

SILICA IN CONSTRUCTION

INSTRUCTOR'S GUIDE

Teaching materials for this training include the following:

- Instructor preparation tools
 - ✓ Overall training objectives
 - ✓ At-A-Glance
 - ✓ Preparing to teach this training
 - ✓ What you need to present this training
- Curriculum
 - Includes all teaching notes and background information to teach the course. Pairs with Silica in Construction PowerPoint presentation and Laminated slides
- PowerPoint presentations
 - ✓ Silica in Construction (110 slides) matches Curriculum
 - ✓ Silica Jeopardy Review Game (42 slides)
- PowerPoint slides reference hardcopy
 - ✓ Silica in Construction handout with space for notes
 - ✓ Silica Jeopardy Answer Key and Game Board
- Videos (suggested)
 - ✓ "Silica Exposure" (2 minutes) Worksafe BC
 - ✓ "Silica in Construction—from danger to safety" (8 minutes) SBCTC
 - ✓ "Eliminate the Hazard—McCarthy Drilling Project" (7 minutes) SBCTC
- Audio (suggested)
 - ✓ Union Bricklayers testimony regarding health effects caused by exposure to silica dust (3:40 minutes) International Union of Bricklayers and Allied Crafts
- 10 Slides to Laminate
 - ✓ Where is silica found/3 forms of crystalline silica
 - ✓ How to know if material contains silica/List of materials that contain silica
 - ✓ Operations that create silica dust/List of tasks that create dust
 - ✓ Respirable particles/Size matters
 - ✓ Diseases caused by silica/Diseases associated with silica exposure
 - ✓ Assessing risk/Examples of engineering controls—wet methods
 - ✓ Before/After photos—more examples of wet method engineering controls
 - ✓ Examples of LEV methods/Before-After photos—examples of LEV controls
 - ✓ Worker best practices/Housekeeping rule
 - ✓ NIOSH-approved respirators/Medical exam facts

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OVERALL TRAINING OBJECTIVES

By the end of this training, participants will be able to:

1. Understand what silica is and where it occurs in building materials.
2. Recognize silica hazards and identify tasks/equipment that create exposure to harmful levels of respirable crystalline silica dust.
3. Describe potential health effects and the signs/symptoms of over-exposure to crystalline silica dust.
4. Identify engineering and work practice controls, and personal protective equipment (PPE) that protect workers from over-exposure to crystalline silica dust.
5. Understand the basic requirements of the new 2016 OSHA Silica Standard for Construction.
6. Use best practices when working with and around crystalline silica.

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AT-A-GLANCE

Module	Slide #s	Time	Training Goal
Introduction	1-7	6 min	-Acknowledge source -Introduce topic -Course objectives
1. Introduction to Silica	8-18	15 min	-Explain what silica is -Where it naturally occurs -Identify type that is hazardous -Learn which construction materials contain silica
2. Silica as a Hazard	19-34	20 min	-Learn factors that make silica dangerous -Understand why respirable dust is a hazard -Learn key terms related to PEL
3. Tasks and Tools that Create Silica Dust	35-42	35 min	-Understand which tasks and equipment put workers at risk for silica dust exposure -Link these to construction materials
4. Health Effects of Silica Exposure	43-60	45 min	-Explain how breathing silica dust damages the body -Identify diseases associated with silica dust -Learn signs and symptoms of overexposure
5. Controlling Silica Hazards	61-87	45 min	-Risk factors for silica exposure -Learn control strategies for preventing exposure -Types of PPE used for silica dust -Best practices for working with silica
6. The New OSHA Standard	88-108	30 min	-Learn basic components of new standard for construction -What workers can expect on-the-job as employers comply with the standard

Total time: Approximately 3.25 hours

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Preparing to Teach This Training

The curriculum is designed to guide you through the entire training with key talking points, background information, activities, and prompting questions to engage the class. The goal of the training is to educate workers about the risks and hazards involved in working with respirable crystalline silica. It is important that workers know when they are likely to be exposed to the hazard; the serious, permanent harm silica dust can cause to their health; what controls should be implemented to protect them; and best practices for assuring they are working safely.

Specialized technical knowledge is not necessary to teach this course. With proper preparation, foremen, union staff, apprenticeship instructors, and others can present the material. A Train-the-Trainer (TOT) class is designed to prepare participants to teach the curriculum by experiencing the training first-hand as well as receiving supplemental technical information from expert guest speakers and teaching tips and adult learning information.

The course is flexible and can be presented in different ways. Feel free to adapt it to your own situation. The minimum recommended training session is 30 minutes. You can use specific modules that are most relevant to your training needs, or present the entire course in one 3.5 hour class.

Laminated Slides: Use the 10 laminated slides for presenting training at a job site where it is not feasible to use PowerPoint or video. We selected 20 slides from the course PowerPoint that cover essential information from each training module. Use the curriculum talking points with these slides to present a shorter, basic training or refresher class. They may be also work well in conjunction with a tailgate training or toolbox talk.

PRACTICE! However you decide to present this training, it is always essential to study the curriculum and rehearse your presentation before holding a class. The curriculum provides a level of detail designed to provide the information you need to competently teach the material. Some of this information is intended to enhance the trainer's understanding of the concepts. You may choose to target only key points in your training as outlined at the beginning of each section and as shown on the PowerPoint slides.

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What you need to present this training:

- Training PowerPoint
- Computer and LCD projector for PowerPoint presentation
- Speakers for videos and audio
- Extension cord and power strip
- Course curriculum
- Class sign-in sheet
- Pre/Post tests
- Class evaluation forms
- Copies of handouts
- Flip chart pad and easel or white board
- Multi-colored markers
- Painter's tape for posting flip charts
- (Optional) Samples of natural silica—pieces of quartz, granite, sandstone, sand
- (Optional) Samples of construction materials—brick, block, concrete
- (Optional) Tools of your trade that create silica dust—e.g. drills, saws, grinders, chippers, jackhammers, etc.
- Props to illustrate size of cubic meter and items that weigh a gram
- Samples of NIOSH-approved air-purifying respirators with proper filters for silica dust
- (Optional) Prizes for playing PowerPoint Jeopardy Review Game
- Master question list for Jeopardy Review Game

SILICA IN CONSTRUCTION



A training
to keep
construction
workers safe on
the job

State Building & Construction Trades Council
of California, AFL-CIO
Funded by Federal OSHA, 2017

TRAINING CURRICULUM

Introduction

(6 minutes)

Key points in this section:

- Acknowledge source and funding of training material
- How material may be used
- Introduce training topic
- Course objectives

Handouts: N/A



Slide 1—Title page

Slide 1 - Insert Trainer's information

Funded by OSHA

This material was produced under grant SH29642SH6 from the Occupational Safety and Health Administration, U.S. Department of Labor. It does not necessarily reflect the views or policies of the U.S. Department of Labor, nor does mention of trade names, commercial products, or organizations imply endorsement by the U.S. Government.



Slide 3—Funded by OSHA

Explain that funding for this program was provided through a grant from federal OSHA.

Through the grant program process, material is reviewed and approved by federal OSHA prior to distribution.

The Susan Harwood Training Grant Program awards grants to nonprofit organizations on a competitive basis. The focus of the program is to provide training and education for workers and employers on the recognition, avoidance, and prevention of safety and health hazards in their workplaces, and to inform workers of their rights and employers of their responsibilities under the OSH Act. Target audiences include underserved, low-literacy, and workers in high-hazard industries. Since 1978, over 2.1 million workers have been trained through this federal OSHA program.

Use of Material Duplication and Photo Credit

- Material is only to be used for non-commercial, instructional, educational purposes
- Fees may not be charged for this material
- Photo credits are given on each slide
- While every effort has been made to ensure information is current and accurate, the SBCTC does not assume any liability for errors or omissions

Slide 4—Use of Material/Duplication and Photo Credit

Emphasize that this training was specifically designed to educate workers about the hazards of working with silica. It cannot be used for commercial purposes.

We have made every effort to give proper credit to photo sources used in the PowerPoint presentation.

Acknowledgements We thank the following organizations for: - Providing technical assistance with developing this training: - Center for Construction Research and Training (CCRT) - UC Berkeley Labor Occupational Health Program (LOHP) - Cal/OSHA - Federal OSHA - Sharing: photos, video, training material: - IBC—International Union of Bricklayers and Allied Craftworkers - CA Dept. of Industrial Relations—Commission on Health and Safety and Workers' Compensation (WOSH/CHS program) - West Virginia Archives - Worksafe KC (Kansas)	Slide 5—Acknowledgements Whenever possible, we use existing sources of information to compile our training. The SBCTC expresses thanks to the organizations listed on this slide for their cooperation in sharing their resources and expertise for the benefit of our training.
Silica—A High Priority for Construction 2 million U.S. construction workers exposed to silica every year	Slide 6—Silica—A High Priority for Construction On construction sites there are many sources of dust that can contain a variety of contaminants. Some of these contaminants are of greater concern than others because they are known to cause serious health effects in workers. Silica is one of these. The photo shows workers scarifying concrete without using dust controls. You may have already seen or heard the slogan "If it's Silica, it's not just Dust" which were the watchwords of a national public education campaign launched in the late 1990's by OSHA and other partners. Silica remains a high priority for construction health and safety and is the topic of this training program. OSHA estimates that 2.3 million U.S. workers are exposed to this hazard every year, and close to 90% (2 million) of those work in construction. Out of the estimated 676,000 establishments affected, 600,000 are construction.

Course Objectives for Silica Training

By the end of this training, participants will be able to:

- Understand what it is
- Recognize hazards
- Describe health effects
- Identify controls:
 - Engineering/work practice/PPE
- Understand new OSHA Standard
- Work safely around silica

Slide 7—Course Objectives for Silica Training

The purpose of this training is to help you understand silica hazards, risk factors and how to work safely with construction materials containing silica. It is not designed to make you an expert, but, by completing this training, you should accomplish these 6 objectives.

ASK: Do you have any questions about this training before we move on?

Section 1: Introduction to Silica

(15 minutes)

Key points in this section:

- Understand what silica is and where it naturally occurs
- Discuss different forms and types of silica
- Identify construction materials that may contain silica
- How to find out if material contains silica

Activity: Brainstorm list of construction materials that contain silica

Handouts: What is Crystalline Silica?

Props: Samples to pass around the class: Natural sources of silica: pieces of quartz, granite, sandstone, a jar of sand. Construction material: pieces of cement fiber-board, cement, concrete, brick, block, tile.



Slide 8—Section title page

Photo: Demolition of Morris Mechanic theater
Baltimore, MD, January 2015



Slide 9—What is silica?

We may not realize it, but silica is all around us every day.

ASK: Does anyone know what we mean by "mineral?"

Answer on next slide.

Mineral means:

- Naturally occurring
- Inorganic—not plant or animal
- Solid form
- Definite chemical composition

**Slide 10—"Mineral" means:**

The four points covered on the slide generally define what identifies a substance as a mineral.

ASK: What's the first thing that comes to mind when you think of a mineral?

Possible answers are: rock, soil, something that comes from the Earth's crust.

ASK: Why would a cell phone appear on this slide?

Most things we use in daily life are made from minerals or produced using mineral products. For example it takes dozens of minerals from different countries to make a cell phone.

The construction industry is the largest consumer of mineral commodities.

Crushed stone is used for foundations, road base, concrete, and drainage.

Sand and gravel are used in concrete and foundations.

Clays are used to make cement, bricks, and tile.

Iron ore is used to make reinforcing rods, steel beams, nails, and wire.

Gypsum is used to make drywall.

Dimension stone is used for facing, curbing, flooring, stair treads, and other architectural work.

These are just a few of the many uses of mineral commodities in construction.

ASK: Where do you think the mineral silica is found naturally?

Go to next slide for answer

Silica is found in rock, soil and sand

- Silica is composed of the elements
Silicon + Oxygen = SiO_2



Slide 11—Silica is found in rock, soil and sand

Silica is just one type of mineral. It is a chemical compound (silicon dioxide) formed from silicon and oxygen atoms.

Because these two elements are so abundant, formation of silica is very common in nature and it occurs all over the planet.

For millennia, humans have used natural building materials that contain silica.

ASK: Can you think of 3 ancient structures that may be made from raw material that contains silica?

Possible answers include: Stonehenge 3100 BC (sandstone and bluestone), Egyptian pyramids 2600 BC (limestone and limestone concrete), Greek temples 6th century BC (marble), Roman temples 2000 years old (brick, concrete, marble, stucco). Many buildings in our own capitol Washington DC are built from granite, sandstone, and limestone.

Silica naturally occurs as:

- Amorphous: no regular form
- Crystalline: well-defined arrangement, regular crystal form

Which is hazardous?



Slide 12—Silica naturally occurs as:

The mineral compound silica occurs in two different states called "amorphous" and "crystalline." These share the same chemical formula SiO_2 but have different properties. This is important to us because one of these types presents a hazard to construction workers and is the focus of this training.

Amorphous describes a type that has no regular form. If you were to look at a piece of amorphous silica, it would be hard to find a defined, repeating pattern.

Crystalline silica has a three-dimensional repeating pattern with a well-defined arrangement, a regular crystal form like what's shown in the photo on this slide.

ASK: If we were to compare two solids that we all know well, butter and ice, which one would be crystalline? It's easy to find regular, repeating

	patterns of form in the ice. The butter appears non-crystalline. Of these two types of silica, it is exposure to the crystalline state that is of greatest concern because it is very common and is proven to cause serious lung diseases. Crystalline silica is found in rocks from every geologic era and from every location around the globe, making it very likely to show up in construction materials that you may work with. There is a type of amorphous silica called "diatomaceous earth" that is produced by tiny organisms that extract silica from water. It is an effective filtering agent, and is used as a filler and as a mild abrasive. You may use it in construction and have to follow appropriate protections, but it is not considered crystalline silica.
 3 forms of crystalline silica Quartz—common, found in sand, gravel, clay, granite, sandstone and other rock Cristobalite and Tridymite—less common, but more toxic to workers	Slide 13—3 forms of crystalline silica There are three forms of crystalline silica that are known to cause occupational disease and even death. Quartz is the most common form of the three. ALL soils contain at least trace amounts of crystalline silica in the form of quartz. It is found in sand, gravel, clay, granite, sandstone, and other forms of rock. Because quartz is very abundant, workers have a high chance of exposure. <i>Teaching Tip: Having samples of quartz, granite, sandstone, and beach sand to pass around the class is a good way to help workers retain this information.</i> Cristobalite and Tridymite—are less common forms found in volcanic rocks and soil. Because these are very stable at high temperatures, they are also produced in some industrial operations that heat quartz or amorphous silica to extremely high temperatures, such as foundry processes, calcining of diatomaceous earth, brick and ceramics

Where is silica found in construction? BRAINSTORM ACTIVITY Based on what you just learned about where silica naturally occurs, list the <u>building materials</u> you think might contain crystalline silica? 	manufacturing. While more rare, these forms are believed to be more toxic. Slide 14—Where is silica found in construction? Activity: the purpose of this activity is to get the class to apply the information they just learned in a practical way by connecting it to the materials they commonly use on the job. Preparation: familiarize yourself with the list on Slide 15 that follows. Materials: flip chart or white board, multicolor pens, tape • Ask the group to brainstorm a list of building materials they think might contain crystalline silica. • Record the group's answers where everyone can see. • Give everyone a chance to give an answer. Try to engage the whole class. • If any items are listed that may be incorrect, discuss this with the class and clarify why they don't fit with the correct examples. Review previous information if necessary. • When finished, go on to the next slide.																								
These materials may contain silica <table border="0"> <tbody> <tr> <td>• Asphalt</td><td>• Refractory Mortar/Castables</td></tr> <tr> <td>• Brick</td><td>• Refractory units</td></tr> <tr> <td>• Cement</td><td>• Rock</td></tr> <tr> <td>• Concrete</td><td>• Roof tile (concrete)</td></tr> <tr> <td>• Concrete block</td><td>• Sand</td></tr> <tr> <td>• Drywall</td><td>• Soil (fill dirt, top soil, soil w/ly ash added)</td></tr> <tr> <td>• Fiber/cement products (siding, cladding panels)</td><td>• Stone (granite, limestone, quartzite, sandstone, shale, slate, cultured, etc.)</td></tr> <tr> <td>• Gunit</td><td>• Stucco/LIFS</td></tr> <tr> <td>• Gunit/Shotcrete</td><td>• Terrazzo</td></tr> <tr> <td>• Mortar</td><td>• Tile (clay and ceramic)</td></tr> <tr> <td>• Paints</td><td></td></tr> <tr> <td>• Plaster</td><td></td></tr> </tbody> </table>	• Asphalt	• Refractory Mortar/Castables	• Brick	• Refractory units	• Cement	• Rock	• Concrete	• Roof tile (concrete)	• Concrete block	• Sand	• Drywall	• Soil (fill dirt, top soil, soil w/ly ash added)	• Fiber/cement products (siding, cladding panels)	• Stone (granite, limestone, quartzite, sandstone, shale, slate, cultured, etc.)	• Gunit	• Stucco/LIFS	• Gunit/Shotcrete	• Terrazzo	• Mortar	• Tile (clay and ceramic)	• Paints		• Plaster		Slide 15—These materials may contain silica Have the class compare their list to the one on this slide which came from CPWR (Center for Construction Research and Training). ASK: Do any surprise you? Discuss the list with the class. It is important to know how much and what kind of crystalline silica is contained in the construction materials you are using. Make the point that, while working with any of these materials, workers need to be aware that they may be at risk for crystalline silica exposure.
• Asphalt	• Refractory Mortar/Castables																								
• Brick	• Refractory units																								
• Cement	• Rock																								
• Concrete	• Roof tile (concrete)																								
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• Paints																									
• Plaster																									

How can you find out if material contains silica?



