

What is Silicosis

Silicosis is a pneumoconiosis, meaning a lung disease caused by dust. It is caused by breathing in “respirable” particles containing crystalline silicon dioxide (SiO₂), commonly called silica. Respirable means the airborne dust fraction that can penetrate deep into the pulmonary alveolar region of the lungs.

There are eight different crystalline silica polymorphs that differ in their toxicity. Tridymite, cristobalite, and quartz are polymorphs with high toxicity, while coesite and stishovite are relatively less toxic. The other silica polymorphs have not been studied in any detail.

It is now recommended for all workers exposed to crystalline silica to undergo lifelong health surveillance on an annual basis. The World Health Organization (WHO) advise that a baseline chest X-ray (ILO CXR) should be obtained at the start of employment, with a repeat chest X-ray performed after 2–3 years. A screening chest X-ray should then be performed every 2–5 years thereafter. Spirometry and symptom questionnaires should also be obtained annually from the start of employment and should prompt referral to specialist respiratory services if any significant change or abnormality is detected.

The Chest X-Ray should be ordered as a ILO CXR. See guidelines regarding this

http://www.ilo.org/safework/info/WCMS_108548/lang--en/index.htm

http://www.ilo.org/safework/info/publications/WCMS_168260/lang--en/index.htm

What workers are at risk?

Quartz is the most common type of crystalline silica. It is the second most abundant mineral in the earth’s crust meaning silica is found in most rock beds and their sands.

Fine silica dust is formed during breaking, cutting, dressing and polishing stone particularly with tools such as saws, hammers, chisels, pitchers, airguns and angle grinders.

Workers at risk include those in

- Mining
- Quarrying
- Tunneling
- Construction
- Stone cutting and installation including composite stone used in kitchen, bathrooms, laundries.
- Glass manufacture
- Sand blasters
- Abrasives manufacturing
- Slate works
- Foundries
- Pottery and ceramic manufacture
- Brick and tile manufacture
- Landscapers who cut stone.

The World Health Organization (WHO) recommends all workers exposed to crystalline silica should undergo lifelong health surveillance with annual questionnaire and spirometry and periodic CXRs.

How does Silica cause disease?

Respirable Crystalline Silica damages lungs in a number of ways. There is a direct cytotoxic action by the crystals on lung tissue. The crystals are also swallowed by immune cells (macrophages) in the lungs. They attempt to chemically destroy the crystals but they themselves die and the toxic chemicals release further damage the lung tissue. New immune cells come to try the same process, with the same result. This creates an ongoing cycle of scarring and swelling in the lungs and the chest lymph nodes that continues after silica exposure ceases.

Three types of silicosis occur:

Chronic silicosis

Results from long-term exposure to low concentrations of silica dust for periods more than 20 years. This is the most common form of silicosis.

Accelerated silicosis

Results from exposure to higher concentrations of silica over a shorter period of time such as 5 to 15 years.

Acute silicosis

Results from short-term exposure to very high concentrations of silica. The lungs become very inflamed and can fill with fluid, causing severe shortness of breath and a low blood oxygen levels.

Symptoms of Silicosis

These are subtle at first and gradually increase as the scarring of the lungs progresses.

Symptoms include:

- Cough
- Excess phlegm production
- Susceptibility to chest infections
- Shortness of breath
- Weight loss

Silicosis is also known to create other health problems. These include

- Autoimmune Connective tissue diseases, including rheumatoid arthritis, scleroderma and systemic lupus erythematosus. These can affect all body organs
- Lung cancer
- A high susceptibility to contract Tuberculosis

Monitoring & Diagnosis

A medical and occupational history is extremely important to understand if silica exposure may have occurred in the past. This includes current work, past work as well as current and past worker hobbies.

A physical exam will be performed with a Lung Function test (spirometry) and a Chest x-ray

If examination or testing indicates silicosis is possible, further tests will be ordered including a High Resolution Chest CT scan. Should silicosis be proven or a diagnosis is still uncertain the worker is required to be referred to Respiratory Physician.

Spirometry Changes

Silicosis can cause any pattern of lung function deterioration. One study found obstruction, restriction, and mixed obstructive and restrictive pattern regardless of smoking status. Individuals with category 3 profusion or progressive massive fibrosis were more likely to have restrictive patterns.

There will be exposed young workers. Lung growth, as defined by measurement of the FEV1, may continue into the late teens and early 20s. Once the maximum FEV1 is achieved, it is usually maintained until the late 30s, following which gradual age-related decline begins. Therefore, it may be difficult to decide, based on FEV1 measurement, whether lung function is affected or not. Any decline in FEV1 in a young worker exposed to silica should prompt further assessment. The WHO advises that spirometry should be considered abnormal if the FEV1 or FVC are below the LLN or loss > 15% from the baseline.

