Workplace Silica Hazards
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What is silica?
What is silica?

Crystalline silica is an abundant mineral in the earth’s crust, and a basic component of most classes of rock.

It occurs in several forms, the most common being quartz.
What is silica?

- “Silica” refers broadly to the mineral compound silicon dioxide (SiO$_2$)
- Silica can be crystalline or amorphous
- Crystalline silica is more hazardous to employees than amorphous silica
- Three common forms:
  - Quartz
  - Cristobalite
  - Tridymite
Where is silica used?
Silica hazards in the workplace

Silica is used in...

Common workplace operations involving:

- Cutting
- Sawing
- Drilling
- Crushing of concrete
- Brick, block, rock, concrete and stone products
- Operations using sand products, such as in glass manufacturing and sandblasting
Silica is used in...

- Many manufacturing facilities in the form of clay-based loose absorbents

- Cat litter, floor sweep, diatomaceous earth and many other types of loose absorbents contain crystalline silica
What industries are at the highest risk for crystalline silica exposure?
High Risk Industries

Occupational exposure to crystalline silica occurs across a broad range of industries, including:

- Mining
- Manufacturing
- Construction
- Maritime
- Agriculture
High-Risk Occupations

- Abrasive Blasting
- Foundries
- Contractors and Construction
- Utilities
- Masonry, Stone Setting and Other Stone Work
- Clay Refractories
- Ready-Mixed Concrete
- Cement and Brick Manufacturing

- Asphalt Paving
- China and Ceramic Manufacturing
- Tool and Die Industry
- Manufacturing of Household Abrasives, Adhesives, Paints, Soaps and Glass
- Cut Stone and Stone Products
- Steel Works, Blast Furnaces
What are silica’s health hazards?
History of Hazards

Silicosis is one of the world's oldest known occupational diseases — reports date back to ancient Greece.

By 1800, many names for silica-related illnesses arose:

- Grinders' Asthma
- Grinders' Rot
- Masons' Disease
- Miners' Asthma
- Potters' Rot
- Stonemasons’ Disease
History of Hazards

• During the 1920s, the health risks of the “dusty trades” emerged as a significant public health concern

• Silicosis was listed as the underlying cause of death in 6,322 fatalities in the United States from 1968 through 1990

• From 1985 to 1992, death certificates for approximately 868 men and 46 women listed silicosis as the underlying cause of death in nonmining occupations
Silica hazards in the workplace

Silicosis

- Silicosis is a fibrotic disease of the lungs caused by the inhalation of crystalline silica dust
- Respirable silica dust enters the lungs and causes the formation of scar tissue, reducing the lungs’ ability to take in oxygen
- There is no cure for silicosis
Silicosis

Chronic/classic silicosis:

• The most common form of silicosis
• Typically occurs after 15 – 20 years of low to moderate exposure
• Symptoms may or may not be obvious at first
• As the disease progresses, the worker may experience shortness of breath upon exercising and have clinical signs of poor oxygen/carbon dioxide exchange
• In the later stages, the worker may experience fatigue, extreme shortness of breath, chest pain, or respiratory failure
Silica hazards in the workplace

Silicosis

Acute silicosis:

- Occurs after a few months or as long as two years following exposure to extremely high concentrations of respirable crystalline silica
- Symptoms of acute silicosis include severe disabling shortness of breath, weakness, and weight loss, which often leads to death
Silica hazards in the workplace

Silicosis

**Accelerated silicosis**

- Can occur after 5 – 10 years of high exposures to respirable crystalline silica
- Symptoms include severe shortness of breath, weakness, and weight loss
- The onset of symptoms takes longer than in acute silicosis
Tuberculosis

- Tuberculosis (TB) is a common, infectious disease caused by various strains of bacteria
- Because silicosis affects lung function, it makes people more susceptible to lung infections like tuberculosis
- NIOSH studies have firmly established an association between tuberculosis (TB) and silicosis
Chronic Obstructive Pulmonary Disease

- Chronic Obstructive Pulmonary Disease (COPD) is a progressive disease that makes it hard to breathe
- This disease can become worse over time
- Studies have shown that occupational exposure to respirable crystalline silica is associated with COPD, including bronchitis and emphysema
Several studies have found statistically significant increases in death or incidences of immunologic disorders and autoimmune diseases in employees exposed to silica.

