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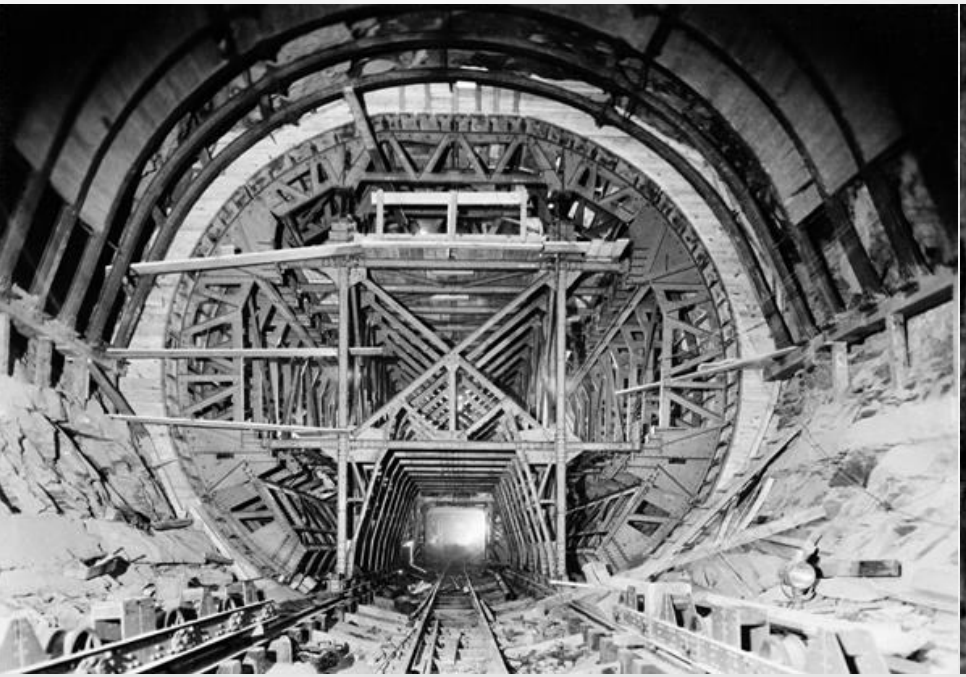
Silica:
The Invisible Hazard in Construction

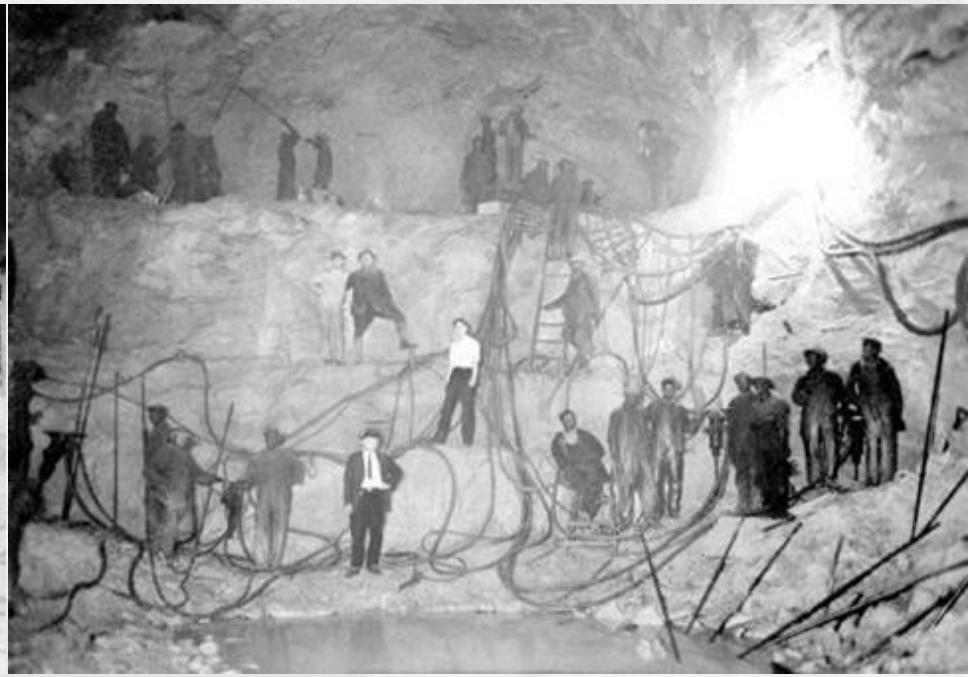
Kristy Thornton, MS, COH
Local Director – San Diego

Agenda

- Brief History & Health Effects
- Understanding the Standards
- Exposure Control Plan

