Understanding and Complying with OSHA's Rule Governing Respirable Silica

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D.A.S.H.

Why a Silica Standard?

OSHA estimates that once the effects of the rule are fully realized, it will prevent:

- More than 600 deaths per year:
  - Lung cancer: 124
  - Silicosis and other non-cancer lung diseases: 325
  - End-stage kidney disease: 193
- More than 900 new silicosis cases per year

Silica Effects

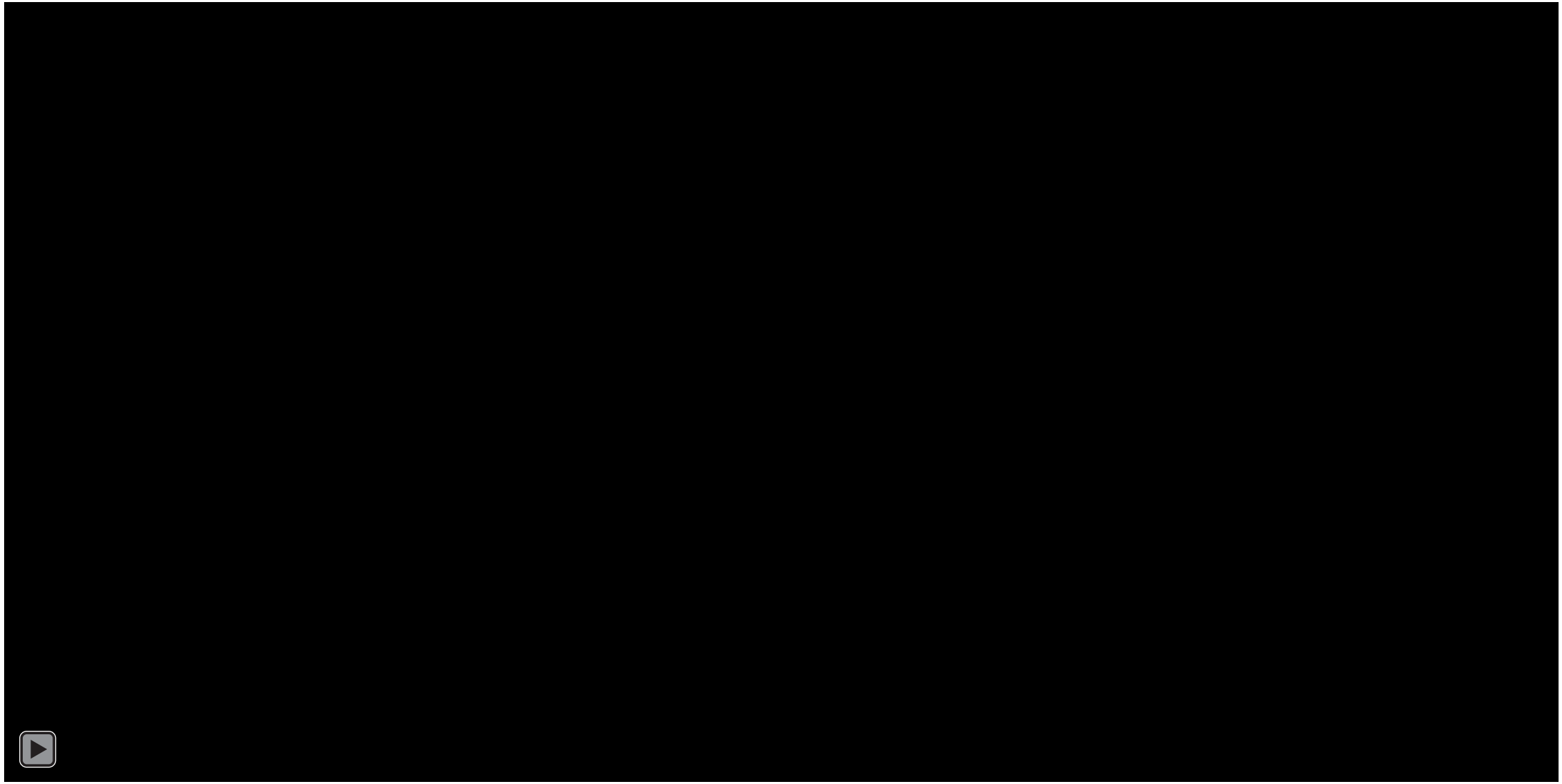
2.3 million workers:

- Construction: 2 million
- GI/Maritime: 300,000

676,000 establishments

- Construction: 600,000
- GI/Maritime: 76,000

Stop Silicosis (2016)

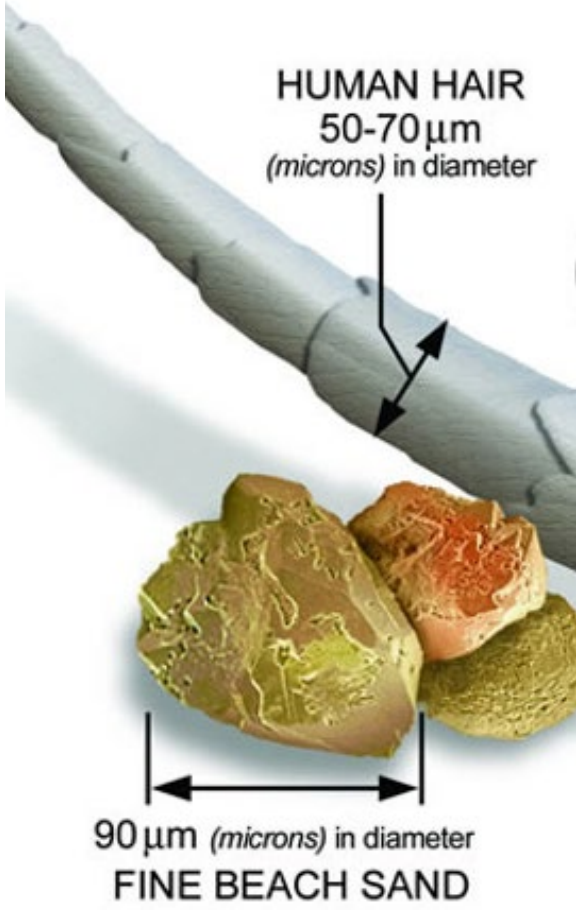


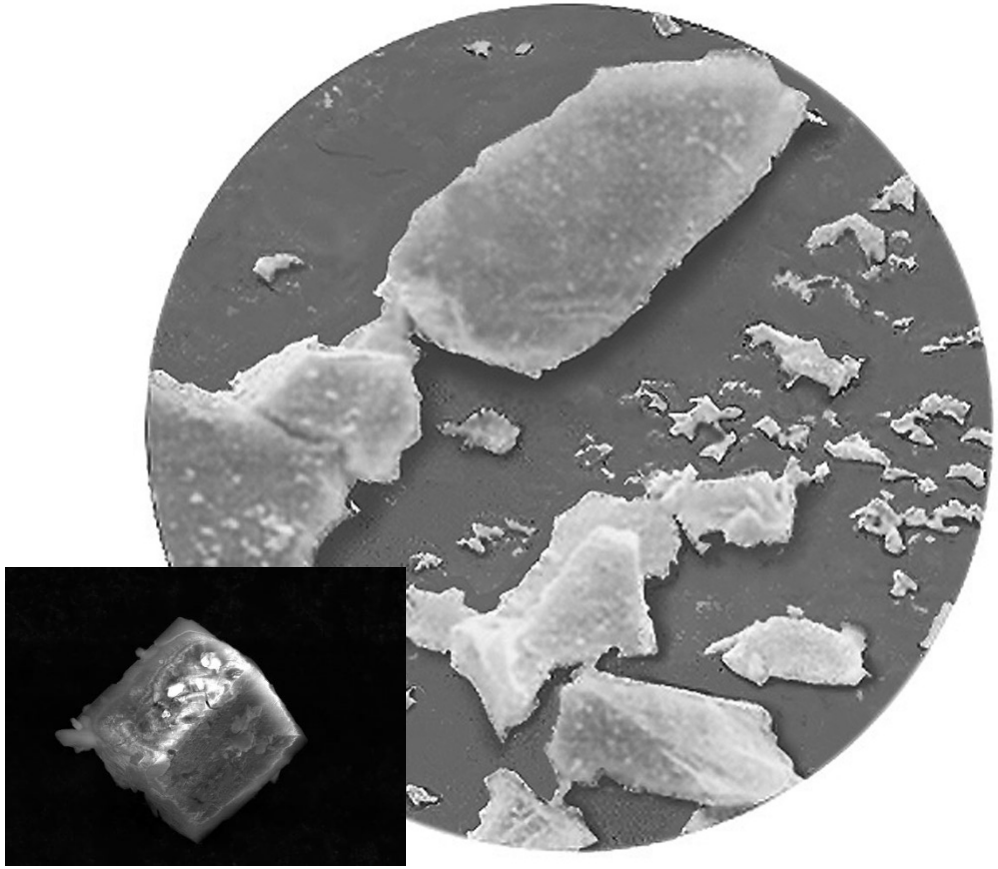
Silica (Silicon Dioxide - SiO_2)