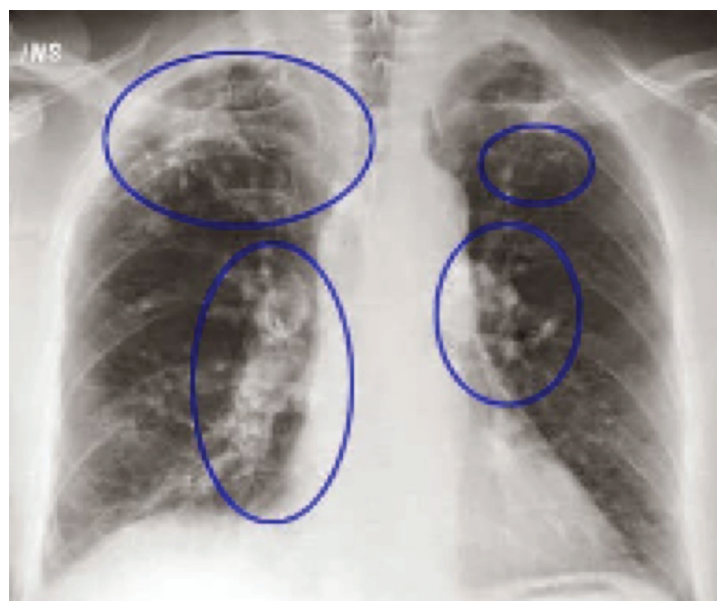
CXR Changes

Simple Silicosis there are multiple nodules 2-5 mm in diameter accompanied by calcification. They tend to be in the upper lobes. Hilar and mediastinal lymph nodal enlargement may precede the development of parenchymal nodular lesions. If enlarged nodes are seen on CXR ILO 0/0 workers should be offered a HRCT.

Complicated silicosis also known as **progressive massive fibrosis (PMF)** develops through the expansion and confluence of individual silicotic nodules. The X-ray differential includes

- Simple coal workers pneumoconiosis (CWP)
- Sarcoid
- Miliary tuberculosis
- Histiocytosis X (eosinophilic granuloma)
- Other diffuse infiltrate pulmonary diseases.

It should be recognized that a normal chest radiograph (ILO 0/0) does not always exclude silicosis. There is greater sensitivity of HRCT but radiation doses and cost prevent HRCT screening.



Management of Results

If any results are NOT normal (spirometry, symptoms or CXR) then Silicosis cannot be excluded. If Silicosis is confirmed or the diagnosis is still uncertain after a HRCT the worker requires a Respiratory Physician review. A workers compensation certificate can be generated in QLD to facilitate both HRCT and Specialist review for diagnosis and billed as a consultation once the worker has been informed by a telehealth consult. Additional specialist directed tests may include:

- DLCO Gas transfer studies
- Bronchoscopy and Lung biopsy

Can Silicosis be treated

No. There is no specific treatment for silicosis at this point in time. Once diagnosed removing the worker from ongoing dust exposure and any other respiratory irritants is critical to prevent the disease from getting worse. Workers should be encouraged to quit smoking and should be provided regular flu and pneumonia vaccines via their elected GP. Supportive treatments can be used to minimise symptoms including cough medicine, puffers if effective and oxygen. People with severe silicosis may need to have a lung transplant.

Workplace prevention is the key

- Recognise what materials contain silica, substitute to non or low silica content materials wherever possible
- Use low dust methods of work (wet cutting)
- Use of Extraction ventilation
- Good housekeeping - regular removal of surface dust with vacuum.
- Dust monitoring
- All workers should wear effective respiratory protection when working with RCS products

Silica Health Surveillance

It is now recommended for all workers exposed to crystalline silica to undergo lifelong health surveillance on an annual basis. Safework Australia will provide updated guidelines in the near future.

It is recommended for the Health Surveillance to be done through an Occupational Medical Provider, with the employer funding this ongoing surveillance. The issue at present is that for workers who are not working in the industry (now or going forward) the assessment is then required to be self-funded until the Federal Government provides an alternative (e.g. establishing a Crystalline Silica Register). This is where the treating General Practitioner will play a crucial part in the ongoing care of patients who used to be working in the industry and therefore still requires ongoing annual assessment.

The following links are useful for more information on Silica and Silicosis

<https://www.safeworkaustralia.gov.au/silica#health-monitoring-for-workers-exposed>

<https://www.racp.edu.au/advocacy/division-faculty-and-chapter-priorities/faculty-of-occupational-environmental-medicine/accelerated-silicosis>

<https://www.racp.edu.au/advocacy/division-faculty-and-chapter-priorities/faculty-of-occupational-environmental-medicine/accelerated-silicosis/faqs>