These disorders and diseases include:

- Scleroderma
- Rheumatoid arthritis
- Lupus
- Sarcoidosis
Renal Disease

Studies report statistically significant associations between occupational exposure to silica dust and several renal diseases or effects, including:

- End-stage renal disease morbidity
- Chronic renal disease mortality
- Wegener's Granulomatosis
What organizations recognize silica hazards?
Recognizing Hazards

The International Agency for Research on Cancer (IARC) has designated crystalline silica as carcinogenic (substance that causes cancer) to humans.
Recognizing Hazards

The U.S. National Toxicology Program has concluded that respirable crystalline silica is known to be a human carcinogen.
Recognizing Hazards

The National Institute for Occupational Safety and Health (NIOSH) has reviewed silica hazards and published guidance documents for preventing silica-related illnesses.
Recognizing Hazards

Exposure to crystalline silica is addressed by several OSHA standards for general industry, shipyard employment, and construction.

- 1972 — OSHA issued guidelines for conducting inspections in workplaces with significant crystalline silica exposure
- 1996 — OSHA issued a Special Emphasis Program (SEP) for Silicosis
- 1998 and 2003 — OSHA identified crystalline silica as a focused hazard
Recognizing Hazards

OSHA has a National Emphasis Program (NEP) for Crystalline Silica designed to:

- Significantly reduce/eliminate employee overexposure to crystalline silica
- Control the health hazards associated with such exposure
- Provide outreach and compliance assistance to employers
Recognizing Hazards

OSHA requires products containing respirable silica to have Safety Data Sheets (SDSs) that identify health hazards.

- A product containing >=0.1% crystalline silica must have a SDS
- Packages for products containing respirable silica must also be properly labeled to identify hazards
Recognizing Hazards

Inhaling silica dust can have both acute and chronic health effects.

Rule of Thumb: If dust containing silica is visible in the air, consider it to be hazardous.
How can silica hazards be controlled?
Eliminating Hazards

Evaluate and document engineering, administrative and other controls as well as work practices intended to reduce exposure to respirable crystalline silica.

Eliminating loose absorbents that contain silica is one easy step that can be taken in manufacturing facilities.
Engineering and Administrative Controls

- Local exhaust ventilation
- Tools with dust-collecting systems
- Substitute less hazardous materials for free silica
- Use wet methods when grinding, sanding or otherwise creating free silica dust
- Process isolation (e.g., control room, enclosures, blasting cabinets or barriers)
Engineering and Administrative Controls

- Use of HEPA-equipped vacuums or wet sweeping for cleaning
- Provide warning labels on machines used for blasting, grinding, etc.
- Attach warning labels to all products containing >= 0.1% crystalline silica and ensure that the label is not defaced or removed
- Dust should be vacuumed from clothing contaminated with silica, not blown or shaken
Engineering and Administrative Controls

- Contaminated surfaces should not be blown clean with compressed air or other forced air.
- Do not allow workers to eat, drink, smoke or apply cosmetics in areas where crystalline silica dust is present — provide separate, silica-free break areas for consuming food and beverages.
- Provide exposure monitoring, health screening and surveillance programs to monitor any adverse health effects.
Respiratory Protection

- NIOSH-Recommended Exposure Limit (REL) for respirable crystalline silica is 50 µg/m³
- When engineering and administrative controls are not sufficient to meet the REL, respiratory protection is necessary to help protect workers
Respiratory Protection

OSHA specifies the use of respiratory protection with at least a N95 filter efficiency.

NIOSH recommends the use of half-facepiece particulate respirators with N95 or better filters for airborne exposures to crystalline silica at concentrations less than or equal to 0.5 mg/m3.
Respiratory Protection

Respirators:

- Must fit properly
- Must be fit-tested
- Must be able to maintain a tight seal
- May not be worn with beards
- Require training on donning/doffing/care/replacement
- Should not be altered in any way
Encouraging Safety

Employers are responsible for making their employees aware of hazards and controls.

Workers have a responsibility to protect themselves:

- Become informed
- Use respirators when needed
- Participate in medical screenings
- Practice good personal hygiene in the workplace
Thank You