- Silica occurs naturally in crystalline and amorphous states

- Quartz, the most abundant type of silica, accounts for 12% of the earth's crust

Crystalline Silica

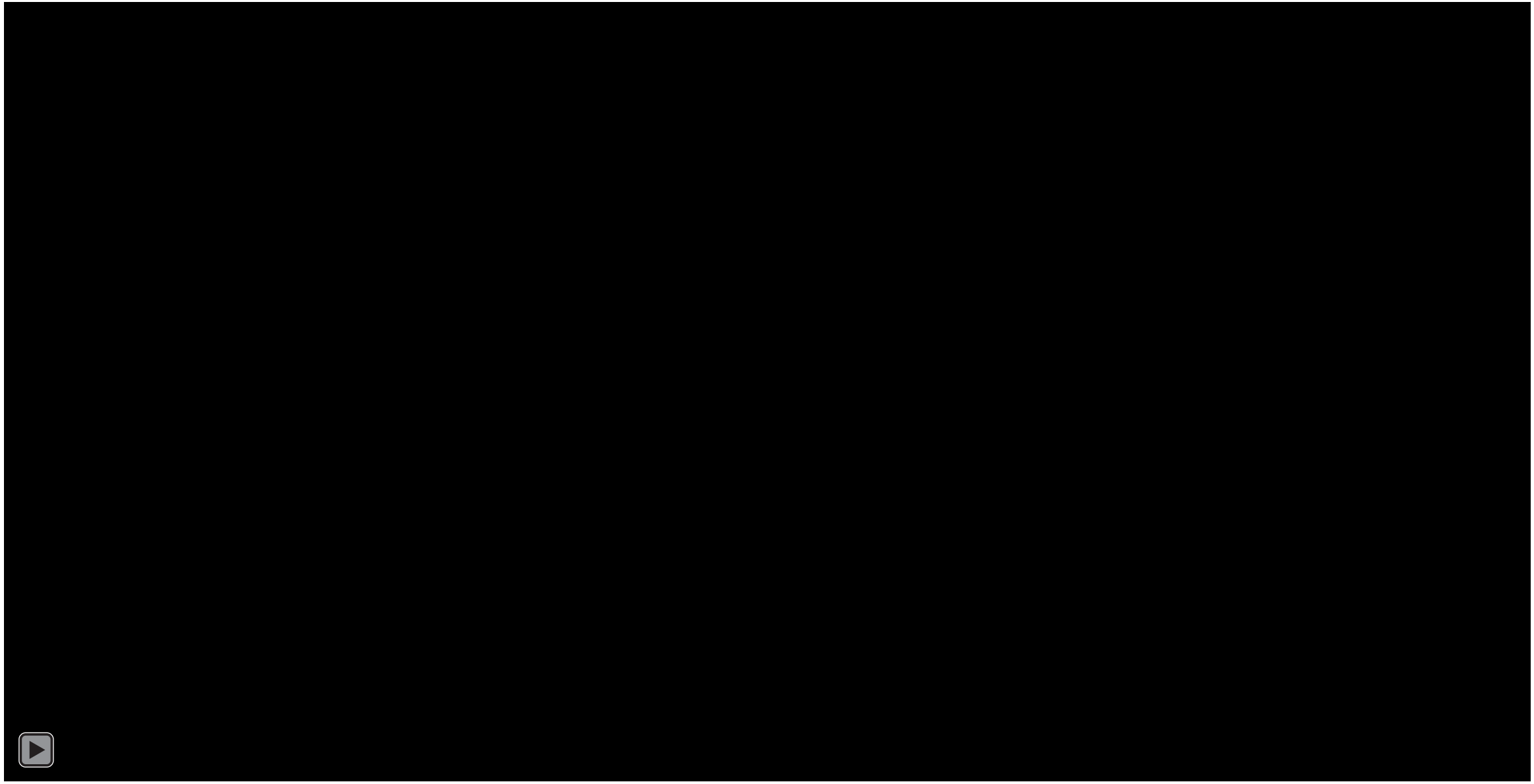




Objectives:

- Define Crystalline Silica.
- How are workers exposed?
- Health Effects.
- Protective Measures.
- Requirements for Handling Silica (Construction & General Industry).

Understanding OSHA’s Silica Standard



Requirements

Applies to all occupational exposures to respirable crystalline silica equal to or greater than 25µg/m^3 under any foreseeable conditions

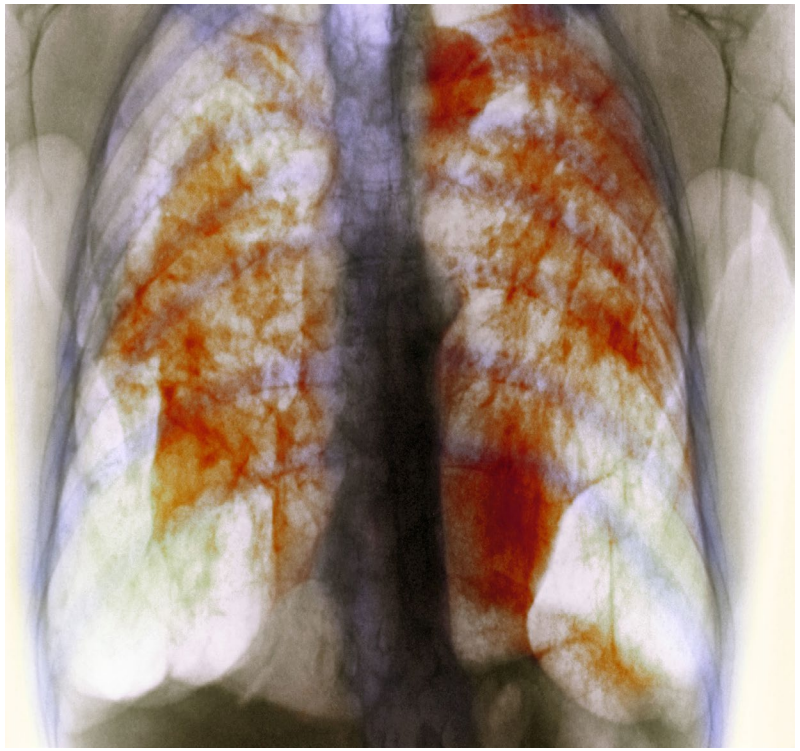
CONSTRUCTION	GNL INDUSTRY/MARITIME

"…work for construction, alteration and/or repair, including painting and decorating."
 	
1910.12(b)
	• Excludes:
	  • Agriculture
	  • Sorptive clays

Commonly Found in:

- Sand
- Stone
- Rock
- Brick
- Block
- Mortar
- Tile
- Stone

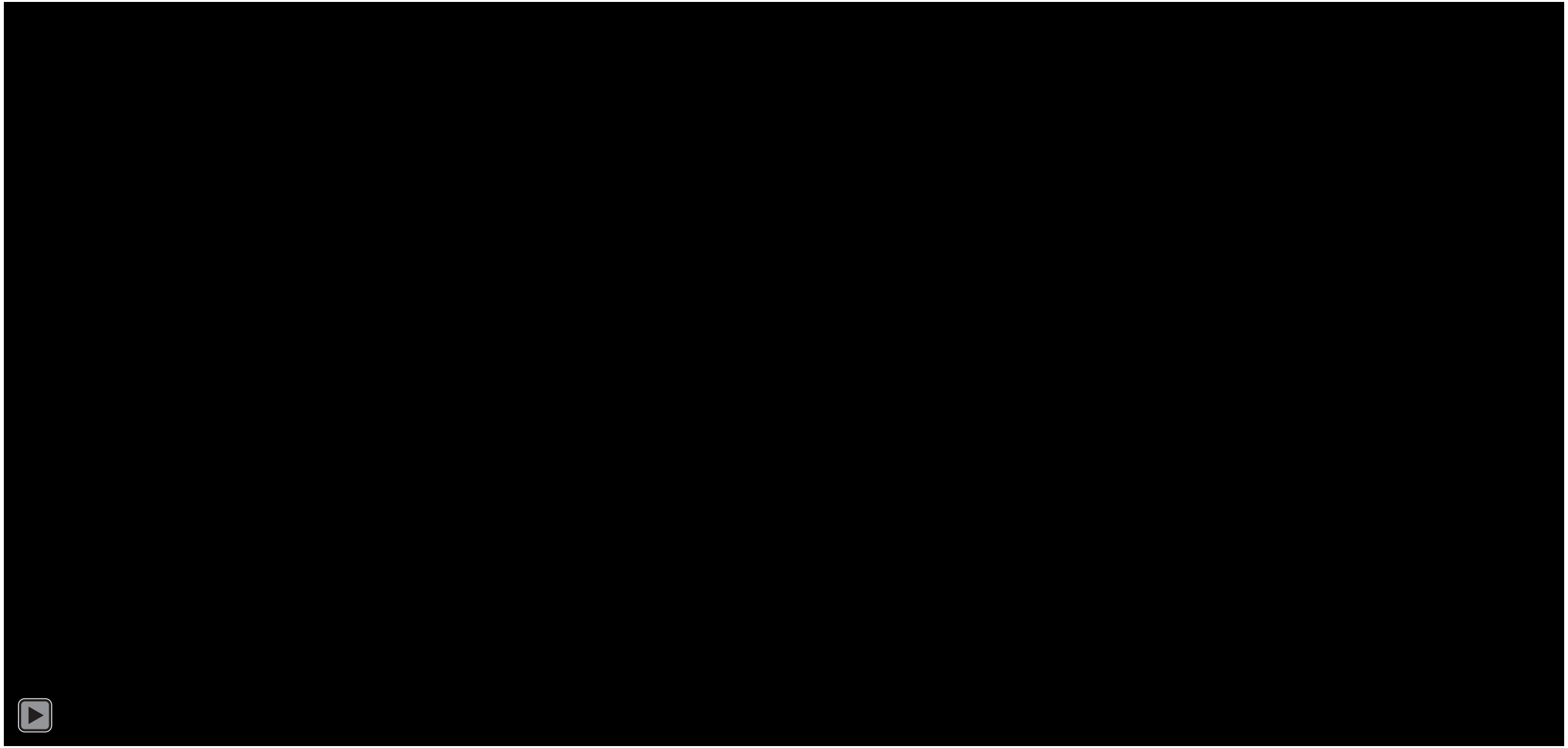
Respirable Crystalline Silica



- These respirable particles are very small -- about 100 times smaller than a grain of sand found on the beach.