Hawk's Nest – Deadly Dust



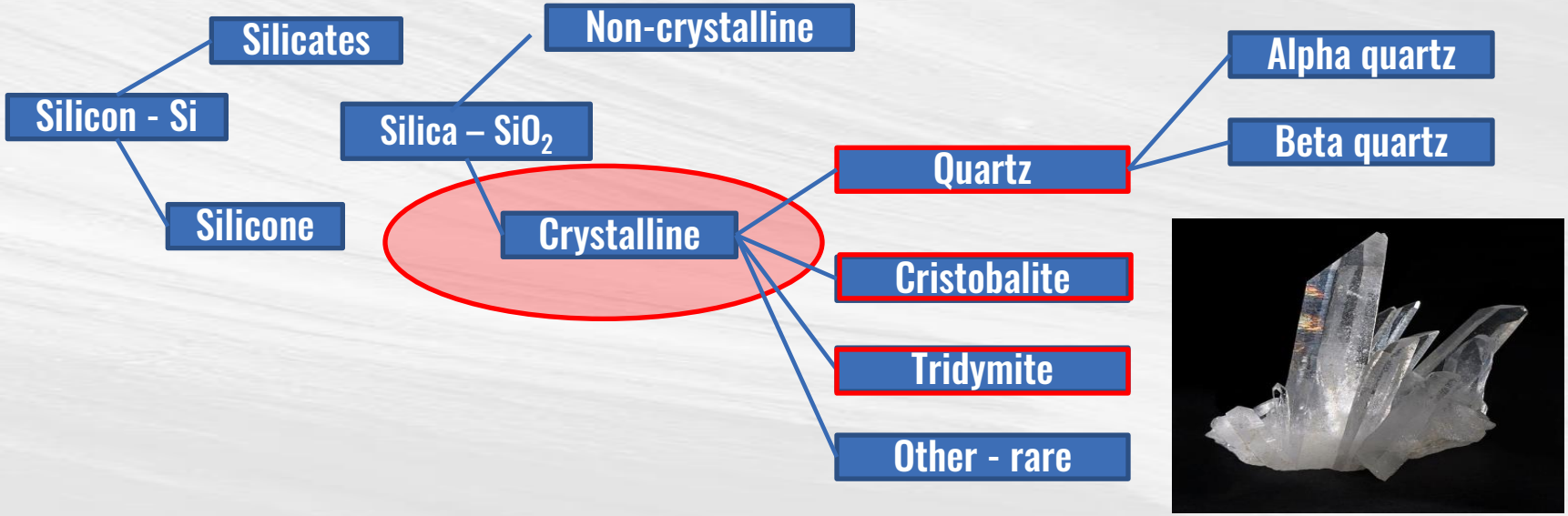


Graphic courtesy of OSHA

About 2.3 million people in the U.S. are exposed to silica at work.

Silica – What is it?

- Relationship between the forms of Silicon



From: Special Publication - Crystalline Silica Primer, US Bureau of Mines, Washington DC, Branch of Industrial Minerals.

Silica - Where is it?

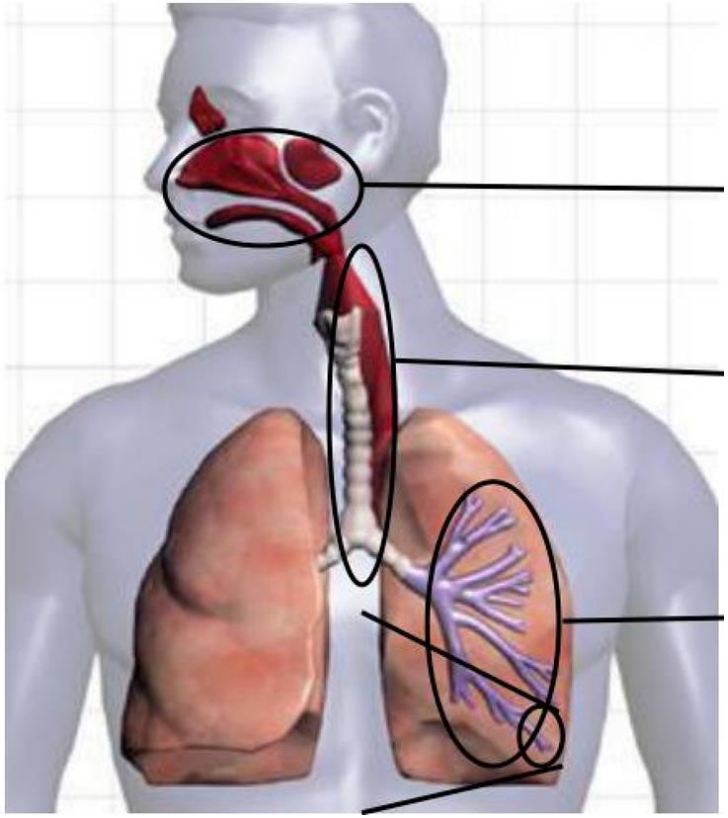
- Sand
- Soil and rock
- Gravel
- Sandstone
- Slate
- Granite
- Clay

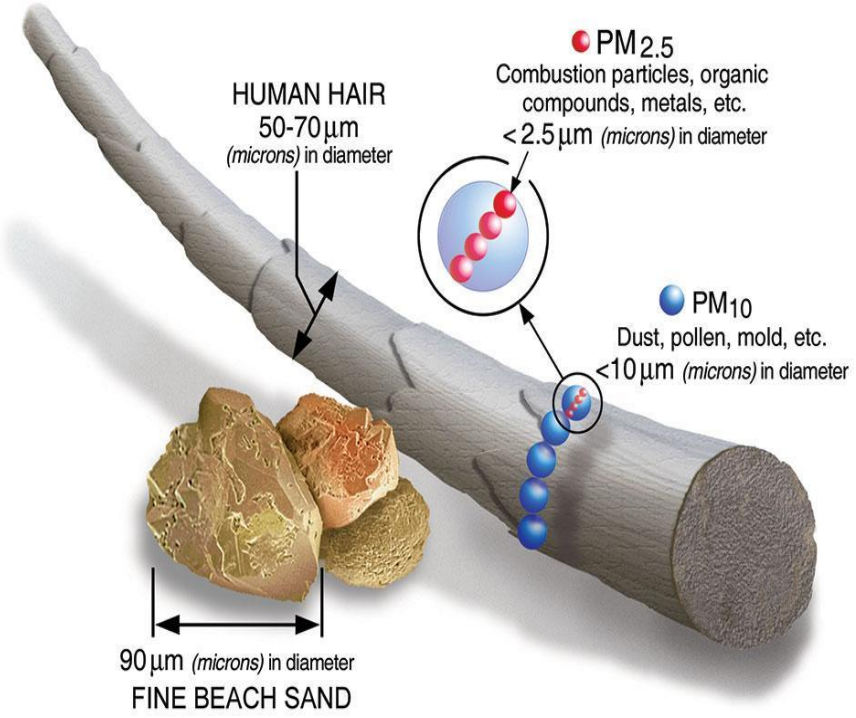
Silica – What Industries

- ❑ Engineered stone fabrication
- ❑ Concrete mixing and cutting
- ❑ Sandblasting
- ❑ Brick and stone cutting
- ❑ Foundry work
- ❑ Construction
- ❑ Mining (including metal, stone, aggregate and coal mining)
- ❑ Fracking (hydraulic fracturing for natural gas extraction)
- ❑ Pottery manufacturing
- ❑ Many others

