

Chapter 2

Health Hazards of Abrasive Blasting

⇒ ⇒ ⇒ **IF YOU PERFORM ABRASIVE BLASTING, BE AWARE OF:**

- ⇒ **Respirable Crystalline Silica**
- ⇒ **Silicosis**
- ⇒ **Noise**
- ⇒ **Metals**
- ⇒ **Mechanical hazards**

⇒ ⇒ ⇒ **WHAT IS CRYSTALLINE SILICA (QUARTZ)?**

The term “crystalline silica” and “quartz” refer to the same thing. Crystalline silica is a natural constituent of the earth’s crust and is basic component of sand, quartz and granite.

⇒ ⇒ ⇒ **THERE ARE TWO TYPES OF SILICA.**

1. Harmful (Silica, crystalline (as respirable dust))

Trade Names for Crystalline Silica

- ⇒ Quartz
- ⇒ Cristobalite
- ⇒ Tripoli
- ⇒ Tridymite

2. Non- or Less-harmful* (Silica, amorphous)

Trade Names for Amorphous Silica

- ⇒ Diatomaceous earth
- ⇒ Diatomaceous silica
- ⇒ Diatomite
- ⇒ Silica gel
- ⇒ Silicon Dioxide (amorphous)

* When diatomaceous earth is heated to 450°C (calcined), the amorphous form begins to convert to the crystalline form, cristobalite. As such, it would be defined as toxic.

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⇒ ⇒ ⇒ WHAT IS SILICOSIS?

Silicosis is a debilitating lung disease caused by breathing dust containing microscopic crystalline silica particles.

⇒ ⇒ ⇒ HOW DOES SILICA HARM MY HEALTH?

The silica dust you inhale damages the region of your lungs where oxygen in the air is exchanged for the carbon dioxide in your blood. This area of your lungs is called alveoli or air sacs. The hairs in your nose and small hair called cilia in your upper lungs will remove a lot of the dust and silica particles before they get into these air sacs. Unfortunately, these hairs can only remove larger particle sizes; the very fine particles of silica dust will escape these defense mechanisms and get into the air sacs. The particles that enter your air sacs are around 3-5 microns (μ) in diameter. To put this into perspective, the diameter of a human hair ranges from 40 μ - 150 μ .

Once in the air sacs, the silica dust stimulates a defense reaction, which causes scar tissue (fibrous nodules) formation in the lungs. As the condition worsens, the nodules become progressively larger. The scar tissue affects your breathing by limiting how much your lungs can stretch during inhalation. This limits the amount of air you can breathe in. The scarring also produces less surface area available in your air sacs to exchange carbon dioxide for oxygen.

In addition to silicosis, inhalation of crystalline silica particles has been associated with other health problems, such as bronchitis, tuberculosis and lung cancer. The rate at which silicosis progresses is related to the length and level of silica exposure. The disease may progress even after exposure has stopped.

Silicosis may be present in an acute or chronic form. The acute form of silicosis may develop after short periods (weeks or months) of extremely high exposure such as occurs with abrasive blasting. Chronic silicosis occurs in three forms: simple, complicated and accelerated. Simple and complicated silicosis occur after 10 or more years of exposure to lower levels of quartz. Accelerated silicosis occurs after 3-5 years of exposure when exposure conditions are high. People with silicosis have increased susceptibility to infections such as tuberculosis and bronchitis, and are at an increased risk of developing lung cancer and autoimmune diseases.

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There is **NO CURE** for silicosis. **PREVENTION IS THE ONLY ANSWER.**

⇒ ⇒ ⇒ WHAT ARE THE SYMPTOMS OF SILICOSIS?

Silicosis begins with few, if any, symptoms! (Exception - acute form)

Simple Silicosis (Limited scarring of the lung)

Chest X-rays show small, rounded masses (nodules) about 1 cm in size. Symptoms might include:

- ⇒ shortness of breath upon exercising.
- ⇒ fatigue.
- ⇒ loss of appetite.
- ⇒ pain in the chest.

Complicated Silicosis (More advanced scarring of the lungs.)

Another name for complicated silicosis is progressive massive fibrosis (PMF). The nodules increase in size and grow together to form larger masses. In fact, the nodules encompass blood vessels and airways. Chest X-rays show both small, rounded masses and large masses (golf ball size and larger). Progression of the disease leads to:

- ⇒ fatigue.
- ⇒ extreme shortness of breath.
- ⇒ loss of appetite.
- ⇒ pain in the chest.
- ⇒ respiratory failure.