- When these very fine respirable silica particles are breathed in, they can travel deep into the lungs, where they can become trapped and cause disease.

Silica Exposure



Activities that Expose Workers to Silica

- Power tools are used to chip, cut, saw, drill, grind, sand, or crush crystalline silica-containing materials;

- It is also produced when sand is used in abrasive blasting.

Health Effects

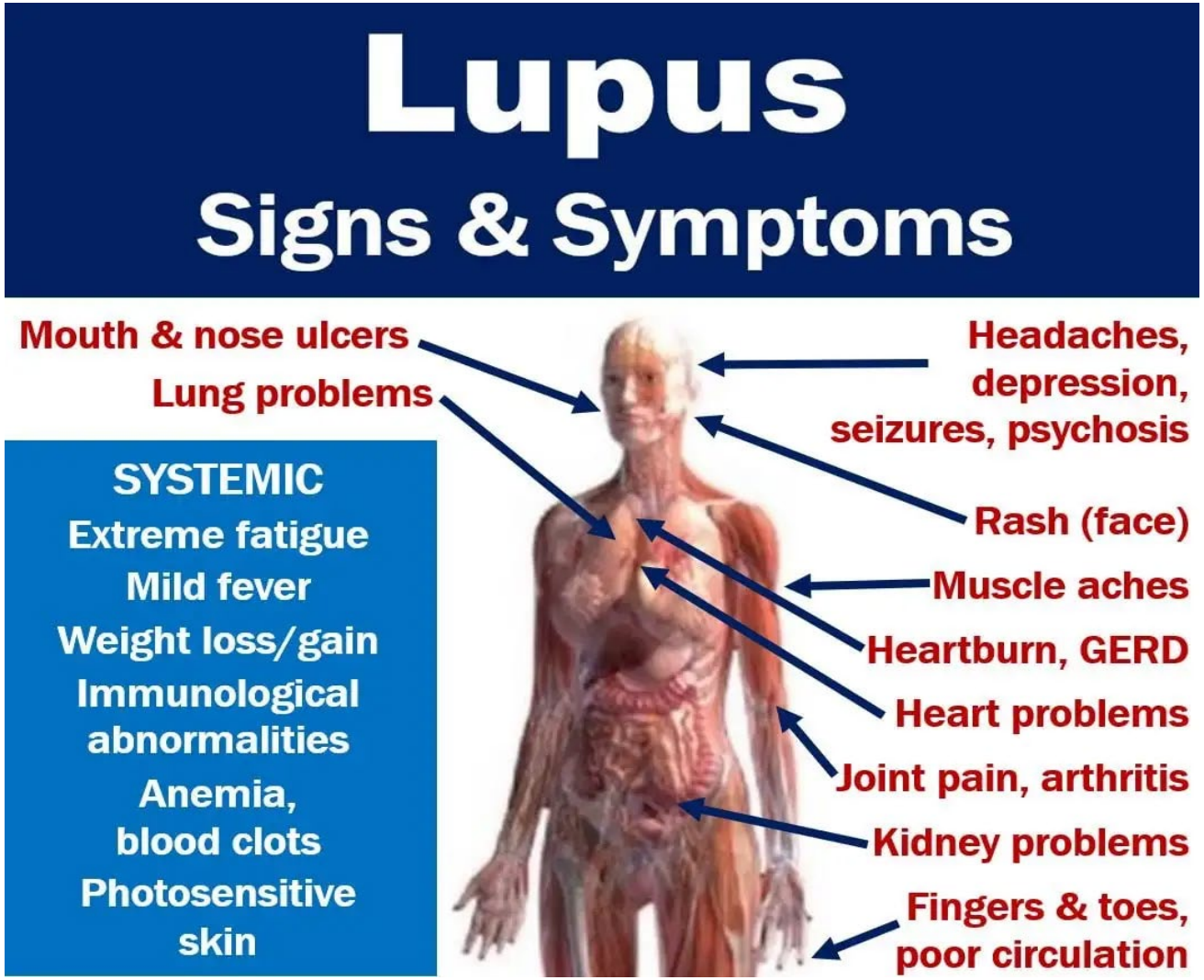
- Three types:
  - Chronic
  - Accelerated
  - Acute
- Permanent
- Can be debilitating or deadly

Health Hazards

- Silicosis
- Lung cancer
- Chronic obstructive pulmonary disease (COPD)
- Kidney diseases
- Autoimmune diseases

Lupus

- Silica exposure can cause autoimmune diseases such as **lupus**, scleroderma, and vasculitis.



Methods of Compliance (29 C.F.R. § 1910.1053(f).

The standard requires employers to use engineering and work practice controls to reduce and maintain employee exposure to silica to or below the PEL, unless they can demonstrate that such controls are not feasible.

Methods of Compliance (1910.1053 (f).

Respiratory Protection

Employers must:

- Provide respirators if needed
- Follow the respiratory protection standard

Written exposure control plan

The employer shall establish and implement a written exposure control plan.

Exposure Assessments (29 C.F.R. § 1910.1053(d) General Industry

Exposure Assessment

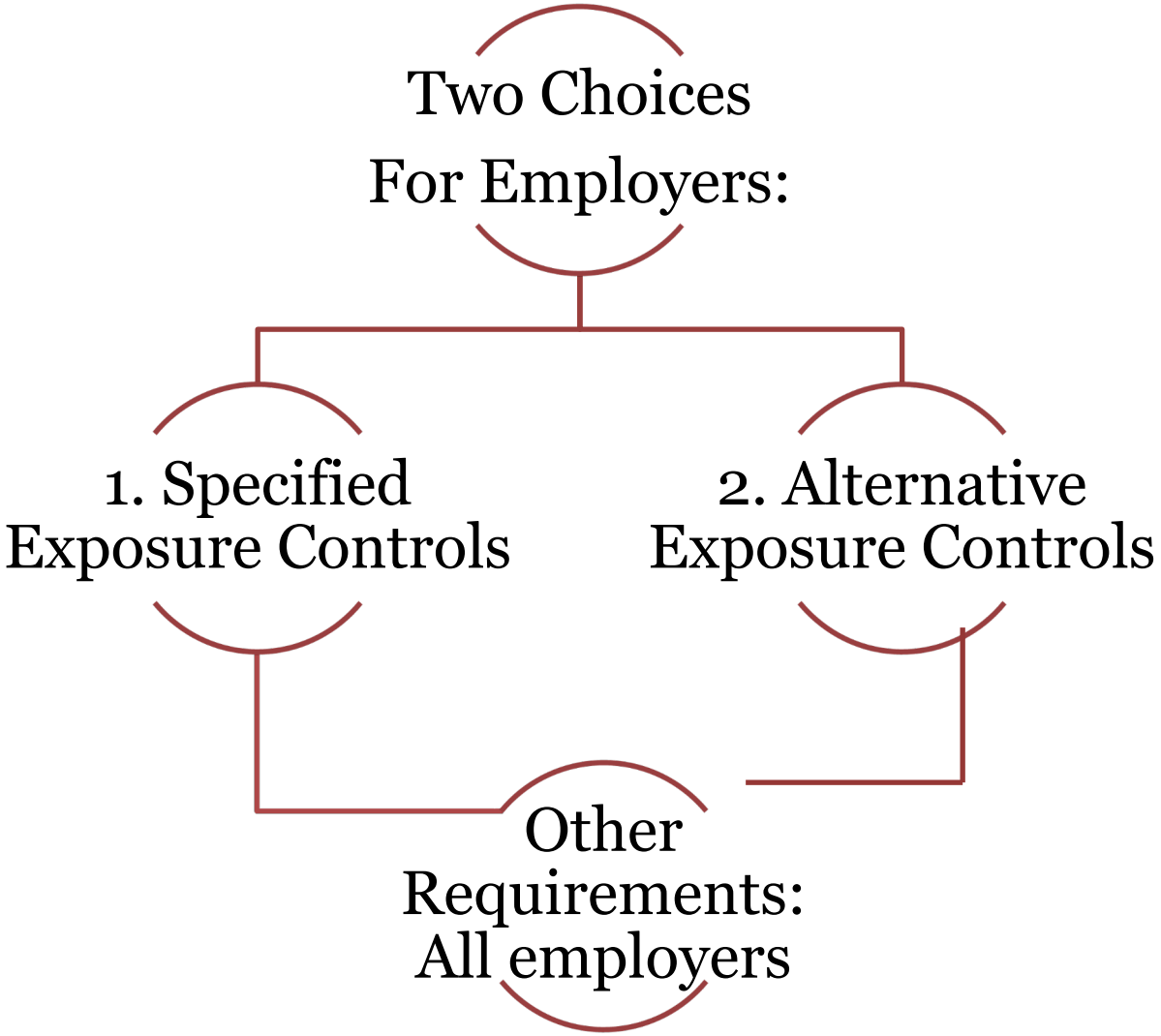
- Exposure assessment is a judgment
  - Acceptable health risk
  - Uncertain health risk
  - Unacceptable health risk