Silica - Construction

- Quartz is in concrete, brick, & mortar materials.
- Typical exposure to silica occurs during any mechanical work on silica containing material (dust creation).
  - grinding, cutting, jack hammering, chipping, & drilling into concrete; pointing of masonry
  - mixing and handling of (manufacturing concrete, demolition, and disposal)



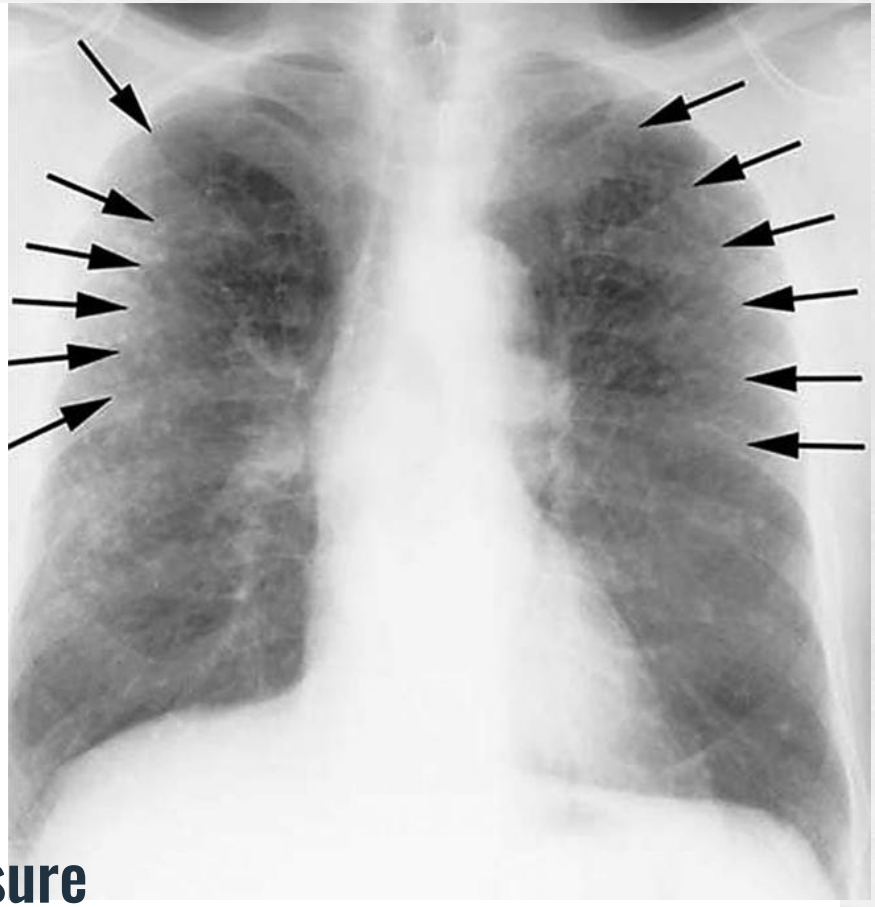


https://www.euroenvironmental.co.uk/news/item/dust

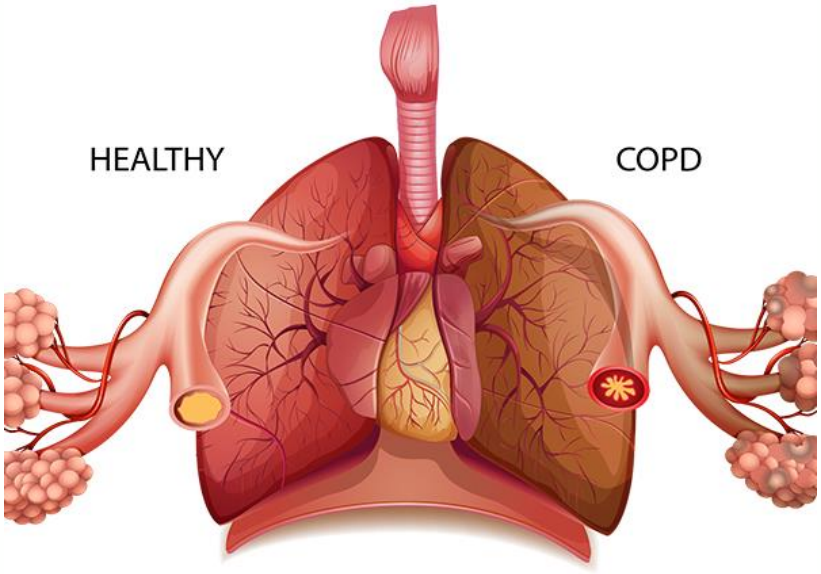
Health Effects

Silicosis:

- Can develop without symptoms
- Symptoms include: shortness of breath and cough
- "scar tissue"
- Recognized as nodules on x-rays
- Debilitating, even fatal
- Chronic, accelerated, acute
- Chronic silicosis, > 20 years exposure



Health Effects



Other Diseases

- Chronic Obstructive Pulmonary Disease (COPD)/Emphysema
- Tuberculosis (TB) and other lung infections
- Lung cancer
- Kidney disease
- Autoimmune diseases (such as rheumatoid arthritis and scleroderma)