- Product label
- Safety Data Sheet
- Published data—online
- Analyze a sample of the material

Slide 16—How can you find out if material contains silica?

Explain to the class that there are ways they can check to see the form and concentration of crystalline silica a material contains.

- Check the product label for immediate information.
- Read the product Safety Data Sheet (SDS) which is required by law under Hazard Communication standards. Discuss where this might be found at job sites. A worker may need to ask their employer where their company keeps this information. Also SDS can often be found online through the manufacturer's website. Note: naturally occurring materials will not have an SDS.
- Review published data about the product by doing a search online.
- The definitive way to know exactly how much and what form of crystalline silica is present is to perform monitoring and take a bulk sample of airborne contaminants for analysis by a testing lab. There is more information about air monitoring later in this training.

Websites that can help you

- CPWR (Center for Construction Research and Training) Work Safely With Silica
www.silica-safe.org
- Federal OSHA Silica eTool
<http://www.osha.gov/dsg/etools/silica>

Slide 17—Websites that can help you

Provide resources that workers can rely upon for help. You may have your own specific to your craft.

Section 1 Review and Questions



Name three important things you learned in this section.



Slide 18—Section 1 Review and Questions

This ends Section 1 "Introduction to Silica"

ASK: Name three important things you learned in this section.

Make certain everyone understands these key points before moving to the next section:

- ✓ Silica is a common, naturally occurring ~~mined~~ found in rock, soil, sand in all parts of the world.
- ✓ Crystalline silica is the type that is of ~~most~~ concern to worker health, and the most common form is quartz.
- ✓ Many common construction materials are known to contain crystalline silica and workers need to be aware there is potential risk for exposure when working with these materials.

Resolve any questions before proceeding to the next section.

Section 2: Silica as a Hazard

(20 minutes)

Key points in this section:

- Crystalline silica becomes a dangerous construction hazard when it takes the form of respirable dust.
- Multiple factors determine the potential for a substance to cause harm.
- Dose and duration of exposure is a critical factor for silica dust.
- Crystalline silica is known to cause serious lung disease, cancer and death.

Activity: Guess what weighs 1 gram.

Handouts: CPWR Hazard Alert

Props: 1 gram packet of sweetener; meter stick or constructed cubic meter: several objects of various weights close to 1 gram.



Slide 19—Silica as a Hazard

ASK: If silica is all around us, why aren't more people sick from it?

To better understand the danger of silica exposure we need to consider the factors that determine if a substance will cause harm to our health. In this section of the training, you will learn 5 factors that apply to silica.



Slide 20—Factors that determine potential to cause harm:

Introduce the five factors which will be discussed individually over the next 13 slides.



Slide 21—Route of Exposure

ASK: How do you think silica gets into your body?

Click on the slide to reveal the answer:

Breathing

ASK: If this is how it enters your body, what form of silica is hazardous?

A: Dust--- "Dust" is a generic term for minute solid particles in the air.

Larger, solid pieces of material containing crystalline silica, like rock, brick, block, quartz crystals, and even beach sand are not hazardous for us to be around because they are too large to breathe.

But when these larger pieces are broken down into dust, very tiny solid particles of the crystalline silica become airborne, and now we are at risk for breathing it into our body. Sometimes these particles may not even be visible in the air.

In construction and demolition projects, dust particles are created in a wide range of sizes. Larger, heavier particles tend to settle out of the air, while smaller, lighter solids may hang indefinitely.

ASK: What are some other particulates that come to mind when you think of construction dust?

A: Lead
 Wood
 Asbestos
 Fiberglass

Size matters!

"Respirable" silica is small enough to penetrate body's natural defenses and get deep into your lungs



It's 100 times smaller than ordinary beach sand

Slide 22—Size matters!

When dealing with contaminants that we breathe-in from the air, particle size really matters.

Crystalline silica dust is considered "respirable" meaning that it is small enough to get past human body defenses in the respiratory system that would normally catch other contaminants with larger particle sizes and different structures.

The larger particles in the inhalable dust classification are typically trapped in the nose, throat or upper respiratory tract. You may be able to expel these by coughing, sneezing or blowing your nose.

But **respirable** crystalline silica dust penetrates deep into your lungs beyond the body's natural cleaning mechanisms where it becomes permanently retained.

Particles of respirable crystalline silica are at least 100 times smaller than ordinary beach sand.

Respirable Particles

A single human hair is between 80 – 120 microns (μm) in diameter



Respirable dust is less than 10 microns (μm) in diameter

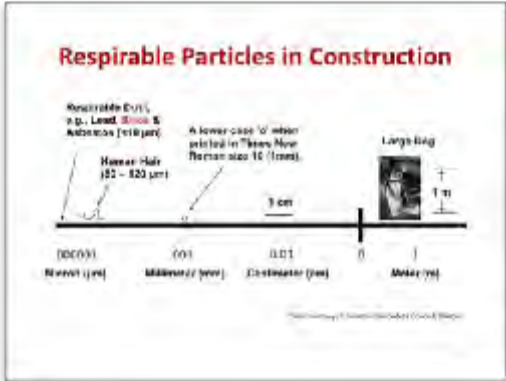
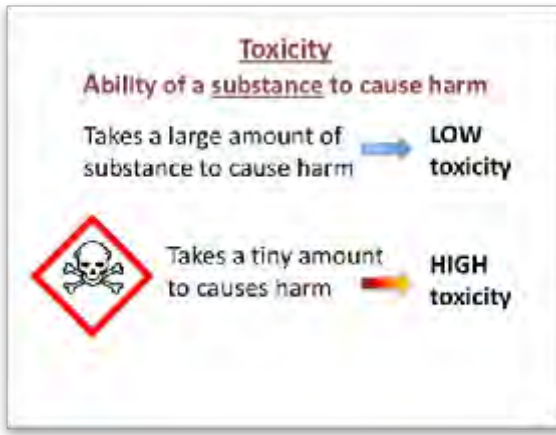
Slide 23—Respirable Particles

Respirable dust generally is identified as particles less than 10 microns in size. That's a fraction of the thickness of a single human hair.

Note: Students may not be familiar with the metric system so you may want to briefly explain some terms and symbols that are used when referring to respirable dust and silica exposure levels.

A "micrometer" also commonly called "micron" is a unit of **length** on the metric scale equal to one millionth of a meter. For comparison, a meter is equal to 39.37 inches.

The symbol for "micro" is μ and looks something like the letter "u" with a line down the side. When this symbol is used before a unit of measurement like a meter "m" it is shorthand for 1/1,000,000 of a meter and looks like this " μm " in print.

	Later we will be seeing the symbol μ used in a metric unit of weight called a "microgram" which is a term often used in OSHA standards and looks like this "μg" in print.
	Slide 24—Respirable Particles in Construction This slide gives more comparisons to help workers understand the relative size of dust particles. The takeaway message here is that these dust particles are very very small and not visible to the naked eye.
	Slide 25—Toxicity This refers to the ability of a substance to cause harm when it gets into the body. If a substance has low toxicity it would require exposure to a very large amount of that substance to cause harm. Conversely, if exposure to a tiny amount of a substance causes harm, it's considered highly toxic. ASK: Who can remember which type of silica is considered more toxic, amorphous or crystalline? A: Respirable crystalline silica is more toxic because overexposure to it causes a serious lung disease called silicosis. It has also been classified as a known human carcinogen (cancer causing substance). Health effects of exposure to silica will be covered in more detail in Section 4 of this training.

Dose and Duration

Amount of substance
entering body



Amount of time you
are exposed

Slide 26—Dose and Duration

Dose refers to the amount of a substance that enters your body. The photo shows the amount of sugar in different quantities of a soft drink.

Duration refers to the amount of time you are exposed to the substance. The amount of time you are actually exposed to respirable crystalline silica averaged over the entire workday is a very important factor in assessing your risk.

The combination of dose and duration is called the "rate of exposure."

This is important for respirable crystalline silica because both smaller doses over a long period of time as well as large doses over a short period of time can cause serious harm to your body.

How much silica dust is too much? 3 Important terms:

- TWA ✓ Time weighted average
- AL ✓ Action Level
- PEL ✓ Permissible exposure limit

Slide 27—How much silica dust is too much?

The new standard includes terms that may be unfamiliar to workers.

ASK: Does anyone know what these terms mean?

Click on slide to reveal answers
"8-hour time weighted average"

This is the average employee exposure to a specific substance over an 8-hour period, based on industrial hygiene monitoring.

ASK: Can you solve this example: An employee is exposed to 0.1 milligrams per cubic meter (mg/m^3) of respirable crystalline silica for 4 hours and then is not exposed to silica at all for the rest of the day. What is the employee's 8-hour TWA?

A:
$$\frac{[(0.1\text{mg}/\text{m}^3 * 4 \text{ hours}) + 0]}{8 \text{ hours}} = 0.05 \text{ mg}/\text{m}^3$$

Multiply the dose ($0.1 \text{ mg}/\text{m}^3$) by the duration of exposure (4 hours). Divide that number by 8 to get the 8-hour TWA. $0.05 \text{ mg} = 50 \text{ micrograms}$

ASK: Here's a tougher problem: An employee is exposed to 0.1 mg/m³ of respirable crystalline silica for 2 hours, exposed to 0.05 mg/m³ for 4 hours, and then exposed to 0.2 mg/m³ for 2 hours. What is the employee's 8-hour TWA?

A:
$$\frac{[(0.1 \text{ mg/m}^3 * 2 \text{ hours}) + (0.05 \text{ mg/m}^3 * 4 \text{ hours}) + (0.2 \text{ mg/m}^3 * 2 \text{ hours})]}{8 \text{ hours}} = 0.1 \text{ mg/m}^3 \text{ TWA.}$$

0.1 mg = 100 micrograms

"Action Level"

OSHA uses this term to express the concentration for a specific substance, calculated as an eight (8)-hour time-weighted average (TWA), at or above which employers must perform certain activities such as exposure monitoring and medical surveillance.

"Permissible exposure limit"

This represents the maximum amount (concentration) of a substance that can be present in the air; the allowable exposure limit set forth by OSHA regulations.

PELs and standards are the minimum requirements to protect workers. They are established through a process of input from stakeholders, taking into account feasibility and cost of compliance and are not based solely on protection of health. Recommended exposure levels based on research may not match the PEL in a standard. In some cases PELs for general industry workers and construction workers are different for the same substance.

Before the new 2016 standard, silica dust PELs for construction and shipyards allowed exposures to be more than twice as high as levels in general industry. At this prior PEL, OSHA estimates that all workers in the construction industry exposed at the limit over a 40-year career could become sick or die from illnesses related to that exposure. (BAC Safety & Health News Journal: Issue 2-2016) This is one of the reasons building trades unions and workers' rights advocates pushed for a better, more protective standard for many years.

New limits for silica

AL = 25 micrograms per cubic meter of air
(25 $\mu\text{g}/\text{m}^3$) calculated as 8-hour TWA

PEL = 50 micrograms per cubic meter of air
(50 $\mu\text{g}/\text{m}^3$) averaged over an 8-hour day

Slide 28—New limits for silica

The new Action Level (AL) for airborne respirable crystalline silica is now a concentration of 25 micrograms per cubic meter of air (25 $\mu\text{g}/\text{m}^3$), calculated as an 8-hour TWA. This is what triggers the standard. If employers can prove through air monitoring or objective data that workers are not exposed to silica above the AL, they are not subject to the silica standard.

The permissible exposure limit (PEL) is 50 micrograms of respirable crystalline silica per cubic meter of air (50 $\mu\text{g}/\text{m}^3$), averaged over an 8-hour day. This means, to be in compliance with the new standard, employers must implement silica dust controls to limit worker exposure to less than this amount of respirable crystalline silica each work day.

These measurements may be difficult to apply in practical terms. The next 3 slides explain what these mean in comparison to more familiar terms.

What is a "microgram (μg)"

A metric unit of weight or mass equal to
1 millionth of a gram
0.000001 g

Too small to see with the naked eye

Slide 29—What is a "microgram (μg)"

In metric units a microgram (μg) is a unit of weight or mass equal to 1 millionth of a gram.

The metric term milligram (mg) may be more familiar to you. It's commonly used in reference to medications and vitamin supplements. For comparison, a milligram (mg) is 1/1000 of a gram and a microgram is 1/1000 of a milligram.

Earlier we talked about respirable dust as being 10 microns or less.

ASK: Does anyone remember what that measures and how it is different from micrograms?

A: Micrograms is a measurement of weight/mass, microns (or micrometer) is length.

A microgram is too small to see with the naked eye. For perspective we will look at something we can see.

	Activity: Guess what weighs closest to a gram. • Gather several common small objects including those shown on the next slide. Choose some that weigh more than a gram. • Hold each one up in front of the class and have people vote on whether they weigh approximately a gram or not. Go to the next slide to reveal which ones weigh close to 1 gram.
	Slide 30—(no title) These objects weigh approximately 1 gram each. The contents of one packet of sweetener is 1 gram. Teaching Tip: Have some packets of sweeteners available to open up and pour out or pass around the class. 50 micrograms of silica dust, the PEL, would be 50 millionths of that mass. Even when the air appears clear to you, respirable crystalline silica may be present in concentrations that can cause harm. Ask: True or False: Respirable crystalline silica has been determined to be toxic enough that even very small doses can put workers' health at risk. A: True To establish an effective PEL there needs to be a defined way to measure the dose and duration of exposure. The dose is determined by the amount of respirable crystalline silica present in the air and the duration is averaged over an 8-hour workday. But we need one more measurement to make this work.

How big is a cubic meter?

1 meter =
39.3701 inches

50 µg of silica
dust is so small it
may be not be
visible to workers
when suspended
in the air



Slide 31—How big is a cubic meter?

The other metric unit referenced in the PEL is a cubic meter which defines a space containing a certain volume of air.

Teaching Tip: Construct a prop to illustrate the volume of a cubic meter. If this is not possible, find spaces in the room (e.g. space under a table) that may help students visualize the space.