	Exposure Rating**	Recommended Follow Up / Exposure Control
	0 (<1% of OEL)	no action
	1 (<10% of OEL)	general HazCom
	2 (10-50% of OEL)	+ chemical specific HazCom
	3 (50-100% of OEL)	+ exposure surveillance, medical surveillance, work practices
	4 (>100% of OEL)	+ respirators & engineering controls, work practice controls
	5 (Multiples of OEL; e.g., based on respirator APFs)	+ immediate engineering controls or process shutdown, validate respirator selection

** - Decision statistic = 95th percentile

AIHA Protecting Worker Health

Respirable Crystalline Silica Standard for Construction

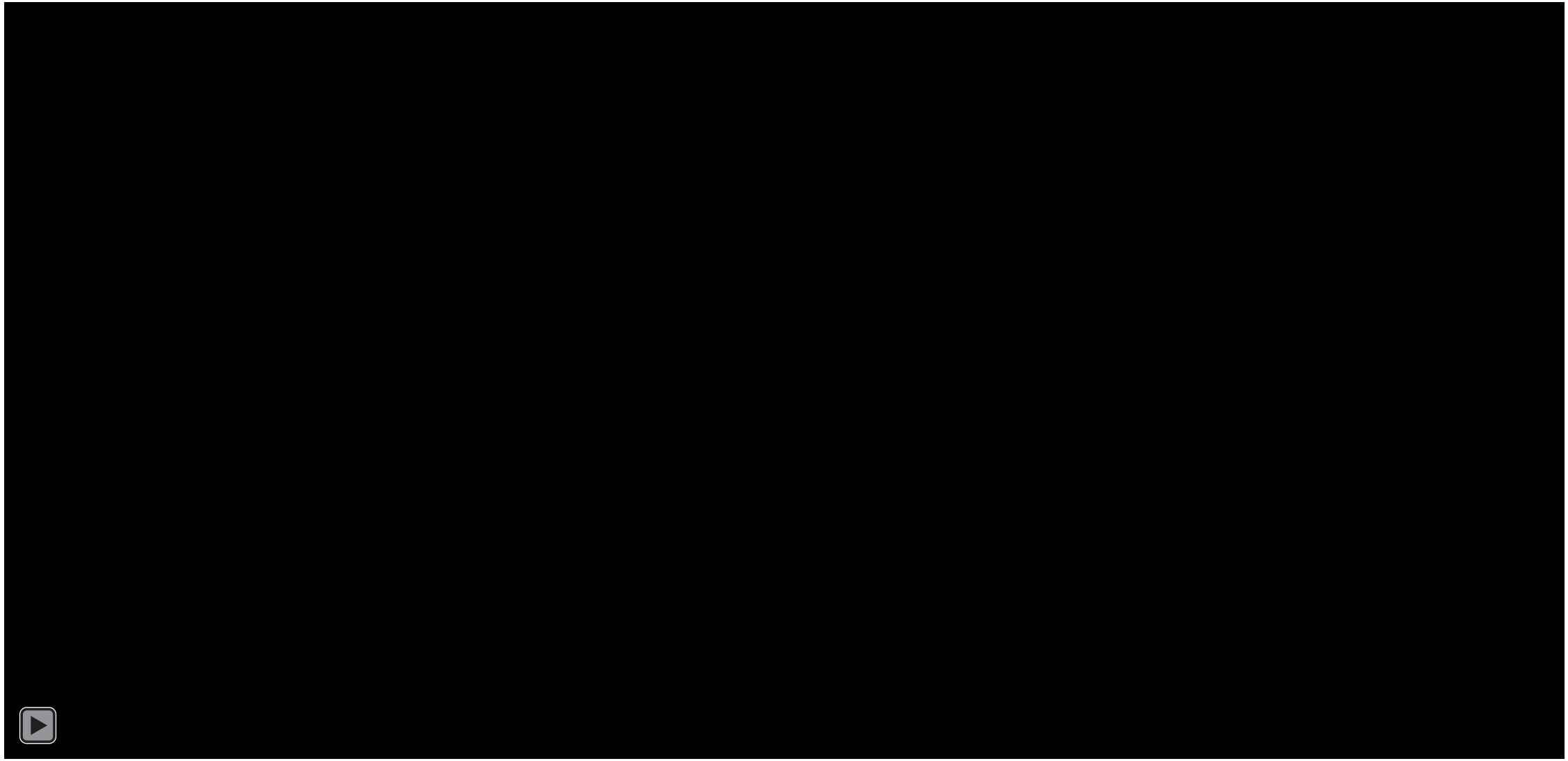


Complying with the Construction Standard

- OSHA's Respirable Crystalline Silica standard for construction requires employers to limit worker exposure to respirable crystalline silica and to take other steps to protect workers.

- The standard provides flexible alternatives, which OSHA expects will be especially useful for small employers. Employers can either use the control methods 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 exposure to the PEL in their workplaces.

How to Use Table 1



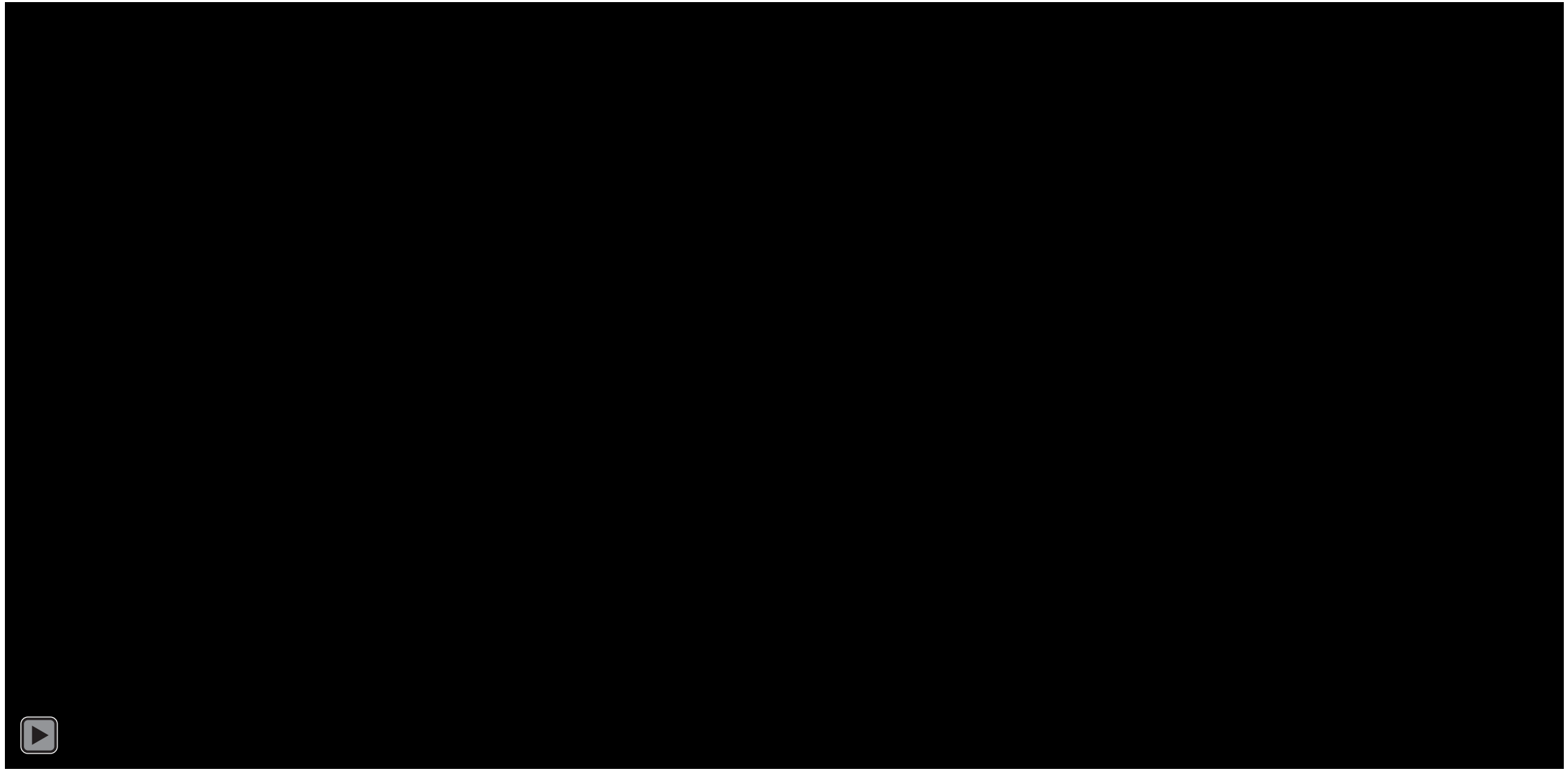
Silica Control Measures (Recalculated Table 1)