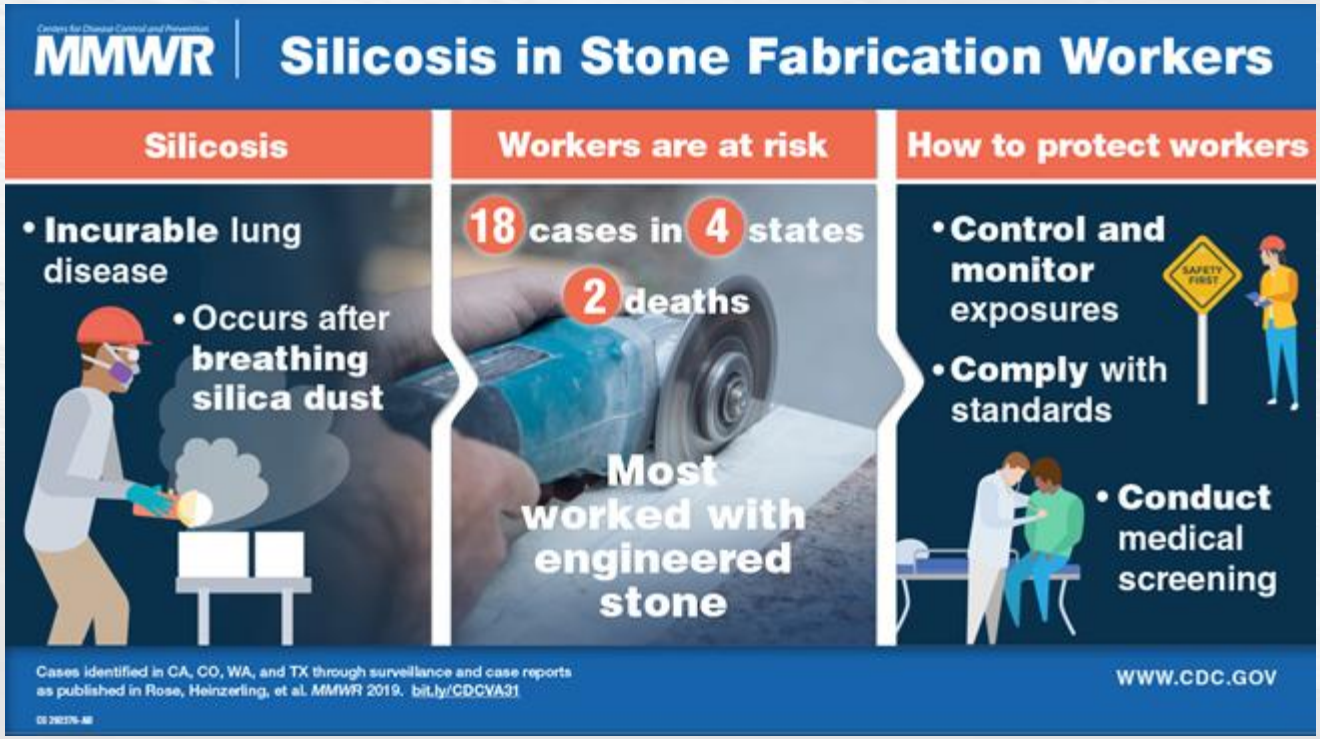
Standards Board Votes to Adopt
Permanent Standard Protecting Workers from Silica Hazards

www.dir.ca.gov/news

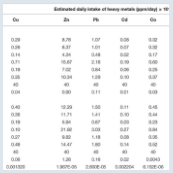
California OSH Standards Board

STATE OF CALIFORNIA
CAL OSHA
DEPARTMENT OF INDUSTRIAL RELATIONS

California Department of PublicHealth



Standards and Regulations



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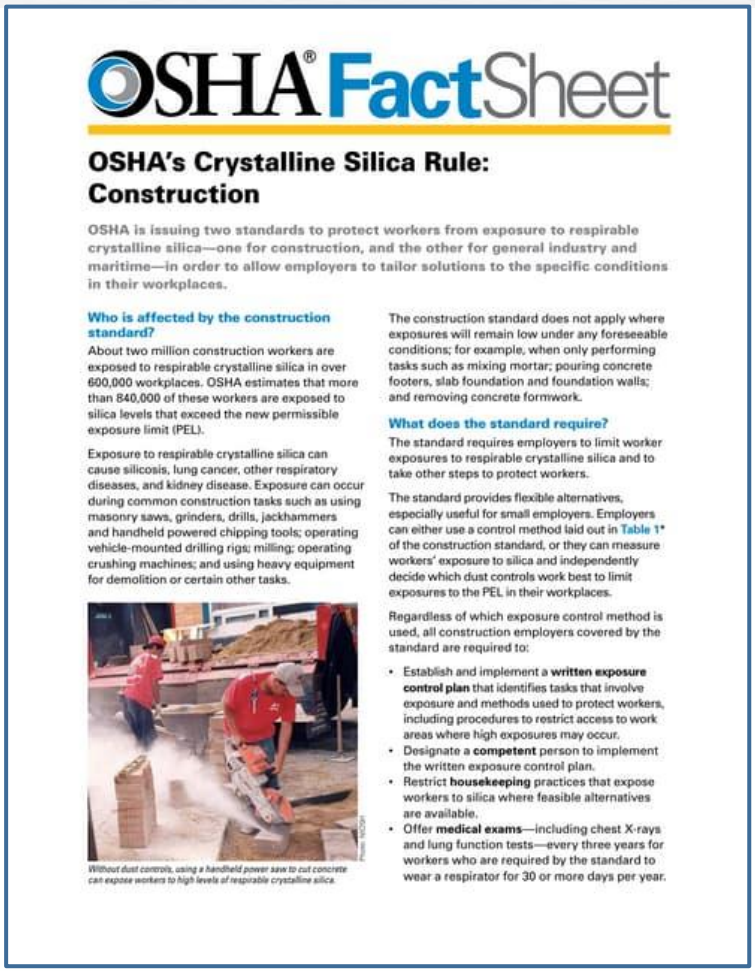
CONSTRUCTION

GENERAL INDUSTRY & MARITIME

Standard Objectives



OSHA® FactSheet

OSHA's Crystalline Silica Rule: Construction

OSHA is issuing two standards to protect workers from exposure to respirable crystalline silica—one for construction, and the other for general industry and maritime—in order to allow employers to tailor solutions to the specific conditions in their workplaces.

Who is affected by the construction standard?

About two million construction workers are exposed to respirable crystalline silica in over 600,000 workplaces. OSHA estimates that more than 840,000 of these workers are exposed to silica levels that exceed the new permissible exposure limit (PEL).

Exposure to respirable crystalline silica can cause silicosis, lung cancer, other respiratory diseases, and kidney disease. Exposure can occur during common construction tasks such as using masonry saws, grinders, drills, jackhammers and handheld powered chipping tools; operating vehicle-mounted drilling rigs; milling; operating crushing machines; and using heavy equipment for demolition or certain other tasks.