The average worker breathes about 16.8 cubic meters of air per day. At the PEL, an average worker would breathe-in 840 micrograms of silica into their lungs in one day. In a year at the PEL, a worker would breathe-in 218,000 micrograms (0.2184 grams) of silica into their lungs. Compare this fraction (just over 20%) of the gram of sweetener. That's the legal limit for silica dust a worker can breathe in a year!

Remember, hazardous levels of silica are not always visible. The only way to positively identify and quantify airborne contaminants is to monitor the air workers are breathing at the job site.

Interactions

Some substances, in combination, will increase the chance a worker will get sick.



Individual Characteristics

Age, gender, diet, state of health, pregnancy, use of medication, drugs and alcohol can change toxic effects



Slide 32—Interactions/Individual Characteristics

Two different substances may interact with one another and, in combination, create more harm.

A person's individual state of health overall can affect how they will respond to exposures.

ASK: Can anyone think of some examples of each?

A: An example is occupational exposure to respirable crystalline silica coupled with cigarette smoking. This combination puts you at much greater risk for getting lung cancer. Also, smokers exposed to the same levels of silica as non-smokers will suffer from silicosis at a greater frequency than non-smokers. Smokers will also suffer from silicosis at lower silica exposures than non-smokers.

If you have an existing health condition that already affects your respiratory system, or a compromised immune system, breathing silica dust may have a greater effect on you.

Putting it all together Silica is hazardous because: 	Slide 33—Putting it all together Review each item highlighted on the slide. Considering all of these factors, construction workers are at high risk. OSHA estimates that of all U.S. workers exposed to crystalline silica each year, close to 90% work in construction.
Section 2 Review and Questions  Name three important things you learned in this section. 	Slide 34—Section 2 Review and Questions ASK: Name three important things you learned in this section. Resolve any questions before proceeding to the next section.

Section 3: Tasks and Tools that Create Silica Dust

(35 minutes)

Key points in this section:

- Connect what kind of work tasks are commonly involved when working with materials that contain silica.
- Identify the tools that workers use when performing these tasks.
- Show that these tools create overexposure to dust if controls are not used.
- Even if you are not the one creating the dust, you may still be exposed.

Activity: Small groups think of tasks/tools that may create silica dust exposure.

Handouts: CPWR Silica-safe.org "Who's At Risk?" list of tasks and materials

Props: Samples of tools or materials



Slide 35—Section 3 title slide

These photos show workers engaged in different activities that seem to be creating dust.



Slide 36—It's dusty work...but somebody has to do it

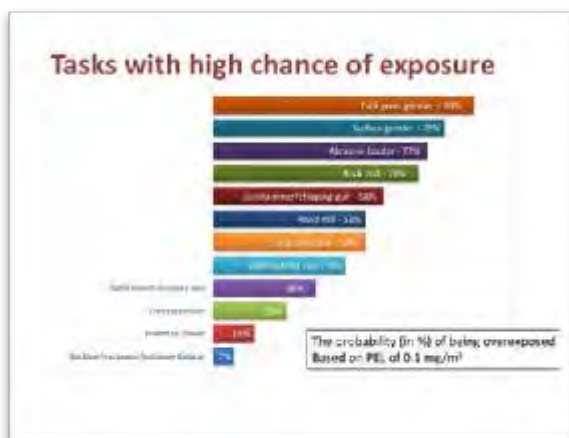
TEACHING ACTIVITY: the purpose of this activity is to get participants to think of construction tasks and tools that may expose them to silica dust.

Preparation: Have the class list of materials generated in the first activity posted where everyone can read it. Make enough copies of Slide 15 to give one to each group. Decide how you will divide the class into small groups. Make sure groups have paper/ pen/pencil.

Materials: flip chart or white board, multicolor pens, tape, handout, paper/pens for groups

	Activity: • Divide the class into small buzz groups of 3-4 people. • Post the class brainstorm list of materials from Section 1 and give each group a copy of Slide 15 (list of construction materials). • Ask the groups to review the list together and write down the tasks they perform and tools/equipment they utilize when working with those materials and note if these generate dust. What type of work is being done? Have them select one person from the group to report back to the class. • Allow no less than 10 minutes for the groups to work together. • Reconvene the class and ask each group to share one or two of their results with the class. Write their findings on a new flip chart page. There will be repetition of tasks, so it is good to give every group a chance to list one task/tool. • Discuss the results of the group exercise. • Save the lists of tasks/tools for later. • Have everyone return to their seats.
	Slide 37—Operations that create silica dust Compare the task/tool list just created by the class with these general categories of tasks shown on the slide. These categories came from the Cal/OSHA Silica eTOOL for construction. Discuss the following information from Cal/OSHA for each category: Cutting, drilling, coring: concrete; roof tile; tile backer; brick; block; granite. Grinding, sanding, sandblasting: Sack and patch; tuck point grinding; scabbling/scarifying; drywall mud sanding; hand-held surface grinding. Pulverizing: jack and chipping hammers; cement truck cleaning; concrete recycling; road milling; backhoes; excavators; demolition. Mixing: Cement; plaster; grout.

	Cleaning up: Dry sweeping; compressed air; hauling. On their Silica-Safe website, CPWR provides a similar list of work activities that expose workers to silica dust: Abrasive blasting Bushhammering Cutting/sawing Demolishing/disturbing Drilling Earthmoving Grinding Jackhammering Milling Mixing Polishing Roofing Sacking/patching Sanding Scabbling Scarifying Scraping Sweeping/cleaning up The key point is that there are many activities that may create exposure to respirable crystalline silica dust at construction sites.
	Slide 38—Group Discussion Have the class discuss the questions on the slide. Key points to make here: • Exposure can happen in all phases of construction. • All crafts have the potential for exposure at different levels. • Workers need to be aware that if they will be using certain tools to work with materials that contain silica, they may be exposed to levels of respirable crystalline silica that can cause harm.



Slide 39—Tasks with high chance of exposure

ASK: What do you notice about this chart?

This chart reflects the results of a study completed by the University of Washington Department of Environmental and Occupational Health Sciences in 2006.

It shows the likelihood of being overexposed to silica dust when using certain tools. The percentages indicate how often samples for that tool exceeded the Washington State allowable limit (or PEL) which was the same as that for California at the time of the study 11 years ago.

Researchers collected data for 12 common construction tools, using over 1,300 samples for a wide range of activities for both commercial and road construction. Average silica exposures for 7 (reading down from top of the list) of the 12 tools were over recommended exposure limits for workers at that time. The highest exposures were surprisingly high.

It is important to note that the permissible exposure limit has just been lowered to half the level it was when this study came out, meaning even more of the tools on this list would expose workers to dangerous levels of silica dust if appropriate controls are not used. There is still a significant risk to workers even at the new PEL for long term exposures.

"It wasn't me!"

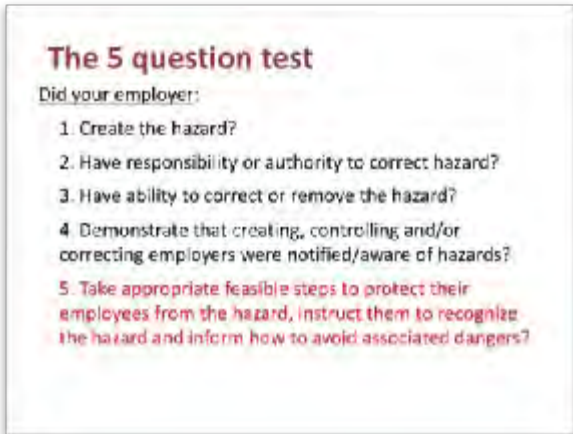
- Workers who are not "engaged" in the task but are working nearby may be exposed to silica hazards.
- May be covered by Multi-Employer Worksite regulations (OSHA & Cal/OSHA)
 - "Creating"
 - "Exposing"
 - "Controlling"
 - "Correcting"

Slide 40—"It wasn't me!"

What if you are not using any of the tools or performing tasks that create silica dust but you are working nearby? Do you still need to be protected?

The answer is yes. Even if you are not creating the dust, there are multi-employer regulations in place to protect you. Your employer is one of the following:

Creating—employer who actually created the hazard

	Exposing—employer whose employees were exposed to the hazard Controlling—employer responsible for safety and health conditions at worksite and authority for ensuring hazardous condition is corrected Correcting—employer responsible for actually correcting the hazard In California, Cal/OSHA regulations outline 5 questions that inspectors can use to determine if an employer is citable for exposing their workers.
 The 5 question test Did your employer: 1. Create the hazard? 2. Have responsibility or authority to correct hazard? 3. Have ability to correct or remove the hazard? 4. Demonstrate that creating, controlling and/or correcting employers were notified/aware of hazards? 5. Take appropriate feasible steps to protect their employees from the hazard, instruct them to recognize the hazard and inform how to avoid associated dangers?	Slide 41—The 5 question test If the answers to these 5 questions are as follows: 1. No 2. No (refers to authority to have the hazard corrected) 3. No 4. Yes 5. Yes Then the employer is not citable. Any other combination of answers means they are not in compliance with multi-employer regulations. It is assumed feasible to provide employees with the appropriate respiratory protection to protect them from respirable crystalline silica hazards at a minimum. Key point: Standards and regulations are the minimum that employers need to do to comply with the law. If you believe that you are being exposed to harmful levels of contaminants, including silica dust, tell your crew leader, foreman or job site safety manager immediately. When you attend weekly Tailgate Training/Toolbox Talks on-the-job, ask questions about the work you will be performing and the tools and materials you will be using. Preparing in advance for how you will be minimizing your exposure to silica dust is the best way to protect your health.

Section 3 Review and Questions



Name three important things you learned in this section.



Slide 42—Section 3 Review and Questions

ASK: Name three important things you learned in this section.

At this point in the training workers should be able to identify:

- What silica is and where it comes from
- That crystalline silica, especially quartz, is the form we are covering
- Which construction materials may contain crystalline silica
- That crystalline silica becomes a hazard when it is worked into respirable dust
- The tasks and tools common to construction that create silica dust
- That it's not just the workers engaged in the task that are at risk

Resolve any questions before proceeding to the next section.

Section 4: Health Effects of Silica Exposure

(45 minutes)

Key points in this section:

- Breathing respirable crystalline silica can lead to significant health effects, even death.
- The body part most affected is our lungs however, other organs can also be affected.
- Learn what silica actually does to the lungs and the signs and symptoms of disease.
- Silicosis is the disease most closely associated with silica exposure.
- Silicosis is permanent, irreversible but preventable.
- There are 3 types of silicosis.
- Silica dust has great historical significance in U.S. worker occupational health.

Activity: Group discussion; "Silica Exposure" video; Bricklayer testimony audio; "Silica in Construction: From danger to safety" video.

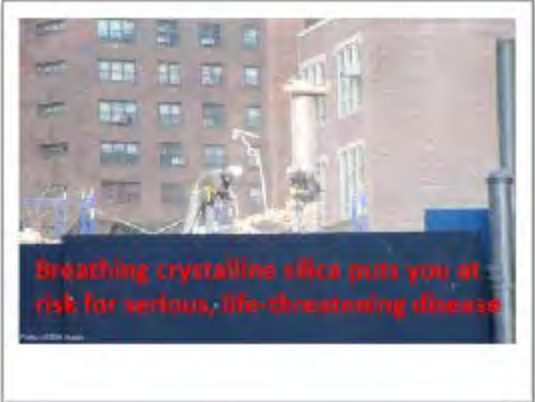
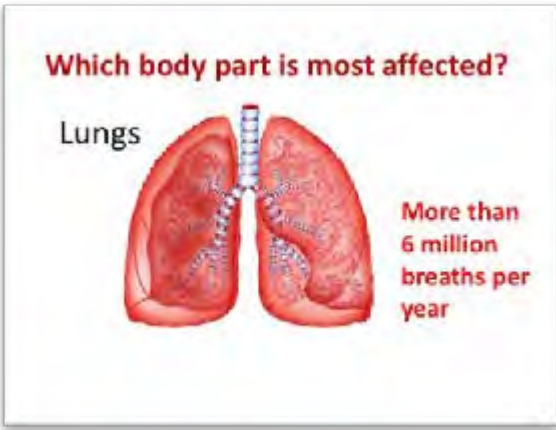
Handouts: OSHA Fact Sheet "Crystalline Silica Exposure Health Hazard Information"

Props:



Slide 43—Section 4 title slide

This segment of the training teaches the potential health effects resulting from silica dust exposure.

	Slide 44—Group Discussion Begin this section by determining if anyone in the class has personal experience with breathing silica dust and have them describe what happened and how it felt. Alternatively, participants may know of someone, perhaps a family member or co-worker who has been affected. Teaching Tip: Real-life, personal stories are very useful for engaging everybody, but as an instructor, you need to keep control of the time and assure that the point of the story stays on the topic of health effects.
	Slide 45—(no title) Silica dust needs to be taken seriously. As we learned in the last section, the risk for overexposure is high for construction workers. This photo shows workers wearing respiratory protection to reduce exposure to silica dust.
	Slide 46—Which body part is most affected? Click the slide to reveal the answer: Lungs Every cell in your body needs oxygen in order to live. Your lungs play a vital role in the process of getting oxygen into the bloodstream so it can be carried through your body and in removing the waste gas carbon dioxide from the bloodstream and exhaling it from your body. This process, essential to life, is automatically performed by your lungs and respiratory system.

Chances are you don't think much about your lungs. They work hard all the time and you may only pay attention to your breathing when something is wrong.

ASK: How many breaths do you think we take each year on average?

Click slide again to reveal the answer: On average, we breathe 12-15 times per minute at rest. That's more than 6 million breaths per year!

If your lungs are not able to function properly, your whole body is affected and your quality of life is diminished.

ASK: What would happen to your lifestyle if your lungs did not work properly?

Simple activities like...

- Walking

- Talking/communicating

- Cheering for your team

- Laughing

- Blowing out candles

- Holding your breath for swimming or diving

- Vigorous physical activity and exercise—

- hiking, sports,

- Playing with your kids and family

- Doing your job

...would become difficult.

Protecting your lungs on-the-job is critical for you and your loved ones.

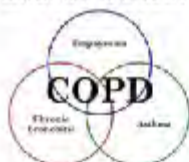
"Life is better when you breathe easier"

ASK: What diseases can you get from breathing silica dust?

Go to the next slide for answer.

Respirable crystalline silica causes:

- **Silicosis**—a serious lung disease
- **Lung cancer**—classified as a carcinogen
- **Chronic obstructive pulmonary disease**



Slide 47—Respirable crystalline silica causes:

Breathing-in crystalline silica can cause multiple diseases that can lead to disability and death.

OSHA estimates that 2 million construction workers are exposed to silica each year and each year, hundreds of workers die from illnesses caused by breathing in silica and thousands more become ill.

The primary disease associated with occupational exposure to crystalline silica is the incurable lung disease called silicosis.

Other diseases related to silica exposures and silicosis are:

Lung cancer: In 1997 the International Agency for Research on Cancer (IARC) published studies concluding that crystalline silica (quartz, cristobalite) is a human carcinogen (cancer causing). Data supports that silicosis increases risk for lung cancer. It is less clear whether silica exposure causes lung cancer without silicosis.

COPD (Chronic obstructive pulmonary disease): This is a chronic airflow limitation that is usually irreversible. It includes 4 interrelated disease processes: chronic bronchitis; emphysema; asthma; peripheral airways disease.

And contributes to:



Slide 48—And contributes to:

These other diseases on the slide.

When your lungs are compromised and overwhelmed by silica dust, they cannot kill infectious organisms and infections like TB (tuberculosis) can make you very sick.

Watch video:**Silica Exposure**

by Worksafe BC

http://www.youtube.com/watch?v=R_5C2wR9Uwc**Slide 49—Watch video:**

This short 2-minute video from Worksafe BC Canada demonstrates very well how silica gets deep into the lungs and how our body responds.