Required Engineering Controls and Respiratory Protection for Silica

The engineering controls and respiratory protection identified below must be used as the selection basis for work practices, controls, and personal protective equipment (PPE). However, if controls and PPE other than these are used, then exposure assessments must be conducted to demonstrate compliance with American Conference of Government Industrial Hygienists (ACGIH) threshold limit values (TLVs) per OPP 650-11 Silica Exposure Prevention and Control. The industrial hygiene (IH) program lead must use good IH judgment to determine when to periodically conduct confirmatory sampling of tasks conducted under this table. Use the highlighted links to Occupational Safety and Health Administration (OSHA) fact sheets for equipment listed in this table.
Key: APF = assigned protection factor.

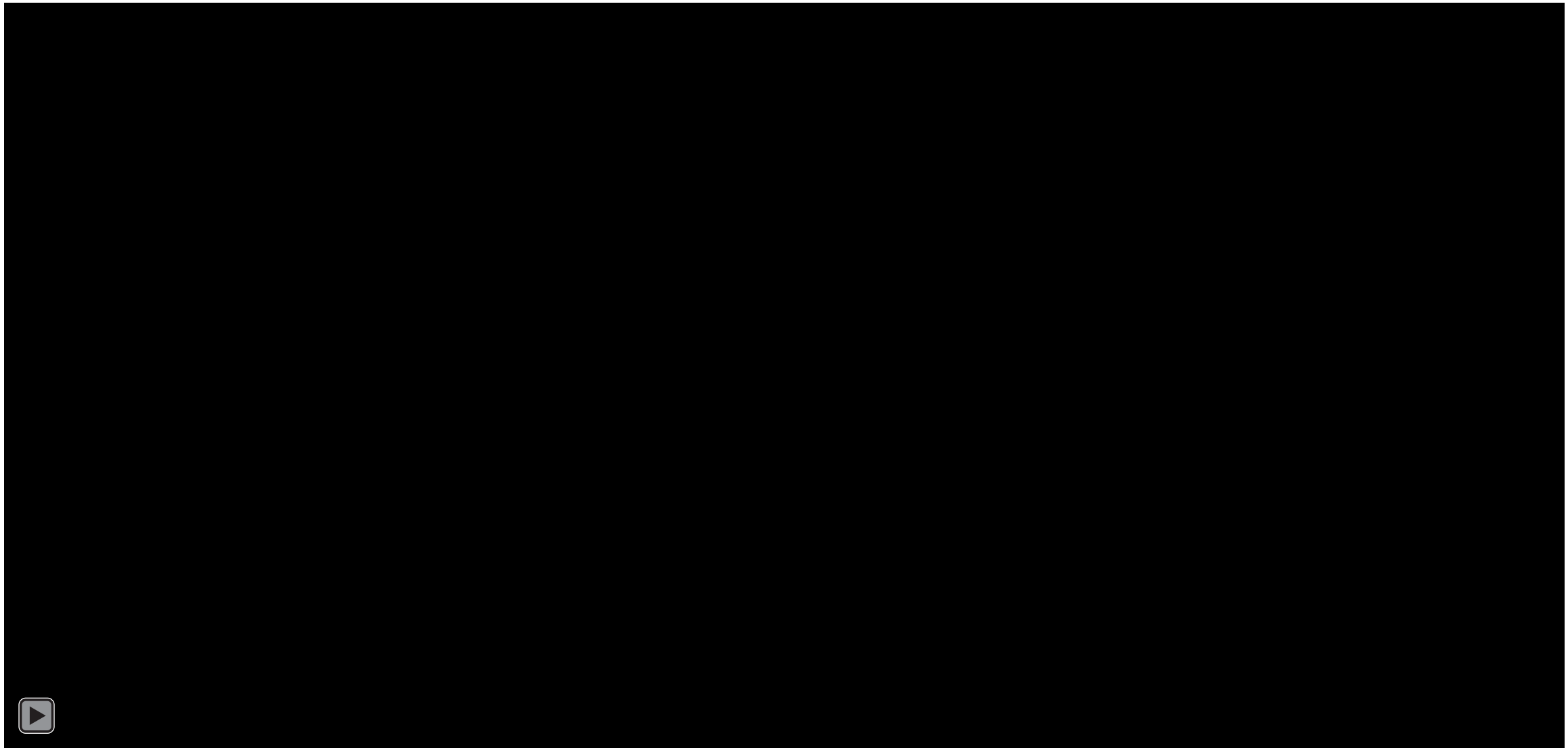
Equipment/Use	**Photo of representative equipment**	**Engineering and work practice control methods** • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. • Operate and maintain machine to minimize dust emissions	**NREL Respiratory Protection** for compliance with ACGIH TLV of 25 µg/m³		
			<2hr./ shift	2-4 hr./ shift	>4 hr./ shift
1 **Handheld and Stand-Mounted Drills** (including impact and rotary hammer drills) [Per 29 CFR 1926.1153 c.1. vii]		https://www.osha.gov/Publications/silica/OSHA_FS-3630.pdf Use drill equipped with commercially available shroud or cowling with dust collection system. Dust collector must provide the air flow recommended by the tool manufacturer, or greater, and have a filter with 99% or greater efficiency and a filter-cleaning mechanism. Dust collector must provide the air flow recommended by the tool manufacturer, or greater, and have a filter with 99% or greater efficiency and a filter-cleaning mechanism. Use a high-efficiency particulate air (HEPA)-filtered vacuum when cleaning holes. Verify that: • The shroud or cowling is intact and installed in accordance with the manufacturer's instructions; • The hose connecting the tool to the vacuum is intact and without kinks or tight bends; • The filter(s) on the vacuum are cleaned or changed in accordance with the manufacturer's instructions; and • The dust collection bags are emptied to avoid overfilling.	None	None	APF 10
2 **Handheld Power Saws** (any blade diameter) [Per 29 CFR 1926.1153 c.1. ii]		https://www.osha.gov/Publications/silica/OSHA_FS-3627.pdf Use saw equipped with integrated water delivery system that continuously feeds water to the blade. Verify that: • An adequate supply of water for dust suppression is used; • The spray nozzle is working properly to apply water at the point of dust generation; • The spray nozzle is not clogged or damaged; • Hoses and connections are intact. When used outdoors:	None	APF 10	APF 25
		When used indoors or in an enclosed area (outdoor requirements above apply as well).	APF 10	APF 25	APF 25

Grinding



Equipment/Use	Photo of representative equipment	Engineering and work practice control methods • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. • Operate and maintain machine to minimize dust emissions	NREL Respiratory Protection for compliance with ACGIH TLV of 25 µg/m³		
			<2hr./ shift	2-4 hr./ shift	>4 hr./ shift
3 **Handheld Power Saws** for cutting fiber cement board (with blade diameter of 8 inches or less) [Per 29 CFR 1926.1153 c.1. iii]		https://www.osha.gov/Publications/OSHA3927.pdf For tasks performed outdoors only: Use saw equipped with commercially available dust collection system. Dust collector must provide the air flow recommended by the tool manufacturer, or greater, and have a filter with 99% or greater efficiency. Verify that: • The shroud or cowling is intact and installed in accordance with the manufacturer's instructions; • The hose connecting the tool to the vacuum is intact and without kinks or tight bends; • The filter(s) on the vacuum are cleaned or changed in accordance with the manufacturer's instructions to prevent clogging; and • The dust collection bags are emptied to avoid overfilling.	None	None	APF 10
4 **Handheld Grinders** for mortar removal (*i.e.*, tuckpointing) [Per 29 CFR 1926.1153 c.1.xi]		https://www.osha.gov/Publications/silica/OSHA_FS-3632.pdf Use grinder equipped with commercially available shroud and dust collection system. Dust collector must provide 25 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. Verify that: • The shroud is intact, encloses most of the grinding blade, and is installed in accordance with the manufacturer's instructions; • The hose connecting the tool to the vacuum is intact and without kinks or tight bends; • The filter(s) on the vacuum are cleaned or changed in accordance with the manufacturer's instructions; • The dust collection bags are emptied to avoid overfilling; • The blade is kept flush against the surface when possible; and • The tool is operated against the direction of blade rotation, when practical.	APF 10	APF 25	APF 50