Without dust controls, using a handheld power saw to cut concrete can expose workers to high levels of respirable crystalline silica.

The construction standard does not apply where exposures will remain low under any foreseeable conditions; for example, when only performing tasks such as mixing mortar; pouring concrete footers, slab foundation and foundation walls; and removing concrete formwork.

What does the standard require?

The standard requires employers to limit worker exposures to respirable crystalline silica and to take other steps to protect workers.

The standard provides flexible alternatives, especially useful for small employers. Employers can either use a control method laid out in Table 1* of the construction standard, or they can measure workers' exposure to silica and independently decide which dust controls work best to limit exposures to the PEL in their workplaces.

Regardless of which exposure control method is used, all construction employers covered by the standard are required to:

- Establish and implement a **written exposure control plan** that identifies tasks that involve exposure and methods used to protect workers, including procedures to restrict access to work areas where high exposures may occur.
- Designate a **competent** person to implement the written exposure control plan.
- Restrict **housekeeping** practices that expose workers to silica where feasible alternatives are available.
- Offer **medical exams**—including chest X-rays and lung function tests—every three years for workers who are required by the standard to wear a respirator for 30 or more days per year.

The standard requires employers to limit worker exposures to respirable crystalline silica and to take other steps to protect workers.

Occupational Exposures to Respirable Crystalline Silica

Construction Industry

Permissible Exposure Limit (PEL) =
50 µg/m3 (8-hr TWA)

Action Level (AL) =
25 µg/m3 (8-hr TWA)

Key Provisions

All construction employers covered by the standard are required to:

- Establish a written exposure plan
- Designate a Competent Person
- Restrict housekeeping
- Offer medical exams
- Train workers
- Keep records

Written Exposure Control Plan

Tasks with Exposure:

Controls (Engineering/Work Practice) :

Respiratory Protection:

Housekeeping:

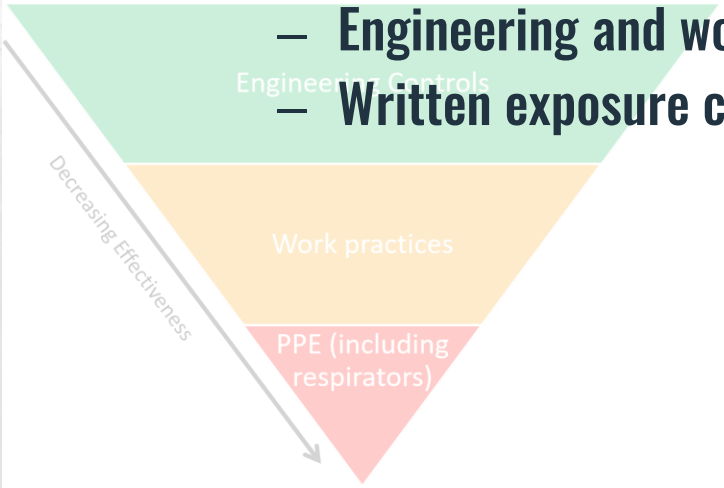
Key Provision

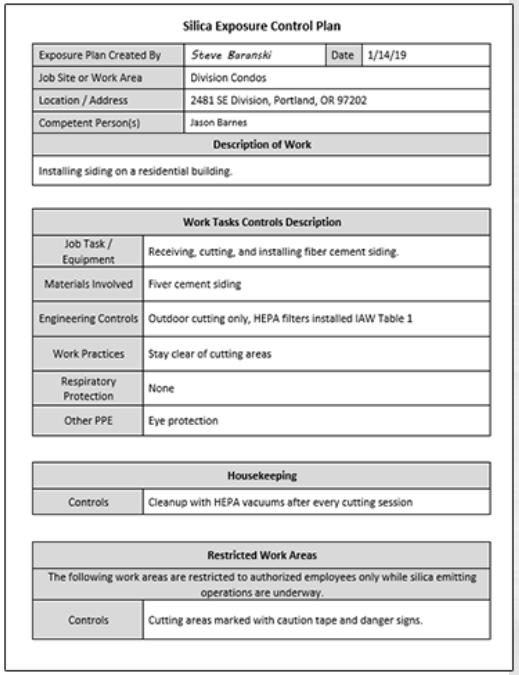
Designation of “Competent Person”

–**Competent person** means an individual who is capable of identifying existing and foreseeable respirable crystalline **silica** hazards in the workplace **and** who has authorization to take prompt corrective measures to eliminate or minimize them.

- Regulated Areas

- Methods of Compliance
  - Engineering and work practice controls
  - Written exposure control plan





Silica Exposure Control Plan

Exposure Plan Created By	*Steve Baranski*	Date	1/14/19
Job Site or Work Area	Division Condos		
Location / Address	2481 SE Division, Portland, OR 97202		
Competent Person(s)	Jason Barnes		

