

Respiratory Protection for Silica.

Silica is a naturally occurring mineral consisting of oxygen and silicon (silicon dioxide) and is present in most rocks and soil - it is the second most abundant mineral in the earth's crust.

Overexposure to certain types and amounts of silica particles can lead to lung disease - it was classified as a human carcinogen (Group 1) by the International Agency for Research on Cancer (IARC) in 1997.



What is Silica?

Silica occurs in two forms, crystalline silica and noncrystalline or amorphous silica.

Crystalline silica (also called “free” silica) is a normal constituent of soil, sand, granite and many other minerals. The most common form is quartz, with cristobalite and tridymite also present in many materials. All of these forms may become respirable sized particles (i.e. less than 10 micron in diameter) when workers chip, cut, drill, abrade or grind materials that contain crystalline silica. These small particles can be released into the breathing air of workers and can travel deep into the lungs.

Non-crystalline or amorphous silica is classified as a nuisance dust and includes materials like diatomaceous earth and silica gel. Crystalline silica is much more toxic than amorphous silica. Naturally occurring granite contains up to 30% crystalline silica, while sandstone has more the 70% content. Many manmade products contain crystalline silica - bricks can have up to 30% silica content, while concrete/cement can be composed of 25-70% crystalline silica.

Workplace Exposure Standards (WES)

The current WES for some forms of silica*:

	Australia	New Zealand
Crystalline silica (Respirable fraction)	0.05 mg/m ³	0.025 mg/m ³
Amorphous silica (e.g. Diatomaceous earth, silica gel)	10 mg/m ³	10 mg/m ³
Fumed silica (Respirable fraction)	2 mg/m ³	2 mg/m ³

*See the Safe Work Australia or Worksafe NZ Workplace Exposure Standards databases for more detail.

What are the Health risks of crystalline silica?

Diseases caused by overexposure to crystalline silica include silicosis. The most common form of silicosis is as an occupational disease resulting from moderate contact with crystalline silica particulates over a long period of time.

The silica dust enters the lung and can then cause scar tissue, decreasing the lung's capacity to absorb oxygen as well as causing inflammation of the lungs, shortness of breath, coughing and fever and is linked to kidney disease. Silicosis is incurable and makes the sufferer more vulnerable to lung infections like tuberculosis and can initiate lung cancer. Excessively high exposures to crystalline silica can cause acute silicosis in months or a couple of years, causing shortness of breath, weakness, weight loss and premature death.

Where can workers be exposed to crystalline silica?

Construction work, brick and tile manufacturing, foundry work, mining, quarrying, tunnelling and stonemasonry are all industries that can have significant crystalline silica exposure risk when working with rock, stone, ceramics, bricks etc. Crystalline silica is also used in abrasives, adhesives, paints and glass and refractory brick furnace linings. Tasks such as dry cutting of bricks, masonry, concrete or tiles, mortar removal, chipping etc. done with a powered tool can require use of some level of respiratory protection.

Note that sand or any silica containing materials should not be used as an abrasive blasting agent. (Safe Work Aust Abrasive Blasting Code of Practice 2020, Section 3.) And as per WorkSafe NZ: to eliminate respirable crystalline silica (RCS) dust risk to health "Use alternative products (eg metallic shot, slag products or grit instead of sand for abrasive blasting)" (<https://www.worksafe.govt.nz/topic-and-industry/dust/silica-dust-in-the-workplace/>)

What controls are available to reduce exposure to crystalline silica?

There is a clear potential for creation of airborne silica particles in the worker's breathing zone when working with silica based materials and an appropriate risk assessment undertaken to determine suitable control measures.

The normal hierarchy of controls will apply, so in the first instance product substitution, use of enclosures, extract ventilation, wet cutting methods and other suitable strategies can be used to control exposures. However, for some circumstances and situations, the use of respiratory protection may be necessary for workers to control the exposures.

Where do I find information about respiratory protection?

Use of respirators in Australia and New Zealand is commonly done using Australian/New Zealand Standard AS/NZS 1715:2009 which provides information and guidance on selection, use and maintenance of respiratory protective equipment in the workplace.

In AS/NZS1715, different types of respirators are rated to provide a stated level of protection to a trained, fitted user. The specific types of respirators selected will depend on the magnitude of the airborne silica concentrations, the specific working conditions, other controls in place and consideration of other PPE involved and personal factors like comfort.

What are the respiratory protection issues associated with crystalline silica?

Silica is a particulate hazard, typically created by mechanical action (cutting, drilling, sanding, sawing) or by flame treating a silica source to create silica particulates. The type and extent of the work being done will affect the particle size and amounts of silica particles being released into the workplace breathing air.

Protection from particulate silica can be provided by certain respirators. There are several different types of respirators providing different features and levels of protection - see some possible product options on this page below for examples and their rated Required Minimum Protection Factor (RMPF) *(ref. AS/NZS 1715:2009).

Respirators that have multiple levels of protection are available i.e. in addition to protecting the lungs, they may also have design features that protect the head, face and eyes to the relevant Australian/New Zealand Standards.

A particle filter rated P1, P2 or P3 will be needed for many of these, while there are also airline supplied respirator options for high level protection. Tasks such as dry cutting bricks, masonry, concrete, tiles, mortar removal, chipping tools etc. with a powered tool will very often require use of some level of respiratory protection.

*The Protection Factor (PF) is the reduction of exposure expected for a respirator when used by a trained, properly fitted clean shaven wearer.

NOTE: Products indicated are rated for protection against certain substances only - each application will be different and an assessment of each is required. The user/PCBU is responsible for determining the suitability of the product for its intended use. Contact 3M for specific advice.

Disposable Respirators (RMPF up to 10 times)



Reusable Respirators (RMPF = up to 10 Half face with P2 or P3, up to 50 Full face with P2 up to 100 Full face with P3)



Powered Air Purifying Respirators with loose fitting headtop (RMPF) = up to 50 with PAPR-P2 or PAPR- P3 filter)



Airline Respirators (RMPF = up to 50 Half face, up to 100 Full face)



3M offers other PPE that can be useful working with silica:

Eyewear



Hearing Protection



Coveralls



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