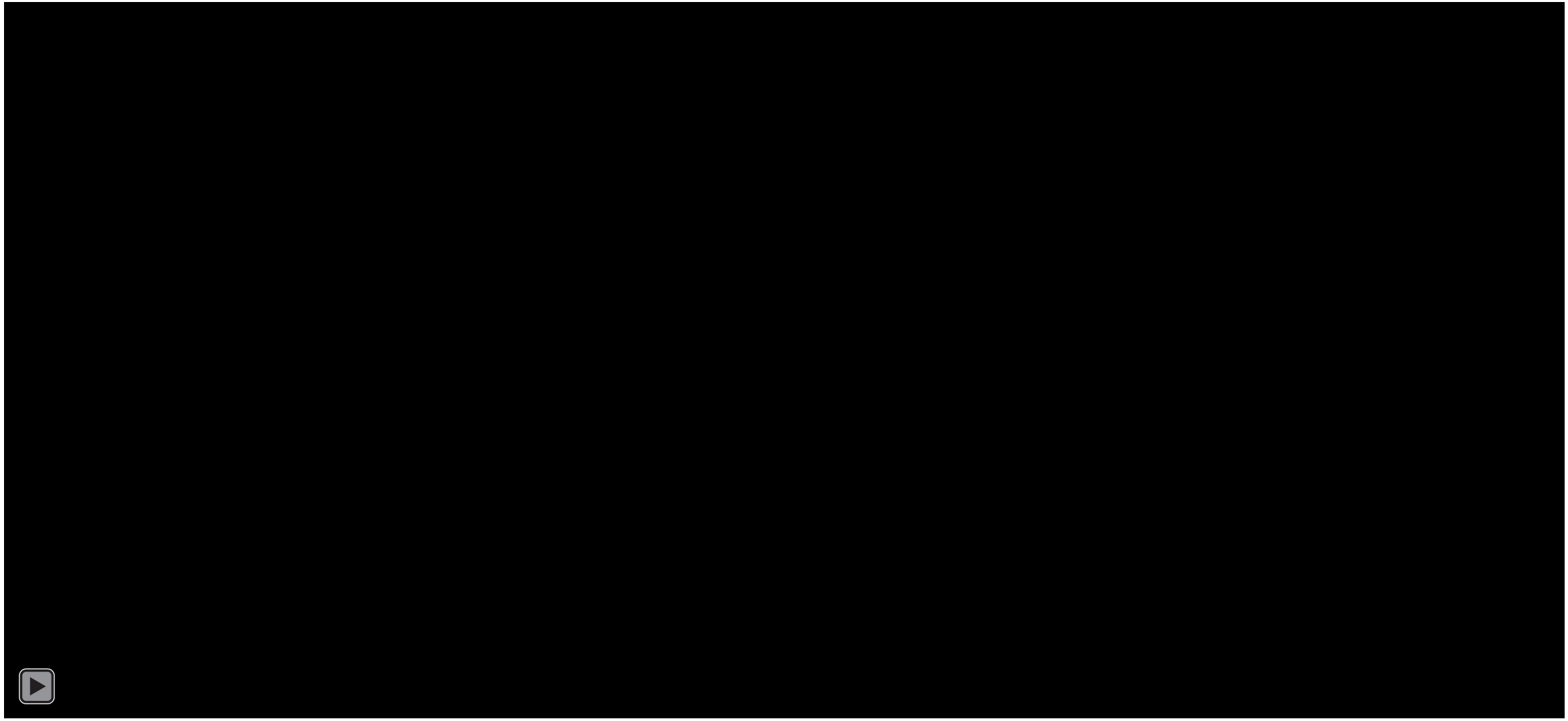
Tuckpointing



Equipment/Use	Photo of representative equipment	Engineering and work practice control methods • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. • Operate and maintain machine to minimize dust emissions	NREL Respiratory Protection for compliance with ACGIH TLV of 25 µg/m³		
			<2hr./ shift	2-4 hr./ shift	>4 hr./ shift
5 **Handheld Grinders** for uses other than mortar removal [Per 29 CFR 1926.1153 c.1.xii]		https://www.osha.gov/Publications/silica/OSHA_FS-3628.pdf Use a grinder equipped with integrated water delivery system that continuously feeds water to the grinding surface. Verify that: • An adequate supply of water for dust suppression is used; • The spray nozzles are working properly and produce a pattern that applies water at the point of dust generation; • The spray nozzles are not clogged or damaged; and • Hoses and connections are intact. Or use a grinder equipped with commercially available shroud and dust collection system. Dust collector must provide 25 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. Verify that: • The shroud is intact and installed in accordance with the manufacturer's instructions; • The hose connecting the tool to the vacuum is intact and without kinks or tight bends; • The filter(s) on the vacuum are cleaned or changed in accordance with the manufacturer's instructions; and • The dust collection bags are emptied to avoid overfilling. For tasks performed outdoors only:	None	None	APF 10
		When used indoors or in an enclosed area (above conditions for outdoor tasks apply as well).	None	APF 10	APF 25
6 **Stationary Masonry Saws** [Per 29 CFR 1926.1153 c.1.i]		https://www.osha.gov/Publications/silica/OSHA_FS-3631.pdf Use saw equipped with integrated water delivery system that continuously feeds water to the blade. Verify that: • An adequate supply of water for dust suppression is used; • The spray nozzle is working properly to apply water at the point of dust generation; • The spray nozzle is not clogged or damaged; • Hoses and connections are intact.	None	None	APF 10

Equipment/Use	Photo of representative equipment	**Engineering and work practice control methods** • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. • Operate and maintain machine to minimize dust emissions	**NREL Respiratory Protection** for compliance with ACGIH TLV of 25 µg/m^3		
			<2hr./ shift	2-4 hr./ shift	>4 hr./ shift
7 **Jackhammers and Handheld Powered Chipping Tools** [Per 29 CFR 1926.1153 c.1.x]		https://www.osha.gov/Publications/silica/OSHA_FS-3629.pdf Use tool with water delivery system that supplies a continuous stream or spray of water at the point of impact. Verify that: • An adequate supply of water for dust suppression is used; • The water sprays are working properly and produce a pattern that applies water at the point of dust generation; • The spray nozzles are not clogged or damaged; and • Hoses and connections are intact. When used outdoors:	None	APF 10	APF 25
		-When used indoors or in an enclosed area (conditions above for outdoor tasks apply).	APF 10	APF 25	APF 25
		Use tool equipped with commercially available shroud and dust collection system. Dust collector must provide the air flow recommended by the tool manufacturer, or greater, and have a filter with 99% or greater efficiency and a filter-cleaning mechanism. Verify that: • The shroud is intact and installed in accordance with the manufacturer's instructions; • The hose connecting the tool to the vacuum is intact and without kinks or tight bends; • The filter(s) on the vacuum are cleaned or changed in accordance with the manufacturer's instructions; and • The dust collection bags are emptied to avoid overfilling. -When used outdoors.	None	APF 10	APF 25
		-When used indoors or in an enclosed area (conditions above for outdoor tasks apply).	APF 10	APF 25	APF 25

Controlling Respirable Crystalline Silica: Jackhammers and Handheld Powered Chipping Tools



Equipment/Use	Photo of representative equipment	**Engineering and work practice control methods** • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. • Operate and maintain machine to minimize dust emissions	**NREL Respiratory Protection** for compliance with ACGIH TLV of 25 µg/m³		
			<2hr./ shift	2-4 hr./ shift	>4 hr./ shift
8 **Walk-behind Saws** [Per 29 CFR 1926.1153 c.1. iv]		https://www.osha.gov/Publications/silica/OSHA_FS-3633.pdf Use saw equipped with integrated water delivery system that continuously feeds water to the blade. (OSHA: <4hr- none; >4hr- none) Verify that: • An adequate supply of water for dust suppression is used; • The spray nozzles are working properly to apply water at the point of dust generation; • The spray nozzles are not clogged or damaged; and • Hoses and connections are intact. When used outdoors:	None	None	APF 10
		When used indoors or in an enclosed area (conditions above for outdoor tasks apply).	APF 10	APF 25	APF 25
9 **Walk-behind milling machines and floor grinders** [Per 29 CFR 1926.1153 c.1.xiii]		https://www.osha.gov/Publications/OSHA3932.pdf Use machine equipped with integrated water delivery system that continuously feeds water to the cutting surface. Verify that: • An adequate supply of water for dust suppression is used; • The spray nozzles are working properly and produce a pattern that applies water at the point of dust generation; • The spray nozzles are not clogged or damaged; and • Hoses and connections are intact.	None	None	APF 10
		Use machine equipped with dust collection system recommended by the manufacturer. Dust collector must provide the air flow recommended by the manufacturer, or greater, and have a filter with 99% or greater efficiency and a filter-cleaning mechanism. Verify that: • The hose connecting the tool to the vacuum is intact and without kinks or tight bends; • The filter(s) on the vacuum are cleaned or changed in accordance with the manufacturer's instructions to prevent clogging; and • The dust collection bags are emptied to avoid overfilling. When used indoors or in an enclosed area, use a HEPA-filtered vacuum to remove loose dust in between passes.	None	None	APF 10