Silicosis Facts

- ✓ Permanent
- ✓ Irreversible
- ✓ No cure
- ✓ Worsens after exposure ends
- ✓ Deadly

Preventing exposure is your best defense

Slide 50—Silicosis facts

Review these important facts that were covered in the video.

3 types of silicosis:

- Chronic
- Acute
- Accelerated

**Slide 51—3 types of silicosis:**

ASK: Does anybody know what the terms "chronic" and "acute" mean?

A:

Chronic effects:

- Health effects develop slowly over time, usually months and years.
- Often involve low exposures, small doses over time.
- Can be difficult to relate the disease to the exposure because of the long time delay.
- Effects are usually not reversible.

Acute effects:

- Health effects occur immediately or soon after exposure.

- Often involve high exposure, large dose over a short period.
- Can be minor or severe.
- The relationship between the exposure to toxic substance and symptoms is generally obvious.

Chronic and acute silicosis may result in death.

Slide 52—(no title)

	Acute	Accelerated	Chronic
Airborne concentration of silica	HIGH	HIGH	Relatively LOW
Time of occurrence after initial exposure	Few weeks-5 years	5-10 years	10 or more years

Many cases of silicosis are not reported and many more are not properly diagnosed

This slide shows silica concentrations and the time it takes for health effects to develop for each of the three types of silicosis. The most important factor in the development of silicosis is the dose.

The delay between the exposure and appearance of disease caused by that exposure is called: latency period

ASK: What other exposures to construction hazards can you think of that cause health effects that occur gradually over time?

A: Noise and hearing loss, asbestos, lead.

The latency period for chronic silicosis can make it difficult to establish the cause-and-effect relationship between the exposure and the illness. Since chronic diseases develop gradually, you may have the disease for some time before it is detected. It is important for your physician to know if you are exposed to crystalline silica at work.

Many cases of silicosis are not reported and many more are not properly diagnosed.

Silicosis can worsen even after exposure ends!

Silicosis signs and symptoms:

Acute	Accelerated	Chronic
Cough	Similar to chronic but symptoms occur faster, rapidly progress	Shortness of breath
Weight loss		Crackles or wheezing in lungs
Fatigue		Lung capacity decreases over time
Chest pain		May need oxygen to help breath
Shortness of breath		
Low blood oxygen levels		

Slide 53—Silicosis signs and symptoms:

Most of us have at some time had a cold or flu that compromises our respiratory system. Imagine what it would be like to live with the symptoms shown here all the time.

Workers who have silicosis or other silica-related diseases have described it as feeling like you are not able to take a deep breath, wheezing, breathing with someone sitting on your chest or a plastic bag tied over your head. They also talk about fatigue and loss of stamina, being physically no longer able to do their normal activity which leads to depression.

Eventually, for some of these trades workers, symptoms reach the point where they are no longer able to work in their craft and must find other types of employment to make a living.

Resource: A good reference for more detailed information about health effects is the NIOSH Hazard Review "Health Effects of Occupational Exposure to Respirable Crystalline Silica" (2002) DHHS (NIOSH) Publication No. 2002-129

Workers speak up

Bricklayer stories of what it's like to live with silicosis.

Play audio



Slide 54—Workers speak up

The union members you're about to hear in the audio clip were testifying at federal OSHA hearings, describing how their lives were changed by silica related diseases.

Play 3:40 minute audio file

The audio file can be accessed on your flash drive or on the Safety HUB website at <http://safety.sbctc.org>

Silicosis: One of oldest occupational diseases



- Documented in 1700's
- Chronic effects tied to crafts
- Increased with use of new power tools

Slide 55—Silicosis: One of the oldest occupational diseases

Silica dust has been linked to health effects for thousands of years. In the 1700's chronic silicosis was documented by physicians who noted in autopsies of stone cutters that their lungs were hardened and filled with sand-like substances.

ASK: Why would newer tools increase silicosis cases?

A: They were more powerful and had greater potential to create dust. As the United States became more industrialized, hand tools gave way to powered tools. Introduction of the pneumatic hammer drill in 1897 and sandblasting in 1904 dramatically increased the number of silicosis cases.

The photo, from a 1911 U.S. Bureau of Mines technical paper, shows a worker wearing a self-contained oxygen breathing apparatus. The caption on the original photo read: "Salvus light apparatus: supplies oxygen for half an hour and weighs about 15 pounds."

ASK: Does anybody know of a silica disaster in the U.S.? Ask them to explain, then go to the next slide.

Hawk's Nest Tragedy

1930's Tunneling project
through rock containing
96-99% silica

Few records kept but
historians now believe
2000-2500 workers
contracted silicosis and
over 700 died.

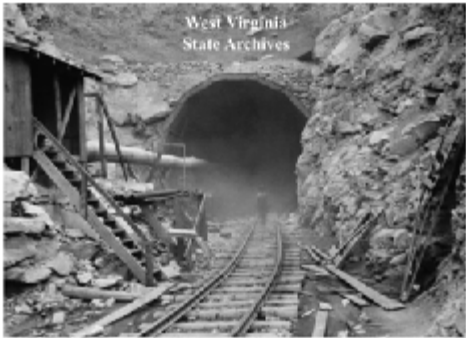


Slide 56—Hawk's Nest Tragedy

In the 1930's, silica dust was the focal point of the worst industrial disaster in US history.

Background information: During the "Great Depression" a project in West Virginia, known as the Hawk's Nest Gauley Bridge project, offered paying work to thousands, many African-American, desperate unemployed who were willing to travel to get a job to support their families. The job was to tunnel through a mountain of rock containing 96-99% silica.

The silica dust exposure was so intense that workers quickly got sick and many died from silicosis. Most of these victims only worked 6 months or less on the project. Actual numbers of the dead are hard to know because few records

	were kept. Hawk's Nest became an infamous tragedy, leading to lawsuits and Congressional hearings that would forever change attitudes toward worker health and safety. In 2017, 87 years later, we still face challenges in obtaining accurate data for work-related silicosis, resulting in possible underreporting.
 West Virginia State Archives Photo courtesy of: Elmer Wilson Collection, West Virginia State Archives	Slide 57—(Hawk's Nest tunnel photo) In this photo, we see a worker walking into the tunnel through a cloud of visible dust. The worker death rate on the job was so high that the company hired an undertaker to dispose of the bodies in unmarked graves in nearby fields. The employer's blatant disregard for workers' lives would be revealed later. Respiratory protection was not provided even though the employer knew of the danger. While acute silicosis was not yet described, the latency period of <u>chronic</u> silicosis was well known; the employer counted on workers completing the project and moving on before illness was tied to the job.
 Impact of Hawk's Nest • Revealed "Acute" silicosis • Directly connected exposure and illness • Spurred public outcry and increased demands for worker protection	Slide 58—Impact of Hawk's Nest The new "acute" form of silicosis presented an undeniable connection between job tasks and health effects. In the late 1930's silicosis became the first chronic disease incorporated into workers' compensation legislation in several states. There was even a blues song written in 1936 called "Silicosis is Killin' Me" by Pinewood Tom (Josh White). You can search YouTube and listen to the song. https://www.youtube.com/watch?v=gd4H1rAoHkk Government involvement in worker protection was growing. With people living longer, chronic diseases became more concerning as "retirement" became a new possibility. Perceptions were shifting about compensation, responsibility and the role of federal government in helping individuals. The Social Security program was created in 1935.

	As an industrial disease, silicosis brought attention to society's obligation to the workforce and ensuring decent quality of life after retirement. Resource: For information about the history of silicosis and the Hawk's Nest tragedy read these two books: <i>The Hawk's Nest Incident</i> by Martin Cherniack (1986) <i>Deadly Dust</i> by David Rosner and Gerald Markowitz (2006)
	Slide 59—Watch Video Show 8 minute SBCTC video "Silica in Construction: From danger to safety" This is a good review and transition to the next section on controlling hazards. The video file can be accessed on your flash drive or on the Safety HUB website at http://safety.sbctc.org
	Slide 60—Review and Questions ASK: Prompting questions: • Which body part is affected? A: Lungs • What disease is most associated with breathing silica dust? A: Silicosis • What other diseases are related to silica dust? A: Lung cancer; COPD; heart disease; kidney disease; vascular disease; autoimmune disease; tuberculosis • Name 3 types of silicosis. A: Chronic; acute; accelerated • Name symptoms of silicosis. A: shortness of breath; crackles/wheezing in lungs; decreased lung capacity; cough; weight loss; fatigue; chest pain; low blood oxygen levels • True or False: Silicosis is curable. A: FALSE, it is permanent and incurable, but preventable Resolve any questions before moving to next section.

Section 5: Controlling Silica Hazards

(45 minutes)

Key points in this section:

- How to use the Hierarchy of Controls
- What factors should be considered in assessing risk for silica exposure
- Workers learn engineering and administrative controls, best practices for working safely with silica and common PPE used for silica
- Examples of each type of control
- How to know if controls are working
- How air monitoring works
- Why PPE is less effective than engineering controls

Activity: Brainstorm ways dust is controlled on-the-job.

Materials: Flip chart/white board; multi-color markers; post-it notes 3 colors; flip chart page with Hierarchy of Controls pyramid drawn on it.

Handouts: CPWR Table of Best Practices; NJ Dept. of Health and Senior Services: What Physicians Need to Know About Occupational Silicosis and Silica Exposure Sources

Props: Samples of respirators; tools with integrated water or vacuum systems; air monitoring equipment



Slide 61—Section 5 title slide

The photo shows an unsafe work practice, scarifying concrete without using appropriate controls.

In this segment of the training we are going to learn ways to prevent exposure to silica dust. The best way to protect workers is to eliminate the hazard.

Your experience on-the-job

BRAINSTORM ACTIVITY

List all actions you've used to control silica.



Slide 62—Your experience on-the-job

Brainstorm Activity: Ask the class to think of all the ways they've seen dust being controlled at their job sites. What have they been told to do by their employers?

Write down the responses on a flip chart/white board and save for the next slide.

Hierarchy of Controls



Slide 63—Hierarchy of Controls

ASK: Raise your hand if you have heard of this before?

Click slide to reveal pyramid and ask someone in the class to explain.

Occupational health professionals use a system called the "Hierarchy of Controls" to categorize hazard control methods into three groups in order of effectiveness:

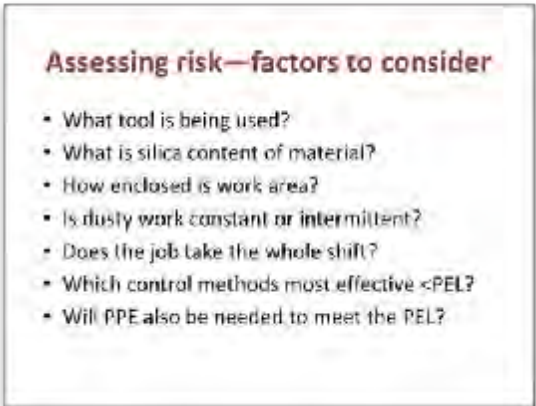
Engineering Controls

Administrative Controls

Personal Protective Equipment (PPE)

Engineering controls are designed to remove the hazard at the source, before it comes in contact with the worker. This could include design changes and modifications, equipment, systems and processes that reduce the source of exposure. Well-designed engineering controls can be highly effective in protecting workers and will typically be independent of worker interactions to provide this high level of protection.

Administrative controls alter the way the work is done, including timing of work, policies and other rules, and **work practices** such as standards and operating procedures (including training, housekeeping, and equipment maintenance, and personal hygiene practices). These controls don't

	actually remove or reduce the hazard and can be more difficult to implement. ASK: What does "PPE" stand for? A: Personal protective equipment PPE is worn by individual workers to reduce exposure such as contact with hazardous substances or exposure to noise. PPE includes items such as respirators, protective clothing such as gloves, face shields, eye protection, and footwear. In the pyramid shown here, the top section is divided into two categories. Often these are combined into one umbrella term of "engineering controls" but this one highlights that it is always best to eliminate the hazard altogether. Activity: Return to the list the class just brainstormed. Ask the class to categorize each entry on the hierarchy of controls.
 Assessing risk—factors to consider • What tool is being used? • What is silica content of material? • How enclosed is work area? • Is dusty work constant or intermittent? • Does the job take the whole shift? • Which control methods most effective < PEL? • Will PPE also be needed to meet the PEL?	Slide 64—Assessing risk—factors to consider These are some of the things to consider when assessing risk for silica dust exposures and determining the most effective controls. ASK: Would you add anything else to this list? Discuss

Engineering controls • Wet methods • Local exhaust ventilation (LEV) • Substitution • Isolation	Slide 65—Engineering controls These are the controls commonly used for silica. ASK: How do these eliminate the hazard? What is the <u>hazard</u>? A: silica dust A: All of these methods either suppress the dust at its source before it can become respirable or they eliminate the hazard by using a non-silica material or confining the dust to an enclosed area away from workers.
Examples of wet methods • Concrete/masonry saws that provide water to blade • Water hose to wet down dust at point of generation • During rock drilling, flow water through drill stem 	Slide 66—Examples of wet methods Water has been used as an effective dust suppressant for decades. It is important to be sure that water is applied at flow rates sufficient to minimize release of visible dust. Photo shows a stationary saw with no control and with water control.
	Slide 67—(Water control photos) Top photos: Handheld grinder with no control and with water control. Bottom photos: Handheld saw with no control and with water control.



Slide 68—(Water control photos)

Top photos: Walk-behind concrete saw with no control and with water control.

Bottom photos: Jackhammer with no control and with water control.

Examples of LEV methods

- Vacuum system captures dust close to source
- Integrate systems onto equipment that generates dust
- Use HEPA (high-efficiency particulate air) filter



Slide 69—Examples of LEV methods

Photos: Handheld grinder for tuckpointing with no control and vacuum control.

Vacuum systems capture dust at the source before it becomes respirable. Often these systems are equipped with high-efficiency particulate air (HEPA) filters.

OSHA defines HEPA filter as a filter that is at least 99.97% efficient in removing mono-dispersed particles of 0.3 micrometers in diameter.

Systems must be maintained according to manufacturers specifications to assure they are functioning at full efficiency.



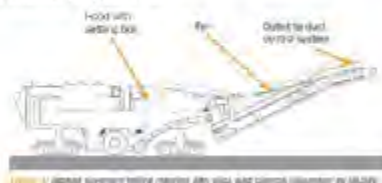
Slide 70—(Vacuum control photos)

Top photos: Right-angle grinder with no control and vacuum control.

Bottom photos: Handheld drill with no control and vacuum control.

Examples of control combinations

Asphalt pavement milling machines use ventilation and water-spray controls



Slide 71—Examples of control combinations

Some equipment utilizes both wet and LEV controls in combination as in this example.



Slide 72—(Control combo photo)

Photos: Vehicle-mounted drilling rig with no controls and with water and vacuum controls.

Are controls working?

- Follow manufacturer's instructions/specifications
- Use tools properly
- Do required maintenance and cleaning regularly
- Test the air for contaminants



Slide 73—Are controls working?

If there is any visible dust while using water or vacuum controls, the control system may not be working properly.

It is critical to maintain adequate water flow and air flow to assure the systems are functioning at the required efficiency to protect workers from respirable dust.

The only way to know the type and actual concentration of contaminants in the air at a given point in time is to perform air monitoring.

Air monitoring



Slide 74—Air monitoring

Monitoring is done by trained professionals such as industrial hygienists using specialized instruments that are properly calibrated.

They may perform general on-site monitoring of ambient air or personal monitoring of workers who are engaged in the tasks that are creating the silica dust.

General area monitoring is done to estimate possible exposure of a group of workers in a particular area.

A defined volume of air is needed to accurately calculate the concentration of silica in the sample collected. In this case that volume is a cubic meter of air. A concentration of respirable crystalline silica greater than $50 \mu\text{g}/\text{m}^3$ averaged over an 8-hour work day exceeds the new legal limit.