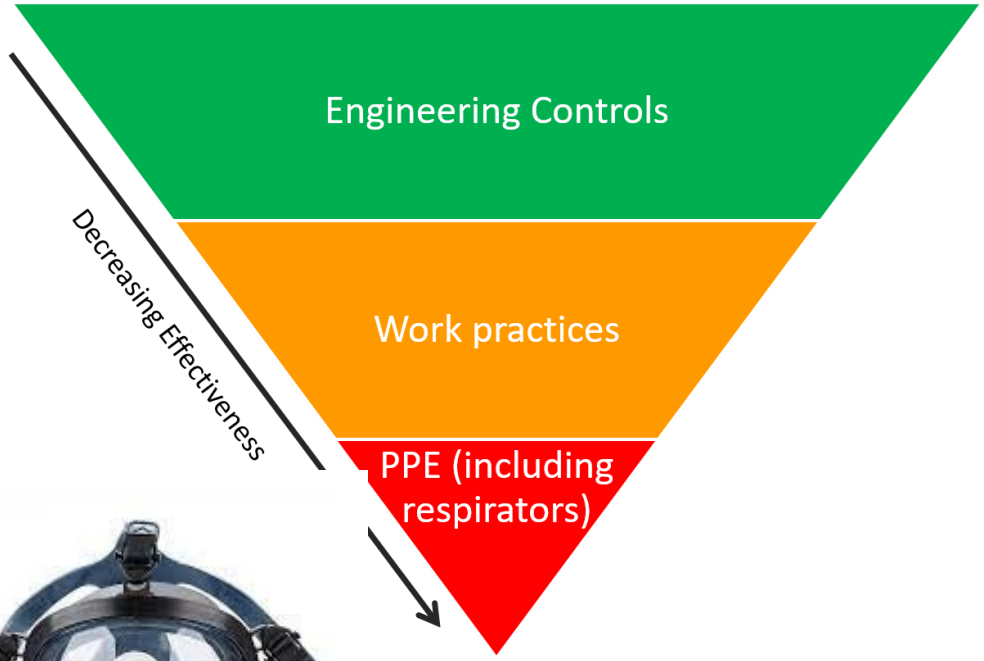
Description of Work
Installing siding on a residential building.

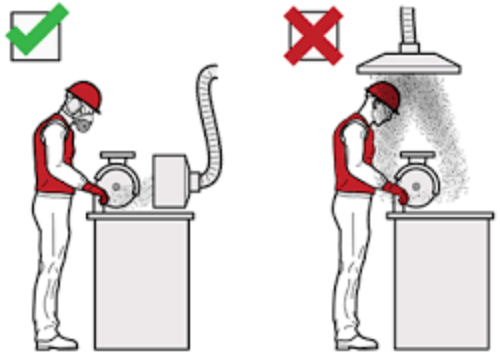
Work Tasks Controls Description	
Job Task / Equipment	Receiving, cutting, and installing fiber cement siding.
Materials Involved	Fiver cement siding
Engineering Controls	Outdoor cutting only, HEPA filters installed IAW Table 1
Work Practices	Stay clear of cutting areas
Respiratory Protection	None
Other PPE	Eye protection

Housekeeping	
Controls	Cleanup with HEPA vacuums after every cutting session

Restricted Work Areas	
The following work areas are restricted to authorized employees only while silica emitting operations are underway.	
Controls	Cutting areas marked with caution tape and danger signs.

Exposure Controls





https://www.abldistribution.com.au/news.aspx?showArticle=82

Housekeeping

https://atrix.com/product/hazardous-particulate-d4-6-hepa-vacuum/

MEDICAL SURVEILLANCE

- **Offered:**
  - Initial Examination - Within 30 days of employment
  - Every 3 years
- **Medical and Work History**
- **Physical Exam**
- **Chest X-Ray**
- **Pulmonary Function Test**
- **Testing for latent tuberculosis infection**

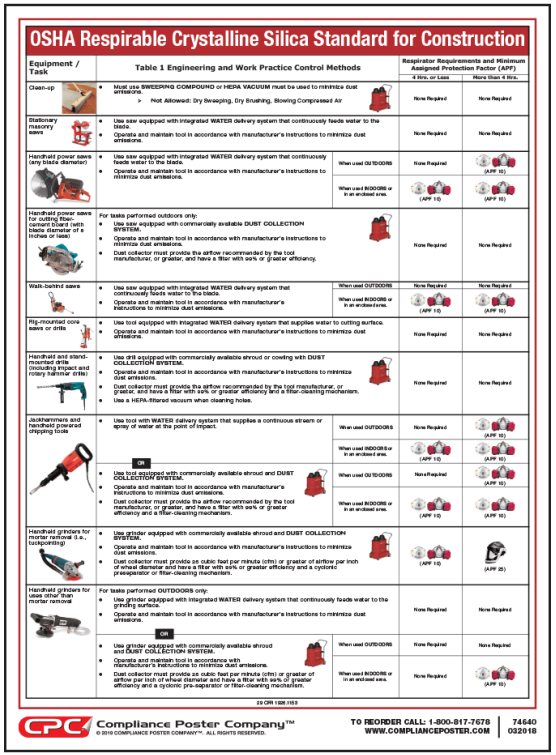
Hazard Communication Training

- Health hazards
- Work tasks & controls
- Standard requirements
- Competent Person
- Medical surveillance