Equipment/Use	Photo of representative equipment	Engineering and work practice control methods • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. • Operate and maintain machine to minimize dust emissions	NREL Respiratory Protection for compliance with ACGIH TLV of 25 µg/m³		
			<2hr./ shift	2-4 hr./ shift	>4 hr./ shift
10 **Drivable Saws** [Per 29 CFR 1926.1153 c.1. v]		https://www.osha.gov/Publications/OSHA3928.pdf For tasks performed outdoors only: Use saw equipped with integrated water delivery system that continuously feeds water to the blade. Verify that: • An adequate supply of water for dust suppression is used; • The spray nozzles produce a pattern that applies the water at the point of dust generation; • The spray nozzles are not clogged or damaged; and • Hoses and connections are intact.	None	None	APF 10
11 **Rig-mounted Core Saws or Drills** [Per 29 CFR 1926.1153 c.1. vi]		https://www.osha.gov/Publications/OSHA3929.pdf Use tool equipped with integrated water delivery system that supplies water to cutting surface. Verify that: • An adequate supply of water for dust suppression is used; • The spray nozzles produce a pattern that applies water at the point of dust generation; • The spray nozzles are not clogged or damaged; and • Hoses and connections are intact.	None	None	APF 10
12 **Dowel Drilling Rigs for Concrete** [Per 29 CFR 1926.1153 c.1. viii]		https://www.osha.gov/Publications/OSHA3930.pdf For tasks performed outdoors only: Use shroud around drill bit with a dust collection system. Dust collector must have a filter with 99% or greater efficiency and a filter-cleaning mechanism. Use a HEPA-filtered vacuum when cleaning holes. Verify that: • The shroud is intact and installed in accordance with the manufacturer's instructions; • The hose connecting the tool to the vacuum is intact and without kinks or tight bends; • The filter(s) on the vacuum are cleaned or changed in accordance with the manufacturer's instructions; and • The dust collection bags are emptied to avoid overfilling.	APF 10	APF 25	APF 25

Equipment/Use	Photo of representative equipment	Engineering and work practice control methods • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. • Operate and maintain machine to minimize dust emissions	NREL Respiratory Protection for compliance with ACGIH TLV of 25 µg/m³		
			<2hr./ shift	2-4 hr./ shift	>4 hr./ shift
13 **Vehicle-mounted Drilling Rigs for Rock and Concrete** [Per 29 CFR 1926.1153 c.1.ix]		https://www.osha.gov/Publications/OSHA3931.pdf Use dust collection system with close capture hood or shroud around drill bit with a low-flow water spray to wet the dust at the discharge point from the dust collector. Verify that: • The shroud or hood is intact and installed in accordance with the manufacturer's instructions; • The hose connecting the tool to the vacuum is intact and without kinks or tight bends; • The filter(s) on the vacuum are cleaned or changed in accordance with the manufacturer's instructions; and • The dust collection bags are emptied to avoid overfilling.	None	None	APF 10
		Operate from within an enclosed cab and use water for dust suppression on drill bit. Verify that: • An adequate supply of water for dust suppression is used; • The spray nozzles are working properly and produce a pattern that applies water on the discharge point from the dust collector; • The spray nozzles are not clogged or damaged; and • Hoses and connections are intact.	None	None	APF 10
14 **Small Drivable Milling Machines (less than half-lane)** [Per 29 CFR 1926.1153 c.1.xiv]		https://www.osha.gov/Publications/OSHA3933.pdf Use a machine equipped with supplemental water sprays designed to suppress dust. Water must be combined with a surfactant. Verify that: • An adequate supply of water for dust suppression is used; • The spray nozzles are working properly and produce a pattern that applies water at the point of dust generation; • The spray nozzles are not clogged or damaged; and • Hoses and connections are intact.	None	None	APF 10

Equipment/Use	Photo of representative equipment	Engineering and work practice control methods • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. • Operate and maintain machine to minimize dust emissions	NREL Respiratory Protection for compliance with ACGIH TLV of 25 µg/m³		
			<2hr./ shift	2-4 hr./ shift	>4 hr./ shift
15 **Large Drivable Milling Machines (half-lane and larger)** [Per 29 CFR 1926.1153 c.1.xv]		https://www.osha.gov/Publications/OSHA3934.pdf For cuts of any depth on asphalt only: Use machine equipped with exhaust ventilation on drum enclosure and supplemental water sprays designed to suppress dust.	None	None	APF 10
		For cuts of four inches in depth or less on a substrate: Use machine equipped with exhaust ventilation on drum enclosure and supplemental water sprays designed to suppress dust.	None	None	APF 10
		For cuts of four inches in depth or less on a substrate: Use a machine equipped with supplemental water spray designed to suppress dust. Water must be combined with a surfactant. Or use a machine equipped with supplemental water spray designed to suppress dust. Water must be combined with a surfactant. Operate and maintain machine to minimize dust emissions.	None	None	APF 10
16 **Crushing machines** [Per 29 CFR 1926.1153 c.1. xvi		https://www.osha.gov/Publications/OSHA3935.pdf Use equipment designed to deliver water spray or mist for dust suppression at crusher and other points where dust is generated (e.g., hoppers, conveyers, sieves/sizing or vibrating components, and discharge points). OSHA: <4hr- none; >4hr- none Use a ventilated booth that provides fresh, climate-controlled air to the operator, or a remote-control station. Verify that: • Nozzles are located upstream of dust generation points and positioned to thoroughly wet the material; • The volume and size of droplets is adequate to sufficiently wet the material (optimal droplet size is between 10 and 150 µm); and • Spray nozzles are located far enough from the target area to provide complete water coverage but not so far that the water is carried away by wind.	None	None	APF 10

Equipment/Use	Photo of representative equipment	Engineering and work practice control methods • Operate and maintain tool in accordance with manufacturer's instructions to minimize dust emissions. • Operate and maintain machine to minimize dust emissions	NREL Respiratory Protection for compliance with ACGIH TLV of 25 µg/m³		
			<2hr./ shift	2-4 hr./ shift	>4 hr./ shift
17 **Heavy Equipment and Utility Vehicles** used to abrade or fracture silica-containing materials (*e.g.*, hoe-ramming, rock ripping) or used during demolition activities involving silica-containing materials [Per 29 CFR 1926.1153 c.1.xvii]		https://www.osha.gov/Publications/OSHA3936.pdf Operate equipment from within an enclosed cab. When workers outside the cab are engaged in the task, apply water and/or dust suppressants as necessary to minimize dust emissions.	None	None	APF 10
18 **Heavy Equipment and Utility Vehicles** for tasks such as grading and excavating but not including: Demolishing, abrading, or fracturing silica-containing materials [Per 29 CFR 1926.1153 c.1. xviii]		https://www.osha.gov/Publications/OSHA3937.pdf Apply water and/or dust suppressants as necessary to minimize dust emissions or	None	None	APF 10
		When the equipment operator is the only worker engaged in the task, operate equipment from within an enclosed cab.	None	None	APF 10

When implementing the control measures specified in the table, each worker must:

- For tasks performed indoors or in enclosed areas, provide a means of exhaust as needed to minimize the accumulation of visible airborne dust.
- For tasks performed using wet methods, apply water at flow rates adequate to minimize the release of visible dust.
- For measures implemented that include an enclosed cab or booth, verify that the enclosed cab or booth:
  - Is maintained as free as practicable from settled dust
  - Has door seals and closing mechanisms that work properly
  - Has gaskets and seals that are in good condition and working properly
  - Is under positive pressure maintained through continuous delivery of fresh air
  - Has intake air that is filtered through a filter that is 95% efficient in the 0.3-10.0 µm range (e.g., minimum efficiency reporting value of 16 or better); and
  - Has heating and cooling capabilities.
- Where a worker performs more than one task on the table during a shift, and the total duration of tasks combined is more than four hours, the required respiratory protection for each task is the respiratory protection specified for more than four hours per shift. If the total duration of tasks in the table combined is less than four hours, the required respiratory protection for each task is the respiratory protection specified for less than four hours per shift.

Basis for NREL Adopted Respiratory Protection APF

The NREL adopted APF modifies the OSHA APF for compliance with the ACGIH TLV of 25 µg/m^3. OSHA permissible exposure limit (PEL) is used to back calculate the maximum concentration associated with the controls listed—time, respirator, or time and respirator. Choose the concentration associated with the same controls when performing the calculation to achieve 25 µg/m^3.

For tasks where OSHA did not restrict exposure duration (time) or require respirators, assumed maximum concentration is 50 µg/m^3. This applies to row one (green row) tasks. Equations reflect control fir time first (divide by 4 or 2), then a second division for respirator.

Note:
Division by 2 accounts for four-hour exposure duration versus the PEL-based eight-hour exposure.
Division by 4 accounts for two-hour exposure duration.
Division by 10, 25, or 50 accounts for the respirator APF reduction.