Air sampling equipment

Personal Air Pump with Cyclone



Slide 75—Air sampling equipment

If your employer is going to monitor the air you are breathing while you work, the professional doing the sampling will fit you with some equipment like that shown in the photo.

It is important that the sampling is performed while you are doing work that has the greatest potential to expose you to silica dust. Otherwise the results may not accurately represent your exposure levels.

To collect a sample representational of your day's exposure you need to use a personal air-sampling pump with a cyclone. The way the cyclone works is that there is a small inlet on the side, air whirls around, dust gets caught. The large/heavy particles fall to the bottom, the ones greater than 10 microns in diameter. The particles less than or equal to 10 microns collect on the filter. Personal sampling has to have the cyclone on it to be correct.

Personal Monitoring

- Determines individual worker exposure
- Done during a specific time period

Pump pulls air through a filter or tube, which traps the dust or toxin.



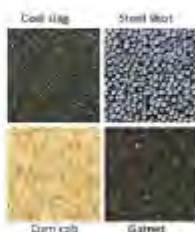
Slide 76—Personal Monitoring

Air monitoring may be done in a number of ways. Some toxins are measured by placing a small pump on your belt and a filter cassette or tube clipped on your collar with a flexible tube running between them. The filter or tube should be located as close as possible to your breathing zone (the air in front of your nose and mouth which you breathe).

The pump pulls air through the filter or tube, which traps the dust or toxin. After the sample has been taken, the filter or tube is sent to a laboratory. The laboratory uses scientific methods to measure the amount of contaminant on the filter or tube. It may take several days or longer before the results are ready from the laboratory.

Examples of substitution

- Eliminate the hazard
- Use silica-free materials when feasible
- Paints/coatings
- Abrasive blasting



Slide 77—Examples of substitution

Substitution means replacing a more hazardous material with a less hazardous material (silica-free) to do a project.

While this option is not feasible for certain construction materials, it is good to check for silica-free options in paints and coatings and for abrasive blasting.

The photos show 4 alternatives to silica sand for abrasive blasting: coal slag; steel shot; corn cob; garnet.

The OSHA website has a more extensive list of alternatives.

Examples of isolation • Separate the worker from the dust • Enclosed cab with ventilation/filtered air • Separate dusty operations from non-dusty areas  Abrasive blasting containment	Slide 78—Examples of isolation Discuss the examples on the slide. ASK: What precautions do you have to take for workers inside a containment area? A: While this method protects workers not involved in the dust-generating task, bystanders, and the environment outside the containment structure, it may substantially increase silica exposures of the workers doing the work inside the structure. Proper control methods need to be used to protect them such as wet methods, ventilation and PPE.
Administrative controls • OSHA standard • Written plan • Job/task planning • Air monitoring • Training • Best work practices 	Slide 79—Administrative controls These controls set policies and procedures and work practices. They include: - Work schedules/job rotation - Staffing levels - Maintenance - Supervision - Inspections - Job hazard analysis - Housekeeping - Providing shower/washing/eating facilities - Signage The next 2 slides give examples of best practices for contractors and workers for silica dust.
Best practices for contractors • Use controls to eliminate dust • Assign competent person • Provide proper respirators when needed • Substitute materials • Create a plan  Proper respirator use	Slide 80—Best practices for contractors <u>Contractors can:</u> 1. Assign an individual to control and monitor for silica on the job, such as a competent person – someone knowledgeable of applicable standards, is capable of identifying workplace hazards relating to the specific operation, and has the authority to correct them. 2. Use vacuums, water, substitutes, or different work practices to reduce or eliminate the dust.

	3. Provide workers with respiratory protection when other controls are not enough, which are properly fitted and appropriate for the exposure. 4. Use a substitute material instead of sand when abrasive blasting. For a list of substitutes, visit the OSHA website at: https://www.osha.gov/dsg/etools/silica/protect_against/protect_against.html#Substitute 5. Create a plan for working safely with silica. The “Create-A-Plan” section of the Silica-Safe website http://plan.silica-safe.org/ walks users through simple steps to identify silica hazards, ways to control the dust, and actions to work safely with silica.
 Best practices for workers • Use equipment and controls properly • Be aware • Participate • Don't bring dust home • Give your doctor silica info • Don't eat, drink, smoke, or apply cosmetics while near silica dust—wash hands/face	Slide 81—Best practices for workers It is possible to work safely with silica and enjoy a long, healthy career in the construction trades by following these simple best practices. <u>Workers can:</u> 1. Use all equipment and follow work practices provided to them by their employer to control the dust. <i>The controls won't work if they're not used.</i> 2. Be aware of the operations and the job tasks that can create crystalline silica exposures and know the steps that should be taken to prevent exposures. Report silica exposures/concerns to their employer, union representative, fellow employees. If the problem does not get resolved, employees can report the problem to OSHA. 3. Participate in training, exposure monitoring, and health screening and surveillance programs to monitor any adverse health effects caused by crystalline silica exposures. Raise silica awareness with co-workers.

	4. Wear disposable or washable work clothes and shower if facilities are available. Vacuum the dust from your clothes and change into clean clothing before leaving the work site. Do not brush or blow the dust off! Contaminated clothing has been found to be a significant contributor to silica exposures. Do not bring dust home! 5. Be aware of the health hazards related to exposures to crystalline silica. Smoking multiplies the lung damage caused by silica exposures. 6. Avoid eating, drinking, smoking, or applying cosmetics in areas where crystalline silica dust is present. Wash your hands and face outside of dusty areas before performing any of these activities. 7. Provide your doctor with a copy of the CPWR Physician's Alert for Silicosis (give this as a handout to the class) to ensure that you are properly diagnosed and treated. Many cases of silicosis and silica-related illnesses are misdiagnosed because physicians are unaware of their patient's work history and unfamiliar with the signs associated with this occupational illness. Without proper diagnosis and reporting, workers cannot receive suitable medical treatment and advice.
Personal protective equipment • Only if engineering and work practice controls aren't enough • Must be NIOSH approved • Employers must comply with OSHA silica and respiratory protection standards • Medical evaluations 	Slide 82—Personal protective equipment <i>This is not a respirator training program. The next few slides are intended to familiarize workers with the types of respiratory protection they may be asked to wear when working around silica dust. Workers who are required to wear respirators must be appropriately trained in compliance with current respiratory protection standards.</i> In some cases workers will be required to wear PPE when engineering and administrative controls do not keep exposures below the PEL. Employers must provide employees with appropriate respirators where required by the silica

standard. The respirators must comply with requirements of the silica standard and with OSHA's Respiratory Protection standard (29 CFR 1910.134).

ASK: What is NIOSH? A: The National Institute for Occupational Safety and Health

The Occupational Safety and Health Act of 1970 established NIOSH as a research agency focused on the study of worker safety and health, and empowering employers and workers to create safe and healthy workplaces. NIOSH is part of the U.S. Centers for Disease Control and Prevention, in the U.S. Department of Health and Human Services.



Slide 83—NIOSH-Approved Respirators

Air-purifying respirators have filters, cartridges or canisters that remove specific contaminants from the air by purifying the air through the cartridge before it reaches the worker. They can be full-face or half-face.

There are four respirator styles that would be good choices for controlling silica dust on construction sites. They are:

- a disposable N95 respirator
- a half face elastomeric respirator with P100 filter
- full face elastomeric respirator with P100 filter
- powered air-purifying respirator (PAPR) with P100 or HEPA filter.

ASK: What's the most common type of respirator used in construction for silica?

Respirator selection depends on the amount of exposure.

All respirators used should be NIOSH approved.

Commonly used respiratory protection for silica is a half-face air purifying respirator with 100 series filter.

For some crystalline silica generating tasks – for example jack hammering and wet saw cutting – a half-face respirator with P-100 filters will ordinarily provide adequate protection. For other tasks, like

	dry saw cutting, drilling in enclosed spaces, and grinding, a more protective respirator may be needed. ASK: Some standards require use of respirators with a specific "Assigned Protection Factor" (APF). What does this mean? A: Assigned Protection Factor is a number assigned by NIOSH representing the minimum anticipated protection provided by a particular type respirator that is functioning properly and being used correctly. An APF of 10 indicates that a worker using that respirator properly could expect to inhale no more than <u>one-tenth</u> of the airborne contaminant present.
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Why is PPE less effective than engineering controls? • Doesn't eliminate hazard • Can be uncomfortable and hot • Hard to communicate • Limited vision and movement and hand dexterity • Workers must know and remember how to use it properly • Difficult to maintain—it can break 	Slide 84—Why is PPE less effective than engineering controls? ASK: Why do you think PPE is so low on the hierarchy of controls and considered the last line of protection? Click slide to reveal answers.
Watch video:  <i>Eliminate the Hazard: McCarthy Drilling Project</i> By: SBCTC DISCLAIMER: This is a case study that illustrates the implementation of engineering controls for silica dust and is for educational purposes only. References to a specific employer or brand of equipment do not imply endorsement by either OSHA or the SBCTC and its affiliates.	Slide 85—Watch video: Show the 7 minute SBCTC video "Eliminate the Hazard: McCarthy Drilling Project" This video shows a large general contractor successfully using vacuum controls for drilling concrete. The video can be accessed on your flash drive or on the Safety HUB website at http://safety.sbctc.org
Section 5 Review and Questions  Name three important things you learned in this section. 	Slide 86—Review and Questions ASK: Name three important things you learned in this section. Prompting questions: • What are 2 engineering controls for silica dust? A: wet methods and Local exhaust ventilation/vacuum systems. • What kind of PPE is used for silica dust? A: NIOSH-approved air purifying respirator. • Why is it important to fit test respirators? A: a leaky respirator provides no protection to the worker wearing it • What are things you can do to protect yourself and your family from silica dust? A: Be aware of hazards, use controls properly, clean-up before leaving work, wash hands/face and don't eat/drink/smoke near silica dust, inform your doctor that you work with silica, participate in training and be involved at work.

Section 6: The New OSHA Standard

(30 minutes)

Key points in this section:

- Understanding basic components of the new 2016 federal silica standard
- Key compliance dates
- Action level and PEL
- Two control strategy options
- What is covered in "Table 1"
- What the Alternative Control option involves
- Requirements for all employers
- Resources for creating a written plan and the new small entity compliance guide

Activity: N/A

Materials: Flip chart/white board; multi-color markers; Jeopardy Game PowerPoint; timer; prizes

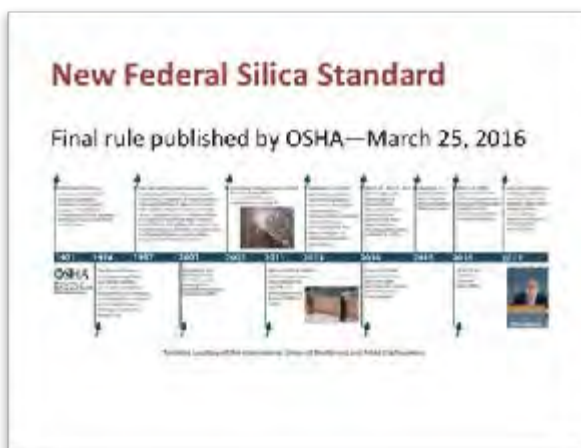
Handouts: OSHA FactSheet "OSHA's Crystalline Silica Rule: Construction; copy of Federal OSHA 2016 Silica standard; Sample Medical Evaluation Form; Post-Test; Course Evaluation form

Props: N/A



Slide 87—Section 6: The New OSHA Standard

This final section of the training discusses basic components of the 2016 federal OSHA Silica Standard for Construction.



Slide 88—New Federal Silica Standard

On March 25, 2016 federal OSHA published a long awaited final rule "§1926.1153 Respirable crystalline silica" for construction.

The timeline shown here was shared by the International Union of Bricklayers and Allied Crafts. It shows the long 45 year effort by unions and other worker advocates to make the case for an enforceable federal standard to protect construction workers from silica dust.

OSHA estimates that the new rule will save more than 600 lives and prevent over 900 new cases of silicosis each year.

Key dates:

June 23, 2016 new standard effective nationally

Why did we need a new federal standard? The first mandatory exposure limits from the early 1970's were inconsistent and based on outdated studies using old methods of measuring exposures. Researchers at the time knew those first limits were out of date even when they were put in place.

Federal standards have been slow to evolve and have not kept pace with power tool technology or research about silica exposures and health effects.

Scope of Coverage

- Quartz, cristobalite and tridymite
- All occupational exposures to respirable crystalline silica in construction work unless below Action Level



Slide 89—Scope of Coverage

The standard defines respirable crystalline silica as quartz, cristobalite, and/or tridymite contained in airborne particles that are determined to be respirable by a sampling device that meets specified standards. All 3 types of crystalline silica we talked about in Section 1 on Slide 13 of this training are covered.

It applies to all occupational exposures to respirable crystalline silica in construction work, except where employee exposure will remain below the **Action Level** under any foreseeable conditions.

Compliance Date



Construction employers must comply with all requirements by **June 23, 2017**

(except requirements for laboratory evaluation of exposure samples, which begin June 23, 2018)

Slide 90—Compliance Date

States with OSHA-approved state plans had six months to adopt a standard that is at least as effective as the Federal OSHA standard.

What does the new standard do?

- AL trigger - 25 $\mu\text{g}/\text{m}^3$ (8-hr TWA)
- Lower PEL - 50 $\mu\text{g}/\text{m}^3$ (8-hr TWA)
- Engineering controls and work practices to limit exposure

Slide 91—What does the new standard do?

Lowered the PEL to significantly reduce the amount of silica dust that workers can be exposed to on the job.

Establishes an Action Level that triggers the standard.

Requires employers to implement feasible engineering controls and work practices that limit worker exposures to respirable crystalline silica below a PEL and to take other steps to protect workers.

Provides flexibility to employers by giving the construction industry two different ways to comply.

Requires employers to:

Control exposures < PEL **AND** Comply with these

Specified Controls
Follow OSHA "Table 1"

OR

Alternative Controls
Air monitoring/
Objective data

1. Housekeeping
2. Written exposure control plan
3. Medical surveillance
4. Communication of hazards/training
5. Keep records

Slide 92—Requires employers to:

This training is intended to inform workers about the basics of the standard. For specific compliance questions, employers should consult with their local OSHA programs. There are many online resources available to help employers. The Resource Section of the Train-the-Trainer course binder has a number of links.

The new standard is written to allow employers flexibility to choose between two possible compliance strategies as shown on the slide.

To better understand the components of each option, we will look at them individually in more detail.

We will also look at what ALL employers must do under the new standard in later slides.

What is "Table 1"

Matches 18 tasks with effective dust control methods and respirator requirements

TABLE 1. RESPIRABLE DUSTS: CONTROL METHODS Which Workers With Multiple Entry Jobs Can Use Table 1			
Equipment Type	Engineering and Work Practice Control Methods	Respiratory Requirements: Protection and Silica/oxide Assigned Exposure Factor (AEFL)	
		24-hour shift	12-hour shift
1. All construction and maintenance work involving the use of power tools (chipping tools).	1. All workers using approved engineering and work practice control methods to reduce dust levels to the lowest feasible level.	1. N95 or equivalent	1. N95 or equivalent
	When used in conjunction with approved controls.	1. N95 or equivalent	1. N95 or equivalent

Slide 93—What is "Table 1"

Distribute copies of Table 1 to class participants.

For 18 common construction operations known to cause high exposures to silica, OSHA has spelled out exact engineering and work practice controls and respiratory protection known to be effective to reduce dust and best protect workers.

Employers who choose to follow Table 1 are not required to conduct sampling to measure workers' exposure to silica. They are effectively exempt from the PEL.

ASK: Why do you think employers don't have to comply with the PEL under this option?

A: As the OSHA standard is written, correctly implementing all controls specified in Table 1 will adequately suppress the dust to reduce worker respirable crystalline silica exposures to the PEL. Employers are not required to provide any additional protection if they follow Table 1.