Annual Audit

Exposure Control Methods

- **Specified Exposure Control Method – Table 1**



OSHA Respirable Crystalline Silica Standard for Construction

Equipment / Task	Table 1 Engineering and Work Practice Control Methods		Respirator Requirements and Minimum Assigned Protection Factor (APF)	
			4 Hrs. or Less	More than 4 Hrs.
Clean-up	• Must use SWEEPING COMPOUND or HEPA VACUUM must be used to minimize dust emissions. > Not Allowed: Dry Sweeping, Dry Brushing, Blowing Compressed Air		None Required	None Required
Stationary masonry saws	• Use saw equipped with integrated WATER delivery system that continuously feeds water to the blade. • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.		None Required	None Required
Handheld power saws (any blade diameter)	• Use saw equipped with integrated WATER delivery system that continuously feeds water to the blade. • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.	When used OUTDOORS	None Required	(APF 10)
		When used INDOORS or in an enclosed area.	(APF 10)	(APF 10)
Handheld power saws for cutting fiber cement board (with blade diameter of 8 inches or less)	For tasks performed outdoors only: • Use saw equipped with commercially available DUST COLLECTION SYSTEM. • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. • Dust collector must provide the airflow recommended by the tool manufacturer, or greater, and have a filter with 90% or greater efficiency.		None Required	None Required
Walk-behind saws	• Use saw equipped with integrated WATER delivery system that continuously feeds water to the blade. • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.	When used OUTDOORS	None Required	None Required
		When used INDOORS or in an enclosed area.	(APF 10)	(APF 10)
Rig-mounted core saws or drills	• Use tool equipped with integrated WATER delivery system that supplies water to cutting surface. • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.		None Required	None Required
Handheld and stand-mounted drills (including impact and rotary hammer drills)	• Use drill equipped with commercially available shroud or cowing with DUST COLLECTION SYSTEM. • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. • Dust collector must provide the airflow recommended by the tool manufacturer, or greater, and have a filter with 99% or greater efficiency and a filter-cleaning mechanism. • Use a HEPA-filtered vacuum when cleaning holes.		None Required	None Required
Jackhammers and handheld powered chipping tools	• Use tool with WATER delivery system that supplies a continuous stream or spray of water at the point of impact.	When used OUTDOORS	None Required	(APF 10)
		When used INDOORS or in an enclosed area.	(APF 10)	(APF 10)
	OR			
	• Use tool equipped with commercially available shroud and DUST COLLECTION SYSTEM. • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. • Dust collector must provide the airflow recommended by the tool manufacturer, or greater, and have a filter with 99% or greater efficiency and a filter-cleaning mechanism.	When used OUTDOORS	None Required	(APF 10)
		When used INDOORS or in an enclosed area.	(APF 10)	(APF 10)
Handheld grinders for mortar removal (i.e., tuckpointing)	• Use grinder equipped with commercially available shroud and DUST COLLECTION SYSTEM. • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. • Dust collector must provide as cubic feet per minute (cfm) or greater of airflow per inch of wheel diameter and have a filter with 99% or greater efficiency and a cyclonic pre-separator or filter-cleaning mechanism.		(APF 10)	(APF 25)
Handheld grinders for uses other than mortar removal	For tasks performed OUTDOORS only: • Use grinder equipped with integrated WATER delivery system that continuously feeds water to the grinding surface. • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions.		None Required	None Required
	OR			
	• Use grinder equipped with commercially available shroud and DUST COLLECTION SYSTEM. • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. • Dust collector must provide as cubic feet per minute (cfm) or greater of airflow per inch of wheel diameter and have a filter with 90% or greater efficiency and a cyclonic pre-separator or filter-cleaning mechanism.	When used OUTDOORS	None Required	None Required
		When used INDOORS or in an enclosed area.	None Required	(APF 10)

29 CFR 1926.1153

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- **Alternative Exposure Control Method**

Table 1: Specified Exposure Control Methods When Working with Materials Containing Crystalline Silica

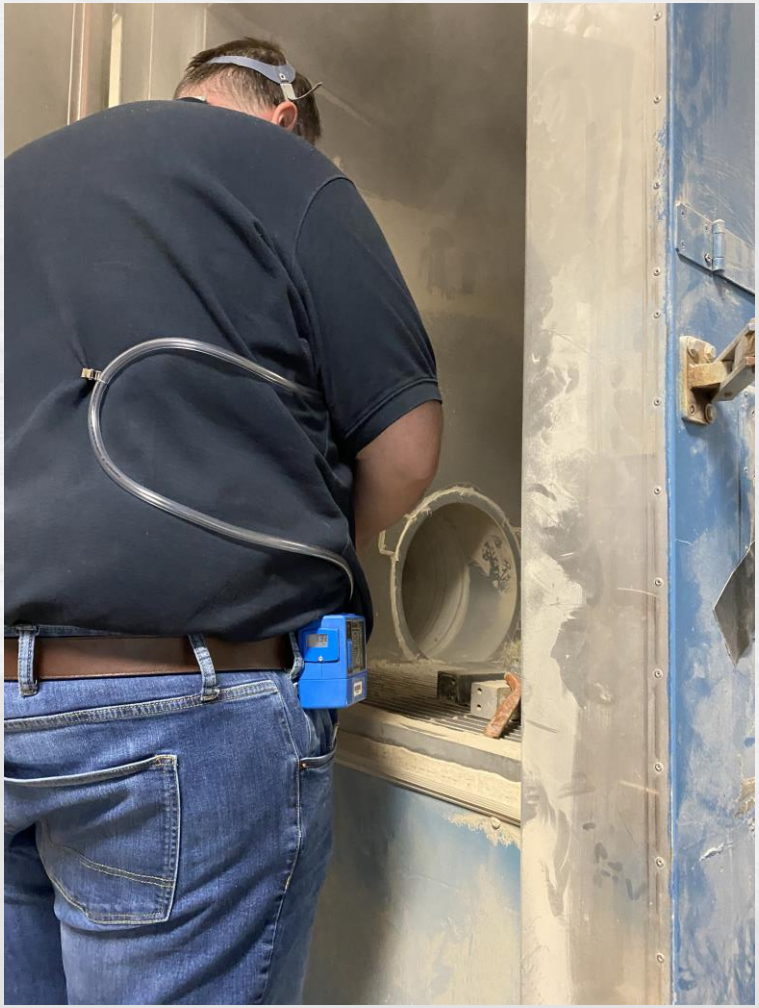
Equipment/ Task	Engineering and Work Practice Control Methods	Required Respiratory Protection and Minimum Assigned Protection Factor (APF)	
		≤ 4 hrs/ shift	> 4 hrs/ shift
(ii) Handheld power saws (any blade diameter)	Use saw equipped with integrated water delivery system that continuously feeds water to the blade. Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. • When used outdoors. • When used indoors or in an enclosed area.	None APF 10	APF 10 APF 10

Excerpt from Table 1

- Air monitoring not required if you follow the table exactly
- Requires employee to be enrolled in medical surveillance program & respiratory protection program

Alternative Exposure Control Method

- For tasks not listed in Table 1, or where the employer cannot fully and properly implement controls
- For employees who may reasonably be expected to be exposed to respirable crystalline silica at or above the action level.