Accelerated Silicosis

Accelerated silicosis results from exposure to high concentrations of crystalline silica. Symptoms are similar to those of simple or complicated silicosis but lung scarring develops 3-5 years after the initial exposure. Chest X-rays show a pattern similar to simple silicosis. This form has been described most often in sandblasters.

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Acute Silicosis

Acute silicosis may develop after short periods such as weeks or months when you are working in exceptionally high exposure concentrations. Under these exposure conditions, the silica causes your lungs to fill up with fluids because of damage to the walls of the air sacs. Acute silicosis may occur when abrasive blasters blast without respiratory protection. Chest X-rays show fluid accumulation in the lungs. Symptoms include:

- ⇒ extreme shortness of breath.
- ⇒ loss of appetite.
- ⇒ pain in the chest.
- ⇒ respiratory failure.

⇒ ⇒ ⇒ WHAT ARE SOME COMPLICATIONS ASSOCIATED WITH SILICOSIS?

Tuberculosis (TB)

Silica particularly affects the cells that control TB infection and makes people more likely to get sick from TB germs if they are exposed. Symptoms include:

- ⇒ coughing up blood.
- ⇒ fever.
- ⇒ shortness of breath.

Lung Cancer

The International Agency for Research on Cancer (IARC), a recognized authority on the health effects of chemicals and mineral dusts, has classified silica as a known cancer-causing agent. Lung cancer symptoms may include:

- ⇒ coughing up blood.
- ⇒ chest pain.
- ⇒ shortness of breath.

Autoimmune Disease and Chronic Renal Diseases

Workers occupationally exposed to crystalline silica may develop autoimmune diseases such as scleroderma, systemic lupus erythematosus (lupus), rheumatoid arthritis and chronic renal disease.

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*If **SUBSTITUTING non-silica containing blast materials is NOT POSSIBLE:***

⇒ ⇒ ⇒ WHAT CAN EMPLOYEES DO TO LIMIT THEIR EXPOSURE TO CRYSTALLINE SILICA?

✓	Employers are required to provide and assure that you use appropriate controls for crystalline silica-containing dust. Be sure to use all available engineering controls such as local exhaust ventilation, general ventilation and containment structures. Make sure all engineering controls are working properly. Tell your employer when they aren't working properly.
✓	Use good housekeeping procedures. Remove dust by wet sweeping instead of dry sweeping or vacuum with a high-efficiency particulate (HEPA) filter instead of blowing it clean with compressed air.
✓	Know your work operations where exposure to crystalline silica may occur. Use good work practices to minimize exposures.
✓	Participate in air monitoring, medical surveillance and any training programs offered by your employer.
✓	Use Type-CE Abrasive-Blasting Positive-Pressure respirators for ALL blast jobs.
✓	Wear, maintain, and correctly use your respirator.
✓	If possible, change into disposable or washable work clothes at your worksite ; shower and change into clean clothing before leaving the worksite.
✓	Do not eat, drink, smoke, or apply cosmetic products in areas where there are dusts containing crystalline silica.
✓	Wash your hands, arms and face before eating, drinking, smoking or applying cosmetics outside the work area.
✓	Do not start smoking cigarettes or stop if you do.
✓	Park your car where it will not be contaminated by airborne silica dust.

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*If **SUBSTITUTING non-silica containing blast materials is NOT POSSIBLE:***

⇒ ⇒ ⇒ WHAT CAN EMPLOYERS DO TO LIMIT THEIR WORKERS' EXPOSURE TO CRYSTALLINE SILICA?

✓	Make a commitment to prevent silicosis at your worksite.
✓	Develop a Silica Control Plan and your Company Health and Safety Plan .
✓	Comply with MIOSHA and OSHA regulations on respirable crystalline silica. If your employees are overexposed, reduce exposure levels through the use of engineering controls.
✓	Install and maintain engineering controls to eliminate or reduce the exposure to crystalline silica. Try to use dust collecting systems, blast rooms, automatic blast cleaning machines or cabinets.
✓	Perform air monitoring at worksites as needed.
✓	Always provide Type-CE Abrasive Blasting Positive Pressure Respirators and Personal Protective Equipment.
✓	Establish a written respiratory protection program. Outfit employees with appropriate respiratory protection. Ensure respirators are kept clean and properly maintained and that employees are trained in their use.
✓	Train the employees about health effects, alternative medias, engineering controls, and work practices that reduce dusts. Also train employees about the importance of good personal hygiene, good work practices, good housekeeping, and the proper use and fitting of respirators. Make sure they know what operations and materials present a silica hazard.
✓	Provide medical examinations for employees who are exposed to crystalline silica and have X-rays read by a specialist in dust diseases.
✓	Post warning signs to identify work areas where respirable silica is present.
✓	Report all cases of silicosis to the State. If required, maintain a MIOSHA log. Record silicosis cases on the MIOSHA log.