Table 1 Tasks/Equipment

- Stationary masonry saws
- Handheld power saws
- Handheld power saws for fiber cement board
- Walk-behind saws
- Drivable saws
- Rig-mounted core saws or drills
- Handheld and stand-mounted drills
- Dowel drilling rigs for concrete
- Vehicle-mounted drilling rigs for rock and concrete
- Jackhammers and handheld powered chipping tools

Slide 94—Table 1 Tasks/Equipment

This slide and the next show the complete list of the Table 1 entries. OSHA anticipates that this will cover the vast majority of construction tasks that involve exposure to respirable crystalline silica.

Review the list with the class and compare to the list of tools they created in Section 3 of the training.

Table 1 Tasks/Equipment con't

- Handheld grinders for mortar removal (tuckpointing)
- Handheld grinders for other than mortar removal
- Walk-behind milling machines and floor grinders
- Small drivable milling machines
- Large drivable milling machines
- Crushing machines
- Heavy equipment and utility vehicles to abrade or fracture silica materials
- Heavy equipment and utility vehicles for grading and excavating

Slide 95—Table 1 Tasks/Equipment con't

Must fully/properly implement controls

- Presence of controls not sufficient
- Employers required to ensure:
 - ✓ Controls present **and** maintained
 - ✓ Employees understand/use properly

1. (1) Must follow up on controls	2. (2) Must perform control maintenance	3. (3) Must	4. (4) Must
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Slide 96—Must fully/properly implement controls

When implementing the controls in Table 1, the term “fully and properly implementing the controls” means that the controls need to be used in a manner that makes them effective.

For example, if you’re using a vacuum with a dust collection system on a grinder, you need to have the shroud intact so that it’s capturing the dust. You need to empty the vacuum and change filters as necessary, in order to ensure its effective.

You need to make sure that the hose is maintained, since it can deteriorate over time because silica is an abrasive. You would need to also make sure that the hose isn’t tied in knots, blocking the airflow, etc.

Click on the slide to activate box that highlights example of instructions in Table 1.

Option 2: Alternative Exposure Control

If employers do not follow Table 1, they must comply with section (d) of the standard

Alternative exposure control methods. (1) **Performance option.** The employer shall ensure that no employee is exposed to airborne concentrations of respirable crystalline silica in excess of 50 $\mu\text{g}/\text{m}^3$ calculated as an 8-hour TWA. (2) **Scheduled monitoring option.** The employer shall ensure that no employee is exposed to airborne concentrations of respirable crystalline silica in excess of 50 $\mu\text{g}/\text{m}^3$ calculated as an 8-hour TWA. (3) **Engineering and work practice controls.** The employer shall ensure that no employee is exposed to airborne concentrations of respirable crystalline silica in excess of 50 $\mu\text{g}/\text{m}^3$ calculated as an 8-hour TWA.

Slide 97—Option 2: Alternative Exposure Control

If employers chose not to follow the control methods in Table 1, they must follow section (d) "Alternative Exposure Control Methods" of the standard. This means employers must measure workers' exposure to silica and independently decide which dust controls work best to limit exposures to silica in their workplaces. There are 3 parts to using this option that cover PEL, monitoring, and methods of compliance.

Section (d) requires:

- Action Level and PEL apply
- Must do exposure assessment using either:
 - Performance option
 - Scheduled monitoring option
- Use engineering and work practice controls

Slide 98—Section (d) requires:

Under this option the following requirements apply:

1. PEL—the employer shall ensure that no employee is exposed to an airborne concentration of respirable crystalline silica in excess of 50 $\mu\text{g}/\text{m}^3$, calculated as an 8-hour TWA.

2. Exposure Assessment— The employers that follow the alternative are required to assess their employees' exposures to respirable crystalline silica anytime those exposures may reasonably be expected to be at or above action level of 25 microgram per cubic meter. This means they will need to do air monitoring at work sites. To meet this requirement they must choose one of the two following options:

Performance option OR Scheduled Monitoring option

Performance option: Exposures are assessed using any combination of air monitoring data or objective data sufficient to accurately characterize employee exposures to respirable crystalline silica. What does "objective data" mean? It is defined by the standard as information such as air monitoring data from industry-wide surveys or calculations based on the composition of a substance, demonstrating employee associated with a particular product or material or a specific process, task, or activity. The data must reflect workplace conditions closely resembling or with a higher exposure potential than

	the processes, types of material, control methods, work practices, and environmental conditions in the employer's current operations. The challenge is that there may not be sufficient data available at this time. Scheduled monitoring option: Employers must perform initial and periodic personal monitoring to assess the 8-hour TWA exposure for each employee on the basis of one or more personal breathing zone air samples that reflect the exposures of employees on each shift, for each job classification, in each work area under a prescribed schedule as follows. If monitoring indicates: Initial below the AL: no additional monitoring Most recent at or above the AL: repeat within 6 months Most recent above the PEL: repeat within 3 months When two consecutive non-initial results, taken 7 or more days apart, are below the AL, monitoring can be discontinued. Reassess if circumstances change
	Slide 99—OSHA Small Entity Compliance Guide OSHA has created this 103 page guide to help employers comply with the new silica standard. It is accessible online as a PDF or you can order copies from OSHA. This gives detailed information about each section of the standard.

All employers must comply with these sections of new standard:



Slide 100—All employers must comply with these sections of the new standard:

These requirements of the standard apply to **ALL** employers regardless of which compliance option they choose to use when the silica standard is in effect.

The next 6 slides cover some of the requirements.

For recordkeeping, employers must maintain records for the following:

- Air monitoring data—includes exposure measurements, information about samples taken and methods used, and employee information such as name, social security number*, job classification of all employees represented by the monitoring, PPE used.
*This might change in CA due to identity theft concerns.
- Objective data--accurate record of all objective data relied upon to comply with the requirements of the standard.
- Medical surveillance records--The employer shall make and maintain an accurate record for each employee covered by medical surveillance

Housekeeping: workers need to know



If contributes to silica exposure:

- Dry sweeping or brushing
- Use of compressed air for cleaning surfaces or clothing

NOT allowed unless used with ventilation

Slide 101—Housekeeping: What workers need to know

Housekeeping requirements are included in the standard because certain housekeeping methods can contribute substantially to worker exposure to respirable crystalline silica, such as dry sweeping/dry brushing, and use of compressed air.

The standard requires use of methods such as HEPA vacuums, wet sweeping, or use of ventilation system to capture the dust.

Dry sweeping/ dry brushing or use of compressed air would only be permitted if no other alternative method is feasible.

Employers must have written plan for managing silica exposure

- Available to each employee
- Describes tasks, controls, PPE, procedures, housekeeping, restricted access to work areas
- Designates a **Competent Person**



Slide 102—Employers must have written plan for managing silica exposure

Employers must establish and implement a written plan for respirable crystalline silica that includes the following:

- Description of tasks that involve exposure.
- Description of engineering controls, work practices and respiratory protection used to limit exposures for each task.
- Description of housekeeping measures used to limit exposures.
- A description of the procedures used to restrict access to work areas, when necessary, to minimize the number of employees exposed to respirable crystalline silica and their level of exposure, including exposures generated by other employers or sole proprietors.

The employer shall:

- Review and evaluate the effectiveness of the written exposure control plan at least annually and update it as necessary.
- Make the written exposure control plan readily available for examination and copying, upon request, to each employee covered by this section, their designated representatives, the Assistant Secretary (OSHA) and the Director (NIOSH).
- Designate a **competent person** to make frequent and regular inspections of job sites, materials, and equipment to implement the written exposure control plan.

Duties of competent person

- Identify existing and foreseeable hazards
- Authority to take prompt corrective measures
- Frequently/regularly inspect job sites, material and equipment



Slide 103—Duties of competent person

The employer must inform employees of who the competent person is. Workers need to know who can take action.

The competent person must have the ability to identify the hazards AND the authority to take action.

Medical exam available at no cost

- If you wear a respirator 30 or more days/year for silica exposure
- Exam includes:
 - Medical/work history
 - Physical exam
 - Chest x-ray
 - Pulmonary function test
 - Tuberculosis test



Slide 104—Medical exam available at no cost

Employers are required to make medical surveillance available at no cost to the employee, and at a reasonable time and place, for each employee who will be required under this section to use a respirator for 30 or more days per year. The exam must be performed by a physician or other licensed health care professional.

What type of exam can a worker expect to have as part of the required medical surveillance?

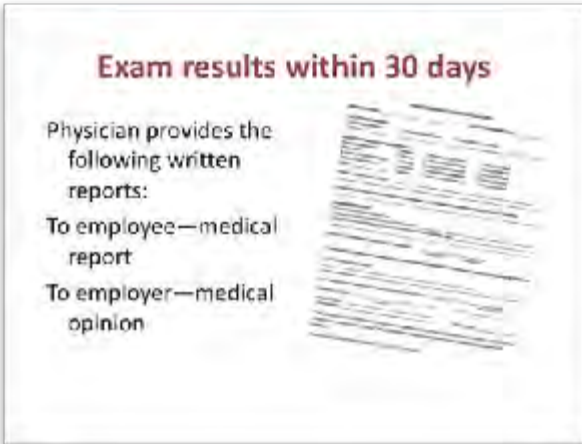
At the initial exam:

- Medical and work history
- Physical exam with emphasis on respiratory system
- Chest x-ray
- Pulmonary function test
- Tuberculosis test

Periodic exams--The employer shall make available medical examinations at least every three years, or more frequently if recommended.

Employers are also required to make sure the physician has a copy of the silica standard and provide the following information:

- Description of the employee's former, current, and anticipated duties as they relate to the employee's occupational exposure to respirable crystalline silica

	• Employee's former, current, and anticipated levels of occupational exposure to respirable crystalline silica • Description of any personal protective equipment used or to be used by the employee, including when and for how long the employee has used or will use that equipment • Information from records of employment-related medical examinations previously provided to the employee and currently within the control of the employer
	Slide 105—Exam results within 30 days What happens with the results of the medical exam? Workers have the right to get a copy. Training Tip: Pass out copies of the Medical Evaluation form from your course binder The standard specifies the following: Employees—Within 30 days of the exam, the physician must provide the employee with a written medical report and explain the results to the employee. The report must contain the following information: • Statement indicating the results of the medical examination, including any medical condition(s) that would place the employee at increased risk of material impairment to health from exposure to respirable crystalline silica and any medical conditions that require further evaluation or treatment; • Any recommended limitations on the employee's use of respirators; • Any recommended limitations on the employee's exposure to respirable crystalline silica; and • A statement that the employee should be examined by a specialist if the chest X-ray

	meets certain criteria, or if referral to a specialist is recommended by the physician. Employers—Get a written medical opinion from the physician within 30 days of the exam. This written opinion will contain the following information: • Date of the examination; • Statement that the examination has met the requirements • Any recommended limitations on the employee's use of respirators. • With written authorization from the employee, the employer may also receive the following medical exam information: • Any recommended limitations on the employee's exposure to respirable crystalline silica; • A statement that the employee should be examined by a specialist The employer must provide the employee with a copy of the medical opinion within 30 days of the medical exam.
Hazard communication and training Workers must have:  Access to: • Labels on material containers • Safety Data Sheets And receive: • Hazard information • Training	Slide 106—Hazard communication and training Employers are required to comply with the hazard communication standard (HCS) (29 CFR1910.1200). The employer shall ensure that each employee has access to labels on containers of crystalline silica and safety data sheets, and is trained in accordance with the provisions of HCS. They must also ensure that at least the following hazards are addressed: Cancer, lung effects, immune system effects, and kidney effects. TRAINING: The standard requires employers to provide training to employees so they can demonstrate knowledge and understanding of at least the following: • The health hazards associated with exposure to respirable crystalline silica;

	• Specific tasks in the workplace that could result in exposure to respirable crystalline silica; • Specific measures the employer has implemented to protect employees from exposure to respirable crystalline silica, including engineering controls, work practices, and respirators to be used; • The identity of the competent person designated by the employer; and • The purpose and a description of the required medical surveillance program
 Section 6 Review and Questions  Name three important things you learned in this section. 	Slide 107—Review and Questions ASK: Name three important things you learned in this section. Prompting questions: • Name two compliance options. A: Follow Table 1 or use Alternative exposure control and do air monitoring • What is the new PEL for silica? A: $50 \mu\text{g}/\text{m}^3$ averaged over 8-hour day • What must a competent person do? A: Identify hazards; be authorized to take action; frequently inspect job sites, material and equipment • Name 4 things a doctor must perform at a medical exam. A: physical exam, chest x-ray, pulmonary function test, tuberculosis test

Course Wrap-Up and Review

(30 minutes)

Activity: Jeopardy review game

Materials: Flip chart/white board; multi-color markers; Jeopardy Game PowerPoint; timer; prizes

Handouts: Post-Test; Course Evaluation form

Props: N/A

Slide 108—Review game

Activity: Play the review game—teams compete in Jeopardy

Materials: Jeopardy PPT file; flip chart/white board to keep track of scores; multi-colored markers; timer; prizes for winning team

- Divide class into teams; each team chooses a fun name
- Decide how teams will select categories
- Teams select category and dollar value
- Moderator clicks \$xxx on that square to reveal the clue and gives team 30 seconds to answer. If their answer is incorrect, another team can try.
- Click "Answer" button to reveal correct answer
- Click "Home" button to return to main board
- Each correct answer earns that dollar amount for the team; track scores on flip chart/white board
- Finish all categories and give prizes to the members of winning team

Review Game



Work safely with silica and enjoy a healthy career in the trades Thank you for attending this training.  Photo courtesy: CCHRI	Slide 109—Work safely with silica and enjoy a healthy career in the trades Thank everyone for their participation in the training. ASK: Do you have any questions or comments about anything we've covered today? Be sure everyone knows where they can get more information if needed. Have students complete their post-tests and course evaluation form.
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SiO ₂	Hazard	Dusty Work	My Health	In Control
\$200	\$200	\$200	\$200	\$200
\$400	\$400	\$400	\$400	\$400
\$600	\$600	\$600	\$600	\$600
\$800	\$800	\$800	\$800	\$800

This common mineral is found in rock, soil and sand

Answer

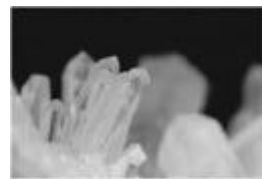
What is SILICA

HOME

This type of silica causes harm to workers

Answer

What is Crystalline



HOME

Most common form
of crystalline silica

Answer



Quartz

HOME

While more rare,
these forms of
crystalline silica are
more toxic

Answer

What are
Cristobalite and
Tridymite

HOME

Crystalline silica is a
hazard when it
becomes this

Answer

What is
respirable dust

HOME

According to OSHA,
workers should not be
exposed to more than
this concentration of
silica

[Answer](#)

What is the Permissible
Exposure Limit:
50 micrograms/cubic meter of
air averaged over 8-hour day.