Exposure assessment

- **Performance Option**
  - Combination of air monitoring data and objective data
- **Scheduled Monitoring Option**
  - Initial air monitoring (representative)
    - If > PEL; repeat every 3 months
    - If > AL; repeat every 6 months
    - If < AL; discontinue
  - Re-assessment air monitoring
    - Whenever there are changes

Requirement	What is it?	How to do it?	How often?
Air Monitoring	Measure the amount of silica in the air. **Permissible exposure limit (PEL)** = 50 micrograms per cubic meter ($\mu g/m^3$) **Action level (AL)** = 25 $\mu g/m^3$	Hire a private consultant, or work with your insurer or Cal/OSHA consultation services	After Initial monitoring: • Repeat every 3 months if > PEL (50 $\mu g/m^3$) • Repeat every 6 months if between the AL and PEL (25-50 $\mu g/m^3$)
Regulated Areas	Regulate areas where employees' exposures to silica are expected to be over PEL (50 $\mu g/m^3$)	Regulated areas have: • Signs at entrances • Limited access • Respirators provided and required	At all times
Control Exposure to Silica and Train Employees	Engineering Controls Work practice controls Employee training Respiratory protection Housekeeping	At or above the AL: • Implement written exposure control plan • Provide hazard communication and training • No dry sweeping or compressed air to clean Above the PEL, all of the above, plus: • Implement engineering and work practice controls • Implement respiratory protection program and provide fit-tested respirators	Evaluate effectiveness of exposure control plan at least annually Reassess when changes in exposure occur
Medical Surveillance	Medical examinations and testing for employees	Work with a medical provider to offer workers medical examinations and testing when exposed to silica at or above AL, including: • Chest x-ray • Lung function test • Tuberculosis test	When starting work, then, at least every three years after

Assessment Data

- **Task:**
  - Concrete grinding
    - Controls: dust collection system; HEPA AFD with flex duct; Hudson sprayer
  - Mixing Concrete
    - Controls: mixing slowly; HEPA AFD with flex duct
  - Saw Cutting
  - Controls: water system; HEPA AFD with flex duct; Hudson sprayer
- **Respiratory Protection: half face with P100**

Assessment Data

- **Task:**
  - Overhead and vertical drilling
    - Controls: dust collection system
  - Concrete chipping
    - Controls: dust collection system; HEPA AFD with flex duct; Hudson sprayer

Assessment Data

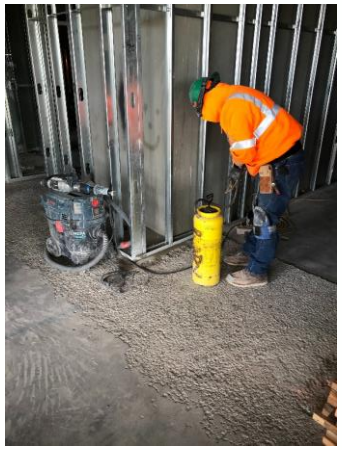
Sample No.	Work Task	Sample Duration (min.)	Respirable Dust (mg/m^3)	Respirable Quartz (mg/m^3)	Respirable Cristobalite (mg/m^3)	Respirable Tridymite (mg/m^3)	Total Respirable Crystalline Silica (mg/m^3)
R01	Grinding	160	NV[3]	**0.04**	<0.050	<0.050	**0.04**
R08	Chipping	160	0.26	<0.025	<0.051	<0.051	<0.025
R03	Drilling Overhead	160	0.69	**0.049**	<0.050	<0.050	**0.049**
R07	Drilling Into Wall	160	0.12	<0.025	<0.050	<0.050	<0.025
R02	Saw Cutting	160	**6**	**0.35**	<0.050	<0.050	0.35
R06		160	**12**	**1.2**	<0.048	<0.048	**1.2**
R04	Mixing	160	0.52	<0.025	<0.051	<0.051	<0.025
R05		160	0.28	<0.025	<0.049	<0.049	<0.025
Cal/OSHA PELs (8-hour TWA)			5[1]	0.05	0.05	0.05	0.05
Cal/OSHA Action Level (8-hour TWA)			--	0.025	0.025	0.025	0.025

Without Controls

Activity	Dust Controls	Sample Duration (minutes)	Respirable Dust[3] (mg/m^3)	Respirable Quartz (mg/m^3)	Respirable Cristobalite (mg/m^3)
Grinding Concrete[2]	None	117	2.3	**0.21**	**0.029**
Saw Cutting[2]	Hand Spray	113	1.3	**0.17**	**0.168**
Drilling Concrete – Down[1]	None	114	1.8	**0.29**	**0.286**
Drilling Concrete – Up[2]	None	60	2.5	**0.3**	**0.320**
Chipping Concrete[2]	None	148	0.72	**0.084**	**0.084**
Cal/OSHA PELs (8-hour TWA)			5[3]	0.05	0.05
Cal/OSHA Action Level (8-hour TWA)			--	0.025	0.025

Assessment Data

- Task: Concrete texturization - grinding and chipping
- Equipment: electric grinder and chipping hammer with shroud
- Controls: HEPA filtered vacuum; Hudson sprayer; N95
- Two employees assessed



Assessment Data

Sample No.	Employee/ Work Task	Sample Duration (min.)	Sample Volume (L)	Respirable Dust (µg/m³)	Respirable Quartz (µg/m³)	Respirable Cristobalite (µg/m³)	Respirable Tridymite (µg/m³)	Total Respirable Crystalline Silica (µg/m³)
S-01	Grinding & Chipping	176	440	<11	<11	<11	<45	<11
Calculated 8-hr TWA[1]		-	-	<11	<11	<11	<45	<11
S-02	Grinding & Chipping	154	385	<13	<21	<13	<52	<13
Calculated 8-hr TWA[1]		-	-	<13	<21	<13	<52	<13
S-B	Field Blank			<5	<5	<5	<20	<5.0
Cal/OSHA PEL (8-hour TWA)				5[2]	50	50	50	50
Cal/OSHA Action Level (8-hour TWA)				NA	25	25	25	25

Note:
1 Calculated TWA assuming same exposure to respirable crystalline silica during the remaining 8 hour work shift.
2 PELs for Particulate Not Otherwise Regulated. Where dust contains crystalline silica, the PELs for crystalline silica apply.
3 TLVs for Particulates Not Otherwise Specified. Where dust contains crystalline silica, the TLVs for crystalline silica apply.
NA = no current exposure limits/guidelines available; AL = Action Level

Thank You!

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Right People.

Right Perspective.

Right Now.