified by the manufacturer); the spray nozzle must be working properly to apply water at the point of dust generation; the spray nozzle should not be clogged or damaged; and all hoses and connections must be intact.
  - Workers should dispose of water containing silica (slurry) in a way that prevents the silica from becoming re-suspended in the air in order to limit the secondary exposure, If the silica is allowed to become airborne, it can contribute to employee exposures. Freezing temperatures complicate the use of water. In cold temperatures, where there is a risk of water freezing, additional work practices should be followed to prevent water from freezing; which include insulating drums, wrapping drums with ice melting heat tape, or using environmentally-friendly antifreeze additives. Adding environmentally –friendly additives will not only prevent supply water from freezing, but will also prevent the water from freezing on the ground. This is a good way to prevent slipping hazards, as well. As an alternative, chipping away the ice, or using deicing compounds or sand may be used to control the slipping hazards.
  - When using wet methods for dust control, ground-fault circuit interrupters (GFCIs) and watertight, sealable electrical connectors for electric tools and equipment provide for electrical safety.
  - Electrical Safety - Use ground-fault circuit interrupters (GFCIs) and watertight, sealable electrical connectors for electric tools and equipment on construction sites
- **Discuss vacuum dust collection equipment (slides 29-31) (4 minutes)**
  - When wet methods cannot be implemented, an alternative is the use of vacuum dust collection systems. You can purchase these systems as kits. This system includes a dust collector (hood or shroud), vacuum, hose, and filter(s). These vacuum dust collection systems must effectively capture dust generated by the tool being used and must not introduce new hazards, such as obstructing or interfering with safety mechanisms.
  - In order for a vacuum dust collection system to be effective, one must use, a vacuum with enough suction to capture dust at the cutting point; a HEPA filter in the vacuum exhaust, and a pre-filter or cyclonic separator to improve vacuum efficiency; a hose size recommended by the manufacturer; and a hood or shroud that is recommended by the manufacturer.

- make sure that all hoses are clear and free of debris, kinks and tight bends and cracks; ensure that appropriate filters and dust bags are in good condition and changed or emptied as needed (may be necessary several times per shift under some circumstances); check the entire system daily for signs of poor dust capture or dust leaks; use high-efficiency (HEPA) filters for maximum dust control; review manufacturers' operating specifications and recommendations for their equipment; and avoid exposure to dust when changing vacuum bags and cleaning or replacing air filters

Silica Training

UNIT 5 – Introduction to Administrative and PPE Controls

Purpose

- Class understanding on how to apply administrative controls
- Class understanding on how to apply PPE controls

Resources

Time: 10 minutes

Materials: Projector, computer, PPP, paper and pencils

Hand-out: None

DETAILED FACILITATOR NOTES

Activity 8:

Discuss administrative controls (slides 32) (5 minutes)

- Explain to the class that along with the engineering controls, OSHA also requires workplace controls to eliminate exposure to silica dust. One of the administrative controls is the safety program and training.
- The training must be provided at the time employees are assigned to a position involving exposure to silica. The employer must make sure that employees trained under the silica standard can demonstrate knowledge and understanding of the standard. Additional training must be provided if the employer asks an employee to perform a task that is new to that employee, and/or when the employer introduces new protection methods and/or an employee is working in a manner that suggests he or she has forgotten what was learned in a previous training.

- **Discuss PPE controls: (slide 33) (5 minutes)**
  - Explain to the class- employers who follow the specified exposure control methods listed in Table 1 must provide respiratory protection where required by Table 1. Employers who follow alternative exposure control methods must provide respiratory protection:
  - Where exposures exceed the PEL during periods necessary to install or implement engineering and work practice controls; and/or where exposures exceed the PEL during tasks, such as some maintenance and repair tasks, for which engineering and work practice controls are not feasible; and/or during tasks in which the employer has implemented all engineering and work practice controls but exposures remain above the PEL.
  - When vacuum dust collection systems and/or wet methods are not feasible or do not reduce silica exposures to PEL, workers need respiratory protection as a last line of defense. Respirators must fit properly to prevent leaks around the edges. Fit-testing must be done with the same make, model, style, and size of respirator that will be used before first wearing a respirator. Fit testing may be conducted by using quantitative method or qualitative method. Employees must only wear the model and size of respirator that they fit tested with. Employers should not permit employees to have facial hair that comes between the sealing surface of the face piece and the face or that interferes with valve function or any condition that interferes with the face-to-face-piece seal or valve function.
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Silica Training

UNIT 6 – Introduction to Housekeeping and Safe Work Practices

Purpose

- Class understanding on how to use good housekeeping and safety work practices

Resources

Time: 10 minutes

Materials: Projector, computer, speaker, PPP, paper and pencils

Hand-out: Equipment and a concrete block.

DETAILED FACILITATOR NOTES

Activity 9:

Classroom activity.