[HOME](#)

The metric symbol
“ μg ” means this
fraction of a measure
of weight

[Answer](#)

What is a microgram,
one millionth of a
gram

[HOME](#)

This combination
puts you at much
greater risk for
getting lung cancer

[Answer](#)

What is exposure to
respirable crystalline
silica and smoking

[HOME](#)

Doing this to
concrete may create
hazardous silica dust

Answer

What is cutting,
drilling, coring,
grinding, pulverizing

HOME

Using silica to do
this job creates very
high exposures to
harmful dust

Answer

What is abrasive
blasting or
sandblasting

HOME

A U of W study found
this task >80% likely to
overexpose workers to
hazardous silica dust

Answer

What is tuckpoint
grinding

HOME

Four categories of
responsibility on
multi-employer
worksites

Answer

What are:
Creating
Exposing
Controlling
Correcting

HOME

Silica seriously
damages this
body part

Answer

What are your lungs



HOME

In 1997 crystalline
silica was listed as
this in humans

Answer

What is a
carcinogen
(cancer causing)

HOME

These 3 forms of this disease are most associated with silica dust exposures

Answer

What are acute, accelerated and chronic silicosis

HOME

Shortness of breath, wheezing, and decreased lung capacity are symptoms of this disease

Answer

What is Chronic silicosis

HOME

This pyramid helps define control strategies

Answer

What is the Hierarchy of Controls



HOME

These are preferred
because they
eliminate the hazard

Answer

What are
Engineering
controls

HOME

These two methods
are the primary ways
to control silica dust

Answer

What are wet
methods and local
exhaust ventilation

HOME

This says employers must
control exposure to silica,
create a plan, train
workers, and offer
medical surveillance

Answer

What is the 2016
federal OSHA Silica
Standard for
Construction

HOME

SILICA IN CONSTRUCTION

Training Pre-Test

Name: _____

Date: _____

Instructor: _____

Location: _____

1. Which of the following is true about silica?
 - a. Occurs naturally
 - b. Is a chemical compound
 - c. Is a common mineral
 - d. All of the above
2. In which of the following is silica found?
 - a. Mortar, concrete, and plaster
 - b. Paints
 - c. Asphalt
 - d. Brick
 - e. All of the above
3. The hazardous type of silica is referred to as:
 - a. Amorphous
 - b. Crystalline
 - c. Cristobalite
 - d. None of the above
4. Crystalline silica is found in rocks from every geologic era and from every location around the globe.
 - a. True
 - b. False
 - c. I don't know
5. List two ways to find out if construction material contains silica:
 - a. _____
 - b. _____
6. Which of the following statements is true regarding respirable dust:
 - a. Particle size is greater than 10 microns.
 - b. You can expel it from the body by coughing, sneezing, blowing your nose.
 - c. Is visible in the air so you know when you're exposed.
 - d. Can penetrate deep into your lungs.
 - e. All of the above statements are true.

SILICA IN CONSTRUCTION

7. Complete the sentence: Grinding, jackhammering, drilling, cutting and blasting all
 - a. allow silica dust to settle.
 - b. reduce the presence of silica dust.
 - c. allow silica dust to become airborne.
 - d. put workers at low risk for silica exposure.
 - e. None of the above
8. How many construction workers are potentially exposed to silica every year?
 - a. Nearly 1 million
 - b. Nearly 2 million
 - c. Nearly 200,000
 - d. None of these
9. The three types of silicosis are:
 - a. Active, acute, and chronic.
 - b. Chronic, active, and accelerated.
 - c. Accelerated, chronic, and acute.
 - d. Acute, active, and accelerated.
10. This type of silicosis occurs within a few weeks to five years after exposure to high concentrations of silica dust:
 - a. Chronic
 - b. Active
 - c. Accelerated
 - d. Acute
11. List three engineering controls for silica exposure:
 - a. _____
 - b. _____
 - c. _____
12. What is the current permissible exposure limit (PEL) for crystalline silica?
 - a. 0.1 mg/m^3 over 8-hr TWA
 - b. $25 \text{ }\mu\text{g/m}^3$ over 8-hr TWA
 - c. 50 mg/m^3 over 8-hr TWA
 - d. $50 \text{ }\mu\text{g/m}^3$ over 8-hr TWA
13. Workers must always wear personal protective equipment (PPE) because engineering controls do not protect them from silica dust exposures.
 - a. True
 - b. False
14. Workers should change into clean clothing before leaving the worksite because contaminated clothing has been found to significantly contribute to silica exposures.
 - a. True
 - b. False

SILICA IN CONSTRUCTION

Training Post-Test

Name: _____

Date: _____

Instructor: _____

Location: _____

1. Which of the following is true about silica?
 - a. Occurs naturally
 - b. Is a chemical compound
 - c. Is a common mineral
 - d. All of the above

2. In which of the following is silica found?
 - a. Mortar, concrete, and plaster
 - b. Paints
 - c. Asphalt
 - d. Brick
 - e. All of the above

3. The hazardous type of silica is referred to as:
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 - b. Crystalline
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4. Crystalline silica is found in rocks from every geologic era and from every location around the globe.
 - a. True
 - b. False
 - c. I don't know

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 - a. _____
 - b. _____

6. Which of the following statements is true regarding respirable dust:
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SILICA IN CONSTRUCTION

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 - a. True
 - b. False

SILICA IN CONSTRUCTION

Training Pre/Post-Test Answer Key

1. Which of the following is true about silica?
 - a. Occurs naturally
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2. In which of the following is silica found?
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3. The hazardous type of silica is referred to as:
 - a. Amorphous
 - b. Crystalline
 - c. Cristobalite
 - d. None of the above

4. Crystalline silica is found in rocks from every geologic era and from every location around the globe.
 - a. True
 - b. False
 - c. I don't know

5. List two ways to find out if construction material contains silica:
Acceptable answers: Product label; Safety Data Sheet; Published data/online; Analyze a sample of material.

6. Which of the following statements is true regarding respirable dust:
 - a. Particle size is greater than 10 microns.
 - b. You can expel it from the body by coughing, sneezing, blowing your nose.
 - c. Is visible in the air so you know when you're exposed.
 - d. Can penetrate deep into your lungs.
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SILICA IN CONSTRUCTION

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10. This type of silicosis occurs within a few weeks to five years after exposure to high concentrations of silica dust:
 - a. Chronic
 - b. Active
 - c. Accelerated
 - d. Acute
11. List three engineering controls for silica exposure:
Acceptable answers: Wet methods; Local exhaust ventilation (LEV); Substitution; Isolation
12. What is the current permissible exposure limit (PEL) for crystalline silica?
 - a. 0.1 mg/m^3 over 8-hr TWA
 - b. $25 \text{ }\mu\text{g/m}^3$ over 8-hr TWA
 - c. 50 mg/m^3 over 8-hr TWA
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 - a. True
 - b. False

SILICA IN CONSTRUCTION

Train-the-Trainer Course Evaluation

Training Date: _____ Your Name (optional): _____

Instructors: _____

Thank you for taking the time to complete this evaluation. Your feedback is important and will be used to improve the program.

OVERALL TRAINING EXPERIENCE

Please rate individual aspects of the training by circling the appropriate number below:

	Poor	Fair	Good	Excellent
Content of training	1	2	3	4
Organization of training	1	2	3	4
Quality of presenters	1	2	3	4
Relevance to your work	1	2	3	4
Opportunity for participation	1	2	3	4
Quality of materials/binder	1	2	3	4
Training venue	1	2	3	4
Overall course rating	1	2	3	4

Comments:

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SILICA IN CONSTRUCTION

INDIVIDUAL TRAINING ELEMENTS

Please circle the appropriate rating for each component of the Silica in Construction training:

	Not useful	Useful	Very useful
Curriculum	1	2	3
PowerPoint slides	1	2	3
Laminated slides	1	2	3
Videos:			
	1	2	3
	1	2	3
	1	2	3
	1	2	3
Guest Speakers:			
	1	2	3
	1	2	3
Training segments:			
1. Introduction to silica	1	2	3
2. Silica as a hazard	1	2	3
3. Tasks and tools that create silica dust	1	2	3
4. Health effects of silica exposure	1	2	3
5. Controlling silica hazards	1	2	3
6. The new OSHA standard	1	2	3
Jeopardy Review Game	1	2	3
Practice Teaching	1	2	3

How confident are you teaching co-workers or students about silica hazards in construction using the material from this course? Circle one:

Not confident

Somewhat confident

Confident

Comments:

SILICA IN CONSTRUCTION

- 1) What did you like most about the training?

- 2) How could the training be improved?

- 3) What was the most important thing you learned from this training?

- 4) How do you plan to use what you learned in this training?

- 5) What additional health & safety training would you like to receive?

Other comments:

SILICA IN CONSTRUCTION

Resource Guide

Organizations

OSHA

OSHA's final rule web page

<https://www.osha.gov/silica/index.html>

Includes links to a lot of information, a very moving video, and a link to the final rule in the Federal Register.

Also has links to:

- FAQs: Respirable Crystalline Silica Rule_
https://www.osha.gov/silica/Silica_FAQs_2016-3-22.pdf
Includes a brief sections on health effects, who is at risk, why the new rule, economic impact, compliance dates, and more
- Factsheet: OSHA's Crystalline Silica Rule: Construction_
<https://www.osha.gov/Publications/OSHA3681.pdf>
- Factsheet: Workers' Exposure to Respirable Crystalline Silica: Final Rule Overview_
<https://www.osha.gov/Publications/OSHA3683.pdf>

OSHA's Silica web page

<https://www.osha.gov/dsg/topics/silicacrystalline/>

Has links to:

- Fact Sheets on controlling the hazard in construction with several different types of equipment_
https://www.osha.gov/dsg/topics/silicacrystalline/control_measures_silica.html#factSheets
- Health Effects_
https://www.osha.gov/dsg/topics/silicacrystalline/health_effects_silica.html
- Hazard Recognition_
https://www.osha.gov/dsg/topics/silicacrystalline/hazard_recognition_silica.html
- Control Measures with Resources for the Construction Industry_
https://www.osha.gov/dsg/topics/silicacrystalline/control_measures_silica.html

Small Entity Compliance Guide for the Respirable Crystalline Silica Standard for Construction [2016]
OSHA

<https://www.osha.gov/Publications/OSHA3902.pdf>

OSHA's New National Emphasis Program: Crystalline Silica ppt. 2008.

- For Employers and Professional Groups_
https://www.osha.gov/dte/library/silicosis/silica_nep_2008_employer_prof.ppt
- For Employees_
https://www.osha.gov/dte/library/silicosis/silica_outreach_2008_employee/index.html

OSHA Silica Advisor

Taking Action to Protect Against Silica

https://www.osha.gov/dsg/etools/silica/protect_against/protect_against.html

Has a list of silica substitutes, engineering controls, work practices, and ppe's with the pros and cons listed for each

Deaths from Silica in the Workplace

https://www.osha.gov/dsg/etools/silica/determine_exposure/silicadeaths/silicadeaths.html

Two charts showing the observed number of deaths from silicosis per occupation and then per industry divided by the expected number of deaths.

Measuring the amount of silica

https://www.osha.gov/dsg/etools/silica/measure_amount/measure_amount.html

Has a diagram of a cyclone filter assembly

Comparing your exposure to OSHA's limit

https://www.osha.gov/dsg/etools/silica/compare_to_limit/compare_to_limit.html

Includes a link to an Advisor Genius to do the calculation for you

NIOSH

Topic page: Silica

<http://www.cdc.gov/niosh/topics/silica/default.html>

Silica in Industry

<http://www.cdc.gov/niosh/topics/silica/industry.html>

a listing of NIOSH publications on silica

Respiratory Protection Recommendations for Airborne Exposures to Crystalline Silica.

DHHS (NIOSH) Publication Number 2008-140

<http://www.cdc.gov/niosh/docs/2008-140/>

NIOSH Pocket Guide to Chemical Hazards

- Silica, crystalline (as respirable dust)
<http://www.cdc.gov/niosh/npg/npgd0684.html>
- Silica, amorphous
<http://www.cdc.gov/niosh/npg/npgd0552.html>

Silicosis: Learn the Facts! [2004]

<https://www.cdc.gov/niosh/docs/2004-108/pdfs/2004-108.pdf>

20 page booklet full of fact sheets. Lots of pictures. Includes information on what silicosis is, who gets it, keeping the family safe, symptoms, how to stay safe, respirators

Silicosis: Number of deaths, death rates (per million population), and years of potential life lost (YPLL) by state, U.S. residents age 15 and over, 1996–2005

<http://bit.ly/2jVNLXa>

CPWR

Working Safety with Silica web site

<http://www.silica-safe.org/>

- Know the Hazard
<http://www.silica-safe.org/know-the-hazard>
- Training and Other Resources
<http://www.silica-safe.org/training-and-other-resources>
Provides links to silica-specific materials in a variety of formats including toolbox talks, presentations, videos, hand-outs, and training guides
- What's Working
<http://www.silica-safe.org/whats-working>
Links to 8 videos and 6 photos
- Create-a-Plan to Control the Dust
<http://plan.silica-safe.org/>
A free online tool designed to help contractors and others responsible for job-site safety develop a written exposure control plan to protect workers engaged in work that produces respirable silica dust

Trainings

It's Not Just Dust – It's Silica [2010]

Parson's Corporation presentation

www.mashainc.com/2010Conf/Parsons%20Presentation%20-%20Silica%20in%20Construction.ppt

Given at the Mid-Atlantic Safety and Health Alliance, Inc. 2K10 Safety Conference, Session 1: Silica in Construction Training Kit

Presentations

Silica

www.silica-safe.org/training-and-other-resources/presentations/asset/8-Training-OSHA-Silica-Detailed-Presentation.ppt

OSHA's New National Emphasis Program for Crystalline Silica for Employees [2008]

<http://www.silica-safe.org/training-and-other-resources/presentations/asset/9-Training-OSHA-2008-National-Emphasis-Program-Crystalline-Silica-presentation-for-employees.ppt>

Silica [2010]

OSHA

by Larry Joswiak, MPH 2010

<http://www.silica-safe.org/training-and-other-resources/presentations/asset/11-Training-OSHA-Silica-Presentation-3-31-10-Larry-Joswial-MPH.ppt>

Silica in Construction Training Kit

Washington State Dept. of Labor and Industries

<http://www.lni.wa.gov/SAFETY/TRAININGPREVENTION/TRAININGKITS/silicainconstruction/default.asp>

Includes instructor's guide, powerpoints, pdfs, handouts, script. Has a link to an online interactive version of this training. Lists typical jobs where workers are exposed.

Toolbox talks:

- Silica Toolbox Talk (CPWR)
http://www.silica-safe.org/training-and-other-resources/toolbox-talks/asset/Silica_9-4-13-1.pdf
- Silica Toolbox Talk in Spanish (CPWR)
<http://www.silica-safe.org/training-and-other-resources/toolbox-talks/asset/slice.pdf>
- Preventing Silicosis (Reagan Power Driven Services)
<http://reagansafety.com/TailGateMtgs/English/prevsie.htm>

Understanding and Implementing the New Construction Silica Standard

CPWR

<http://www.silica-safe.org/regulations-and-requirements/osha>

Webinar on the new silica standard. Explains the CPWR online tool 'Create-a-Plan to Control the Dust'

Videos

Controlling Silica Dust – Learning from Each Other: Videos

CPWR listing of some of the videos available on the web taken from a variety of sources

<http://www.silica-safe.org/whats-working/controlling-silica-dust-learning-from-each-other>

"Deadly Dust" Silica 9:13

OSHA

<https://www.youtube.com/watch?v=eXsGJ1C4Xcw>

Personal story; physical effects discussed; vacuums shown; Dr. David Michaels speaks

Silica Exposure 2:00

WorkSafeBC

https://www.youtube.com/watch?v=R_sC2wX9Uwc

explains how the silica makes workers sick

Stop Silicosis 3:11

OSHA

<https://www.youtube.com/watch?v=HABylzQSuU&feature=youtu.be>

Frances Perkins; personal story by worker

General

Construction Silica Exposures and Solutions [2006]

University of Washington

http://depts.washington.edu/silica/pdf/Construction_Silica_Exposure_and_Solutions-web.pdf

includes a look at 12 tools and solutions including respirators. 6 pgs

Construction Workers Should Know: Silica: It's More than Dust [2014]

Department of Environmental and Occupational Health Sciences, University of Washington

<http://depts.washington.edu/silica/index.html>

Includes a tool to help workers select the respirator to use based on the tool and environment that they're in.

Guides for Managing Crystalline Silica Control Programs In Construction [2002]

Mount Sinai-Irving J. Selikoff Center for Occupational & Environmental Medicine, Construction Hygiene

and Ergonomics Program and Hunter College, Urban Public Health Program, CUNY

<http://www.blueprintproject.org/silica.pdf>

This is a series of individual “how-to” guides for managing silica in construction activities. It was designed to aid construction managers in planning, implementing, and integrating health hazard control programs for crystalline silica in daily operations.