OSHA PEL = 50 µg/m^3			**ACGIH TLV = 25 µg/m^3**			**OSHA Table 1 Tasks**
≤ 4 hours/shift	> 4 hours/shift		≤ 2 hours/shift	≤ 4 hours/shift	> 4 hours/shift	
None*			None			3,4,5, 12 outdoors, 1, 6, 7, 9 13, 14, 15, 16, 17, 18
50 µg/m^3			50/4 = 12.5			
None (time only)						2 outdoors, 10 outdoors, 12 indoors/enclosed
100-2 = 50 **100 µg/m^3**						
						2 indoors/enclosed 4 indoors/enclosed 8 outdoors 10 indoors/enclosed
				APF 10 not protective		
						11
1000/2/10 = 50 **1000 µg/m^3**	1250/25 = 50					

In the Preamble to 29 CFR 1925.1153 in the Federal Register Vol. 81, No. 58 (pages 16461-16463), OSHA discussed the adequacy of use of 29 CFR 1925.1153c.1 Table 1 for compliance with the OSHA action level of 25 µg/m^3. The OSHA table does not ensure compliance with 25 µg/m^3. The OSHA action level and the ACGIH TLV are both 25 µg/m^3, thus this comparison is appropriate to be used for U.S. Department of Energy-mandated ACGIH TLV. To address the lower TLV value, when OSHA's Table 1 provided an APF, NREL has reduced the exposure time or increased the APF value as necessary to stay within the 25 µg/m^3 TLV. For instance, if the OSHA Table 1 listed APF = 10, NREL set the APF = 25-50 to stay within the TLV. When OSHA listed "None" for eight hours, NREL may have adopted APF = 10 as needed. NREL added the <2 hour/shift column to allow safe exposure without respiratory protection when possible.

Alternative Exposure Control Methods - Permissible Exposure Limit (PEL)

50 Micrograms per Cubic Meter of Air ($\mu g/m^3$)

Averaged over an 8-hour work day

Alternative Exposure Control Methods - Exposure Assessment

Employers must:

- Determine exposures
- Give employees results
- Let representatives observe

Air Sampling for Silica

Housekeeping

When cleaning silica dust, avoid:

- Dry sweeping/brushing
- Compressed air without a ventilation system to capture the dust

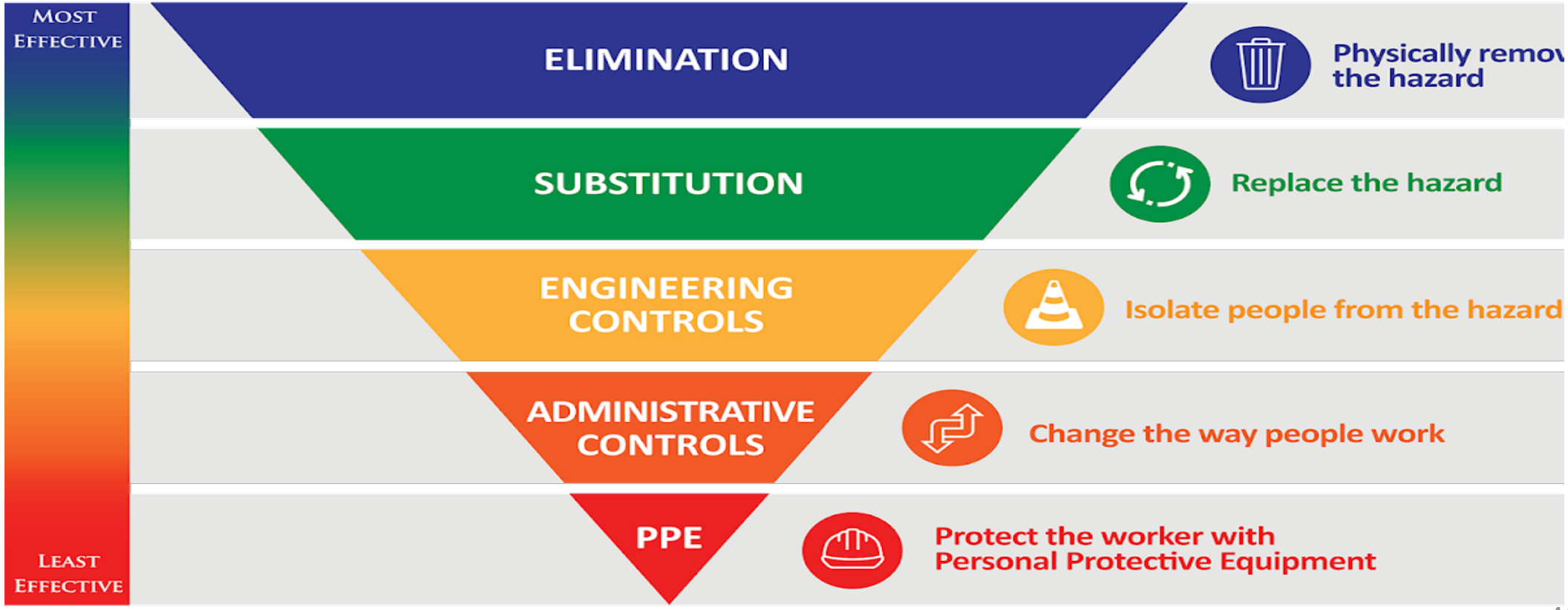
Housekeeping

Employers must let employees know which housekeeping methods:

- Must be used in the workplace
- Must not be used in the workplace

Specified Exposure Control Methods - 1926.1153(c)

- For each employee engaged in a task identified on Table 1, the employer shall fully and properly implement the engineering controls, work practices, and respiratory protection specified for the task on Table 1, unless the employer assesses and limits the exposure of the employee to respirable crystalline silica in accordance with paragraph (d) of this section.



Medical Surveillance

- ***Initial examination:***
  The employer shall make available an initial (baseline) medical examination within 30 days after initial assignment, unless the employee has received a medical examination that meets the requirements of this section within the last three years.
- Includes:
  Work History,
  Physical Examination,
  Chest x-ray,
  Pulmonary Function Test,
  TB,
  and others deemed appropriate by the PLHCP.

Information provided to the PLHCP (1910.1053.(i)(4)

The employer shall ensure that the examining PLHCP has a copy of this standard, and shall provide the PLHCP with the following information:

- A description of the employee's former, current, and anticipated duties as they relate to the employee's occupational exposure to respirable crystalline silica;
- The employee's former, current, and anticipated levels of occupational exposure to respirable crystalline silica;
- A 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; and
- Information from records of employment-related medical examinations previously provided to the employee and currently within the control of the employer.

Written Reports by the PLHCP

- ***PLHCP's written medical report for the employee***.
- The employer shall ensure that the PLHCP explains to the employee the results of the medical examination and provides each employee with a written medical report within 30 days of each medical examination performed.

- ***PLHCP's written medical opinion for the employer***.
- The employer shall obtain a written medical opinion from the PLHCP within 30 days of the medical examination.

Communication of Respirable Crystalline Silica Hazards to Employees - 1910.1053(j)

- The employer shall include respirable crystalline silica in the program established to comply with the hazard communication standard (HCS) (29 CFR 1910.1200).
- 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 and paragraph (j)(3) of this section.
- The employer shall ensure that at least the following hazards are addressed: Cancer, lung effects, immune system effects, and kidney effects.

Signs

- The employer shall post signs at all entrances to regulated areas that bear the following legend:
  - DANGER
  - RESPIRABLE CRYSTALLINE SILICA
  - MAY CAUSE CANCER
  - CAUSES DAMAGE TO LUNGS
  - WEAR RESPIRATORY PROTECTION IN THIS AREA
  - AUTHORIZED PERSONNEL ONLY

Employee Information and Training - 1910.1053 (j)(3)(i).

The employer shall ensure that each employee covered by this section 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 contents of this section; and
- The purpose and a description of the medical surveillance program required by paragraph (i) of this section.
- The employer shall make a copy of this section readily available without cost to each employee covered by this section.

Record Keeping

Employers must:

- Keep medical and exposure records.
- Make them available.

Quiz

1. The most common symptom of excessive respirable crystalline silica exposure is:
   a) Cancer
   b) Shortness of breath
   c) Tuberculosis
   d) Liver disease

Quiz

1. This is another name for the scarring that occurs in the lungs of workers diagnosed with silicosis:
   a) Pneumoconiosis
   b) Bronchitis
   c) Fibrosis
   d) Cancer

Quiz

1. Workers suffering from silicosis have _____ lung capacity.
   a) Decreased
   b) Increased
   c) Unchanged
   d) Interrupted

Practice Questions

1. Employees are required to receive a medical exam within this many days after assignment?

   30

2. The employer will receive a written opinion that contains: date of the exam, statement that exam met the requirements of the standard and?

   limitations on use of respirators

3. When must training on the hazards of silica occur?

   Prior to the start of work

Summary

- You are now able to:
  - Define Crystalline Silica.
  - Understand How Workers are Exposed?
  - Identify the Health Effects of Crystalline Silica.
  - Select the Appropriate Protective Measures.
  - Comply With the Requirements for Handling Silica (Construction & General Industry).

Resources:

- https://www.osha.gov
- https://www.osha.gov/sites/default/files/SilicaGeneralIndustryFAQs.pdf
- https://www.osha.gov/silica-crystalline/general-industry-info#collapse1_1
- https://www.nrel.gov/about/assets/pdfs/agc-silica-control-measures-guide.pdf
- https://www.youtube.com