- **Discuss housekeeping and safe work practices (Slide 34) (5 minutes)**
    - Explain to the class- As another workplace control; the standard requires all construction employers covered by the standard, including those who fully and properly implement the control methods specified in Table 1, to avoid certain housekeeping practices. Cleaning methods such as dry sweeping, dry brushing, and use of compressed air can cause silica dust to become airborne and be inhaled by employees. Therefore, the silica standard limits the use of these cleaning methods to prevent unnecessary exposures to employees. Standard states that, when it is likely to contribute to employee exposure to silica, employers must not allow-dry brushing or dry sweeping, unless methods such as wet sweeping and HEPA-filtered vacuuming are not feasible; cleaning of surfaces or clothing with compressed air, unless the compressed air is used together with a ventilation system that effectively captures the dust cloud, or no other cleaning method is feasible.
    - Employers are required to use other cleaning methods such as wet sweeping and HEPA-filtered vacuums whenever feasible, because such methods reduce employee exposures. Employers are not required to follow these housekeeping requirements when cleaning ordinary soil, large debris, and non-silica- containing materials, such as sawdust.
    - To prevent unnecessary exposure; the standard also requires employers to regulate areas of concern by restricting access to areas of
    - high exposure. Scheduling certain tasks when others are not around, telling employees to stay out of areas where dust is generated, moving employees to an area where they are not exposed to dust, or posting warning signs are some examples of regulating the exposure areas.
- **Classroom Activity-Discuss how equipment is used to reduce silica dust exposure: (slide 35) (20 minutes)**
    - Have all the equipment out on display.
    - Have the trainees gather in a circle around the equipment.
    - Pick each piece of equipment and demonstrate how to inspect the dust collection and water injection systems for efficiency.

- The instructor does a mock demonstration of how to cut or drill a cement block using the dust collection and or water injection system to prevent dust exposure following table 1 construction standards.
- Have each trainee do an actual demonstration of how to properly use the equipment using all the safety features.
- Have trainees provide feedback on the effectiveness or deficiency on the equipment.
- Answer any questions trainees may have on the equipment.

Silica Training

UNIT 7 – Introduction to competent person

Purpose

- Class understanding of a competent person

Resources

Time: 5 minutes

Materials: Projector, computer, speaker, PPP, paper and pencil

Hand-outs: None

DETAILED FACILITATOR NOTES

Activity 10:

Introduction to competent person

Discuss competent person (slide 36) (5 minutes)

- Explain to the class -under the silica standard, the employer must designate a competent person to frequently and regularly inspect job sites, materials, and equipment to implement the written exposure control plan.
- A competent person is defined as an individual who is capable of Identifying existing and foreseeable silica hazards; Is authorized to promptly eliminate or minimize these hazards; and has the knowledge and ability to implement the written exposure control plan.
- An employer can designate any of his/her employees as a competent person as long as they meet the above capabilities. The standard does not require specific training for a competent person. The employer is responsible for determining what training is necessary to provide the scope and nature of the knowledge and ability for the competent person, so the written exposure plan can be successfully implemented

Silica Training

UNIT 8 – Written exposure plan and alternative exposure controls

Purpose

- Class understanding of a written exposure control plan
- Class understanding of alternative exposure controls
- Class understanding of communication of silica hazards
- Class understanding of record keeping
- Class understanding of employee notification and corrective action

Resources

Time: 21 minutes

Materials: Projector, computer, speaker, PPP, paper and pencil

Hand-outs: None

DETAILED FACILITATOR NOTES

Activity 11:

- **Discuss workers covered under the standard (slide 37) (2 minutes)**
  - Explain to the class - All employers covered by the standard (generating silica exposure at or above AL 25 µg/m3) are required to comply with the following mandatory requirements, whether they use Table 1 or Alternative Method of Exposure Controls.
  - Establish and implement a Written Exposure Control Plan, including respiratory protection as needed, and designate a competent person to oversee activities under that plan
  - Restrict housekeeping practices that expose employees to silica where feasible alternatives are available;
  - Offer medical exams to employees who will be required to wear a respirator under the standard for 30 or more days a year;
  - Communicate hazards and train employees; and keep records of medical examinations of workers; additionally, the worker's silica exposure assessments if they are following the alternative control method.
- **Discuss alternative silica exposure controls (slide 38) (1 minute)**
  - Explain to the class that if their employer opts out for not implementing table 1, they must follow the alternate exposure control methods
- **Discuss communication of silica hazards (slide 39) (1 minute)**
  - Explain to the class that hazard communication plays a role in that employers must inform their employee of hazards of silica exposure, have a written program and address all the health hazard effects from silica exposure.
- **Discuss record keeping (slide 40) (1 minute)**
  - Explain to the class that records must be maintained and made available to employees and their representative.
- **Discuss employee notification and corrective action (slide 41-42) (2 minutes)**
  - Explain to the class that upon results of the any air monitoring exposure data and health care findings, the employer must notify the employee within 5 working days.

- **Evaluation surveys (15 minutes)**
    - Explain to the class that our survey contains two parts. First, level one based on the facility, instructor and materials presented. Second, is about what you learned and how you will apply what you learned in class.
    - For each category circle whether you strongly agree, agree, neutral, somewhat disagree or strongly disagree.
    - In two months make contact with you and asked five questions to see how well you applied what you learned in class.

Course completed