It’s Not Just Dust! [4/15]

OR/OSHA

<http://osha.oregon.gov/OSHAPubs/3301.pdf>

16 page nicely laid out booklet with lots of information and pictures

Notes from the Field: Update: Silicosis Mortality — United States, 1999–2013

MMWR, CDC

http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6423a7.htm?s_cid=mm6423a7_e

Respirator Guidance Based on Silica Exposure Modeling for the Construction Industry [2007]

University of Washington

<http://depts.washington.edu/silica/pdf/Respirator%20Prediction2.pdf>

Silicosis: Learn the Facts! [2004]

NIOSH

<https://www.cdc.gov/niosh/docs/2004-108/pdfs/2004-108.pdf>

20 page booklet full of fact sheets. Lots of pictures. Includes information on what silicosis is, who gets it, keeping the family safe, symptoms, how to stay safe, respirators

Silica Exposures for Common Construction Tasks

U Wash

http://deohs.washington.edu/sites/default/files/images/general/silica_exposuresbrochure.pdf

2 page brochure

Silicosis in Sandblasters: A Case Study Adapted for Use in U.S. High Schools [2002]

NIOSH

<http://www.elcosh.org/document/2155/d000048/Silicosis%2Bin%2BSandblasters%253A%2BA%2BCase%2BStudy%2BAdapted%2Bfor%2BUse%2Bin%2BUS%2BHigh%2BSchools.html>

This training booklet provides clear information about silica exposures and how to prevent resulting lung damage, while focusing on 10 sandblasters at one company in Texas, who had silicosis in 1988-89. One section mentions a case in 1936, known as the Hawk's Nest incident, when more than 1,000 workers tunneling through a mountain in West Virginia are believed to have died from silicosis on the job.

Silica Dust: Competent Person Training: References and Resources Handout [2014]

CNA

<http://precast.org/wp-content/uploads/2011/05/Silica-Resources-and-References-vCSHEC2014.pdf>

A nice 8 page document with many resources

Includes links to 21 YouTube videos and two 30 second videos from New Jersey Dept of Health showing the difference between using dust controls vs no controls. Also has links to Spanish language materials.

Working Safely With Silica: What Employers and Employees Can Do to Prevent Silicosis [6/2015]
State Compensation Insurance Fund
<http://www.silica-safe.org/training-and-other-resources/toolbox-talks/asset/slice.pdf>

Trades/Tasks

OSHA's New National Emphasis Program: Crystalline Silica ppt. 2008.

For Employers and Professional Groups

https://www.osha.gov/dte/library/silicosis/silica_nep_2008_employer_prof.ppt

Slide 11 is titled: Probable Use of Silica, and has a list of industries, occupations, and materials that indicate that Silica is used at your work and that it is airborne.

Silica Exposures for Common Construction Tasks

University of Washington

http://deohs.washington.edu/sites/default/files/images/general/silica_exposuresbrochure.pdf

2 page brochure

NEPSI: The European Network for Silica [2006]

<http://www.nepsi.eu/>

NEPSI is the acronym for the *European Network for Silica* formed by the Employee and Employer European sectoral associations having signed the Social Dialogue "Agreement on Workers' Health Protection Through the Good Handling and Use of Crystalline Silica and Products Containing it" on 25 April 2006.

This site includes a link to the Good Practice Guide on Workers Health Protection through the Good Handling and Use of Crystalline Silica and Products Containing It

http://www.nepsi.eu/sites/nepsi.eu/files/content/editor/good_practice_guide_-_english_original_additional_task_sheets_-251006_modified_16072012-.pdf

Explains occupational exposure and health effects before detailing a large number of tasks (jobs) where workers might come into contact with silica. Each task has its own factsheet which provides advice on dust control while doing the job in the workplace. They typically discuss design and equipment, ppe's needed, training, a checklist, and more. A very EU viewpoint, with EU regulations, but also with some good general information that might be of interest.

Silica Manager for the Construction Industry

Georgia Tech

<http://www.oshainfo.gatech.edu/silica/silica-matrix.pdf>

The enclosed document is intended for construction safety personnel who need assistance in developing safe work practices for employees exposed to silica dust. This easy to use matrix references common construction tasks, control measures, and the respiratory protection recommended for each task. The matrix consists of those construction tasks which are associated with high exposures to silica.

Fact Sheets

Construction Dust: Respirable Crystalline Silica [updated Oct 2016]

WorkCover Queensland, Australia

<https://www.worksafe.qld.gov.au/construction/workplace-hazards/silica-exposure-a-serious-risk-for-construction-workers>

Health Alert: Silica Exposure in Construction Workers [2009]

Connecticut Department of Public Health

http://www.ct.gov/dph/lib/dph/environmental_health/eoha/pdf/silicaconstructionfall2009.pdf
short fact sheet

Learn About Silicosis [nd]

American Lung Association

<http://www.lung.org/lung-health-and-diseases/lung-disease-lookup/silicosis/learn-about-silicosis.html>
short fact sheet

Silica Hazard Alert [nd]

Cal/OSHA

http://www.dir.ca.gov/dosh/dosh_publications/P08-019V3.pdf

Protect Yourself from Silicosis

U Wash

http://depts.washington.edu/silica/pdf/pocketcard_poster.pdf

one page fact sheet with controls on it; a respirator chart at the bottom with 4 types of respirators matched to 11 tools

What Can I Do to Protect Myself and My Family?

OSHA

https://www.osha.gov/dte/library/silicosis/what_can_i_do.html

Key Terms

It's Not Just Dust! [4/15]

OR/OSHA

<http://osha.oregon.gov/OSHAPubs/3301.pdf>

16 page nicely laid out booklet with lots of information and pictures. Includes a list of key terms on pg 9.

Silicosis in Sandblasters: A Case Study Adapted for Use in U.S. High Schools [2002]

NIOSH

<http://www.elcosh.org/document/2155/d000048/Silicosis%2Bin%2BSandblasters%253A%2BA%2BCase%2BStudy%2BAdapted%2Bfor%2BUse%2Bin%2BUS%2BHigh%2BSchools.html>

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Includes a glossary.

How Adults Learn Best

MAKE THE TRAINING RELEVANT

Adults need to see that the subject matter and the teaching methods are relevant to their lives and what they want to learn.

Find out beforehand about the participants, and what they're most interested in learning. Use examples and discussions in the training that reflect participants' own experiences, and are relevant to their needs.



RESPECT PEOPLE'S EXPERIENCES, KNOWLEDGE, AND SKILLS

Adults come to the class with a wealth of prior experience and knowledge. They are more open to learning if treated with respect.

Explain to the class that participants will learn from each other, and plan activities that build on and incorporate participants' own experience.

BUILD ON PREVIOUS LEARNING

Adults learn best when they can relate new material to what they already know. Learners need road maps, with clear objectives. Each new piece of information needs to build logically on the last.

Avoid presenting large amounts of new information all at once. Use visual aids. Be sure to allow time for breaks and questions. Make sure everyone is ready for the next step before proceeding.

USE DIVERSE TRAINING METHODS

Adults have different learning styles. Some people learn better if the material is reinforced with visual aids, and some learn better through hands-on activities. Learning works better when information is presented in different ways.

Use a variety of teaching activities, including brainstorming, discussion, visual aids, role plays, games, and case studies. Change the pace and the method frequently, especially when covering difficult and abstract topics.

ENCOURAGE CLASS PARTICIPATION

When adults are involved in and help direct their own learning, they are more engaged and learn more. People need to practice as they learn, and hear things more than once to remember them.

Encourage questions and discussion during the class. Use hands-on practice, role playing, non-competitive quizzes, and other exercises often. Incorporate information presented earlier into new activities. Remember that an instructor's skill in asking questions and analyzing people's answers is of greater value than flooding the class with a mass of information they can get elsewhere or don't need.

An old proverb says:

Tell me, I forget.

Show me, I remember.

Involve me, I understand.



Training Steps

1. **DO A NEEDS ASSESSMENT.** Find out about your audience and their training needs. What do they already know, and what do they want to learn?
2. **SET OBJECTIVES.** Objectives help you focus on what is most important. Aim for the bull's-eye: emphasize the essential information.
3. **SELECT TEACHING METHODS.** Training is most effective when you use a variety of methods. People learn in different ways and retain more if they hear, see, and practice. Some useful methods are games, role plays, case studies, demonstrations, small group activities and brainstorming.
4. **DEVELOP A TRAINING PLAN.** A training plan is an outline that spells out what activities and methods you will use, how much time each activity will take, and what materials you will need.
5. **PRESENT THE TRAINING.** Follow your training plan as much as possible, but be flexible in meeting participants' needs.
6. **EVALUATE TRAINING AND REVISE TRAINING PLAN AS NEEDED.** Get participants' feedback on how well the training went and how effective it was. Decide what needs to be changed and improve your training plan for next time.

Your Training Plan

Topic: _____

Time	Activity	Instructor's Notes	Materials Needed

Aim at What is Essential to Know

Sometimes trainers try to cover too much material and lose sight of what is most important.

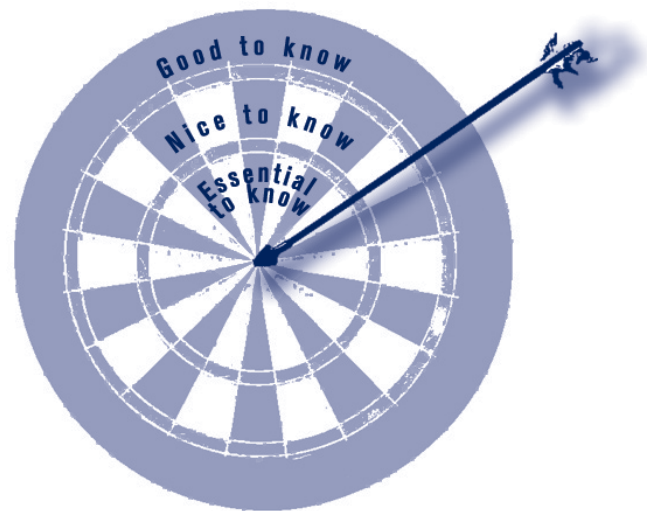
Being selective is critical. Determine whether the material you want to teach is:

- Essential to know,
- Good to know, or
- Nice to know.

Your main aim is to cover what is essential. Since your teaching time is limited, you need to aim carefully.

Aim for the bull's eye. Ask yourself:

- Why am I teaching this?
- In what way will this prepare the person to stay safe at work, or to perform a new skill?
- Could this time be better used to teach something else that's more important, or to teach the same thing in a better way?



Aim your teaching at what is most essential!

Memory and Learning Methods

Hear Only



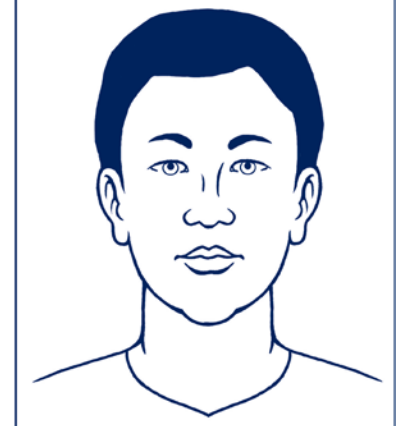
20% Retained

See Only



30% Retained

Hear + See



50% Retained

Hear + See + Discuss + Practice



90% Retained

Teaching Methods Chart

TEACHING METHODS	STRENGTHS	LIMITATIONS	PREPARATION
Lecture	Presents factual material in direct, logical manner. Can include personal experiences which inspire. Stimulates thinking to open a discussion. Works for large audiences	Experts may not always be good teachers. Audience is passive. Learning is difficult to gauge.	Needs clear introduction and summary. Needs limits on time and content to be effective.
Brainstorm	Allows creative thinking and new ideas. Encourages full participation because all ideas are equally valued.	Can become unfocused. Needs to be limited to 10-15 minutes.	Instructor must select and clearly define the problem or questions, then ask for all ideas (without debate or comment), which are recorded on board.
Large Discussion	Pools ideas and experiences from the group. Effective after a lecture, film, story, or brainstorm that needs to be analyzed.	Not practical with more than 20 people. A few people can dominate, while others may not participate.	Needs careful planning by instructor to guide the discussion. Needs advance preparation of questions and key points to bring out in the discussion.
Small group Discussion	Allows participation of everyone in small groups (4-6 people). Develops group process skills.	Needs careful thought as to the purpose and task of group.	Needs preparation of specific tasks or questions for group to answer.

Teaching Methods Chart (CONTINUED FROM PREVIOUS PAGE)

TEACHING METHODS	STRENGTHS	LIMITATIONS	PREPARATION
Risk Mapping	Small groups creates a visual map of hazards, controls, and plans for action. Does not rely on reading or writing skills. Useful as a follow-up tool after discussion.	Works best for workers from the same or similar workplace.	The work areas being mapped need to be chosen carefully to make sure they are relevant to participants.
Case Studies	Develops analytic and problem-solving skills. Allows for exploration of different solutions. Allows students to apply new knowledge and skills.	People may not see the relevance to their own situation.	The scenario must be clearly defined to be effective. Need to pose the right questions for drawing out critical thinking.
Role Playing	Introduces a problem dramatically. Develops analytic and problem-solving skills. Allows people to assume roles of others and understand their views. Allows for exploration of different solutions. Allows for practice in speaking up.	People may be too self-conscious. May not be appropriate for large groups.	Need to define the problem and roles clearly.
Report Back Session	Allows for full class discussion after role plays, case studies, and small group exercises. Gives people a chance to reflect on what happened.	Can be repetitive if each small group says the same thing.	Instructor should prepare questions to focus the discussion, so it is not repetitive.

Teaching Methods Chart (CONTINUED FROM PREVIOUS PAGE)

TEACHING METHODS	STRENGTHS	LIMITATIONS	PREPARATION
Hands-on Practice	Provides classroom practice of learned behavior (use of equipment, techniques, etc.).	Requires enough time, appropriate physical space, and equipment.	Instructor has to obtain, set up, and check equipment.
Worksheets and Questionnaires	Allows people to think for themselves without being influenced by others. Individual thoughts can then be shared with small groups or the entire class.	Can be used only for a short period of time. Can be isolating since people work alone. May not work if participants have literacy or language limitations.	Instructor has to prepare handouts, select questions, and have a clear idea of the goal. Materials may need to be translated into other languages. Participants should be encouraged to ask for help and work with others.
Audiovisual Materials (videos, DVDs, etc.)	Entertaining way of teaching content and raising issues. Keeps audience's attention. Effective in large groups.	Too many issues may be presented at once to have a focused discussion. Follow-up discussion may not have full participation.	Need AV equipment set up in advance. Effective if instructor prepares questions to discuss after the show. Need to screen material ahead of time to make sure it is relevant and well-organized.

Training Evaluation Checklist

The trainer:

- ☐ Respects the participants, and the knowledge and experience they bring to the class.
- ☐ Knows the participants' needs and tailors the training to these needs (makes it relevant, builds on what they already know).
- ☐ Uses participatory, interactive methods that actively involve the learners and draw on their own skills and knowledge.
- ☐ Uses a variety of different training methods to keep things interesting and to accommodate diverse learning styles.
- ☐ Uses "hands-on" activities whenever possible.
- ☐ Uses good props, demonstration equipment, visuals, etc.
- ☐ Is careful to do more listening than talking.
- ☐ Demonstrates enthusiasm and commitment to health and safety.
- ☐ Is well-prepared in advance and has a clear training plan.
- ☐ Makes expectations clear from the beginning.
- ☐ Gives an overview of what the training will cover.
- ☐ Avoids giving a talk or lecture for more than 10 minutes at a time.
- ☐ Involves all participants, not just some.
- ☐ Creates a safe learning environment for all participants.
- ☐ Recognizes and accommodates cultural and linguistic differences among participants.

Your Training Plan

Topic:

TIME	ACTIVITY	INSTRUCTOR'S NOTES	MATERIALS NEEDED