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⇒ ⇒ ⇒ WHAT MIOSHA AND OSHA REGULATIONS APPLY?

MIOSHA and OSHA enforce permissible exposure limits (PELs) for numerous air contaminants, including silica. The PELs published for crystalline and amorphous forms of silica stipulate the maximum amount of each form an employee may be exposed to during an eight-hour work shift.

General Industry employers are subject to the PEL requirements outlined in MIOSHA Occupational Health Standard, Part 301 – Air Contaminants. Construction employers are subject to the Maximum Allowable Concentration (MAC) requirements outlined in MIOSHA Occupational Health Standard, Part 601 – Air Contaminants for Construction.

Please Refer to:
Appendix III – Part 301: Air Contaminants and Part 601 – Air Contaminants for Construction

Other relevant MIOSHA and OSHA regulations pertaining to the use of silica include: abrasive blasting, respiratory protection, posting of warning signs, record keeping, reporting of occupational illnesses, personal protective equipment, and training. There are also rules on hazard communication, safety and health programs, and access to employee exposure and medical records.

A reminder to both workers and employers:

The American Lung Association recommends quitting smoking for better lung health. Call 1-800-LUNG-USA for more information on how to quit.

⇒ ⇒ ⇒ WHERE CAN YOU GET MORE INFORMATION ON PREVENTING SILICOSIS?

⇒ **Michigan State University:** Our website contains information on silicosis, this training manual, and other health and safety information. Internet Address: www.oem.msu.edu/.

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⇒ **OSHA Silica Advisor:** eTools are "stand-alone," interactive, Web-based training tools that provide guidance information for the development of a comprehensive safety and health program. Therefore, they include elements that go beyond specific OSHA mandates, such as recommendations for good industry practice. eTools do not create new OSHA requirements. Internet Address: www.osha.gov/SLTC/etools/silica/index.html.

⇒ **CDC-NIOSH Silica Topic Page:** The Centers for Disease Control (CDC), National Institute for Occupational Safety and Health (NIOSH) has a searchable bibliographic database of occupational safety and health publications, documents, grant reports, and journal articles supported in whole or in part by NIOSH as well as other information on silica and silicosis. Internet Address: www.cdc.gov/niosh/topics/silica/default.html.

⇒ **NIOSH:** NIOSH Alert "Preventing Silicosis and Deaths From Sandblasting" Publication No. 92-102. Internet Address: www.cdc.gov/niosh/92-102.html

Other Health Hazards

⇒ ⇒ ⇒ NOISE

Steady exposure to high noise levels and repeated exposure to loud impact noises can lead to permanent deterioration of your hearing system. An evaluation of noise levels and their duration should be conducted, particularly because potentially hazardous levels are not always apparent. The MIOSHA permissible exposure level (PEL) is 90 dBA, and the action level (AL) is 85 dBA. Noise levels associated with abrasive blasting operations (e.g. blasting hose noise) often exceed both the MIOSHA PEL and the MIOSHA AL.

When noise levels are at or above the action level (AL), the employer must develop a hearing conservation program. This program should include:

- ⇒ Testing the employee's hearing at the time of hire and annually thereafter.
- ⇒ Developing and implement a noise monitoring program.
- ⇒ Training employees on the hazards of noise and how to protect themselves.
- ⇒ Wearing hearing protection when you blast.
- ⇒ Developing a recordkeeping system to audit the program.

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⇒ ⇒ ⇒ METALS

You should be aware of the hazards associated with exposure to metals including lead, cadmium and inorganic arsenic. MIOSHA has air contaminant rules for these materials. Before you blast, find out what you are blasting and protect yourself from the hazards. Metals cause adverse health effects in nearly every organ of your body.

Read the MSDS of the abrasive material you are using. Silica substitutes may also contain potential health contaminants. If you don't have the MSDS, assume the worst-case scenario.

Mechanical Hazards

⇒ ⇒ ⇒ **OTHER HAZARDS** associated with abrasive blasting are the mechanical hazards of:

- ⇒ media ricochet,
- ⇒ a jammed hose, and
- ⇒ the ever present danger of one blaster inadvertently shooting another.

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Notes