

Silica—Identifying and managing crystalline silica dust exposure

This information guide provides brief guidance on the legislative requirements for identifying and managing respirable crystalline silica (RCS) dust exposure in workplaces.

Background

Dusts containing respirable silica represent a longstanding health hazard in Queensland's workplaces. This hazard can be found in construction, foundries, tunnelling, brick, tile and concrete product manufacturing, monumental masonry, some abrasive blasting operations and metal polishing. Silica is also a widespread hazard in all mining.

No single source of information has been previously available that combines health risk, regulatory requirements, risk management advice, exposure standard data, control information and training requirements. There are up to 15 different sources that the person in control of a business or undertaking (PCBU) or health and safety representative has to refer to, to fully understand duties and control the risks from RCS. Condensed information is available in the document *Silica – Technical Guide to managing exposure in the workplace – Work-related Disease Strategy 2012–2022* found on Workplace Health and Safety Queensland's website. Additional information about the risks to health can be found in the WHSQ fact sheet *Silica and the lung*.



How is silica regulated as a hazardous chemical?

In all instances, RCS exposures will be subject to the requirements as set in the *Work Health and Safety Regulation 2011* (WHS Regulation), *Chapters 3 and 7.1*. Best practice control of silica incorporates the use of the Workplace Exposure Standard for RCS found in Safe Work Australia's *Workplace Exposure Standards for Airborne Contaminants* and the *Hazardous Substances Information System*.

What are risks from silica?

Health risks from RCS exposure include chronic obstructive pulmonary disease (including chronic bronchitis and emphysema), silicosis, lung cancer, and renal disease. Lung defence mechanisms against the very fine dust that penetrates to the alveolar oxygen exchange part of the lung can be overwhelmed by silica particles, which can be toxic to macrophages. These diseases have a long latency, usually appearing decades after exposure commences. Although cases of silicosis have decreased substantially over the last three to four decades, increases in mechanisation have resulted in potentially very high exposures in some workplaces.

What does the legislation say about working with crystalline silica?

Crystalline silica has been the subject of regulation in Queensland's workplaces since 1995. Details of general requirements can be found in the WHS Regulation, Chapters 3 and 7.1 dealing with hazardous chemicals. Workplaces supplied with products comprising silica (such as sand) and all workplaces where silica containing dust is generated in a process will be subject to the WHS Regulation.

The process recommended below has been determined to be appropriate for identifying and managing risks from RCS. The risk from RCS is present in the form of dust exposure arising usually through some processing operation.

There are seven basic steps in the process to meet the requirements of the WHS Regulation. Induction, and providing information, training and supervision together with record keeping should form an integral part of these steps.

Step 1: Identifying crystalline silica through the safety data sheet or other source

The duty to identify hazards is established in WHS Regulation s.34. When crystalline silica containing materials are supplied and brought into workplaces, they need to have accompanying documentation in the form of a safety data sheet (SDS). A SDS will identify the presence of silica as a hazardous chemical, and provide additional information on composition, exposure controls, appropriate personal protection, toxicological (health) information, together with other safety information and contacts.

Where no SDS is likely to be present such as tunnelling through rock, drilling building foundations, or crushing stone or concrete, the PCBU will need to look for other sources of information to identify if there is likely to be a RCS hazard.

Step 2: Managing the risk

Managing the risk (WHS Regulation s.35) from operations involving crystalline silica commences with an assessment of information in the SDS or other technical information where no SDS is likely to be present. The SDS will provide the crucial information about the risks to health from RCS, the workplace exposure standard (WES) and a range of controls appropriate for dealing with RCS.

A thorough examination has to be made of all work processes involving crystalline silica to identify those processes which are generating dust, and whether workers are being exposed to dust containing RCS.

Managing the risk may require the PCBU to measure worker's dust exposure so that adequate controls can be put in place to protect the long-term health of the worker. Adequate control of RCS



exposure is being exercised when no person is exposed to RCS in an airborne concentration which exceeds the WES (WHS Regulation s.49).

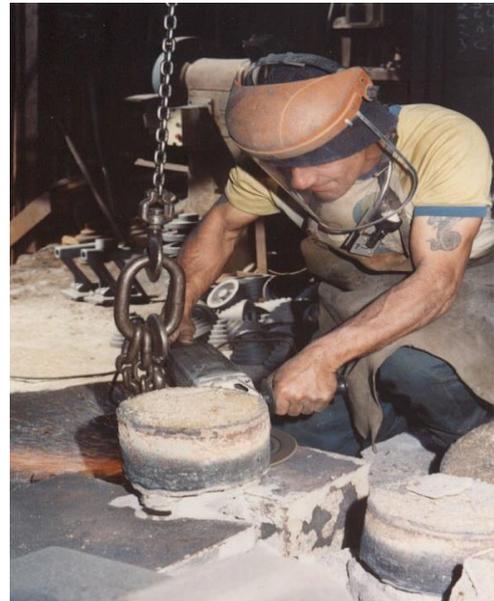
You may not be able to tell whether or not the exposure exceeds the WES (remembering that respirable dust is not visible to the naked eye), so you might need to monitor airborne contaminant levels. Section 50 of the WHS Regulation requires that if you are not certain that the exposures comply, then you must undertake air monitoring to establish some certainty.

Step 3: Air monitoring

Air monitoring involves sampling the air that a worker breathes to compare the worker's exposure with the level permitted by the WHS Regulation (see below).

Measurement will best determine the level of control required and will point the way to the most appropriate control strategy.

Monitoring for RCS usually requires sampling the atmosphere where the worker is exposed to the dust by using a portable pump and a special sampling device (a vertical cyclone elutriator), which is attached to the worker for most of a working shift. Samples are then analysed by a laboratory for their respirable dust concentration and the RCS content. Because of environmental and workplace task variability, repeat sampling may be needed to determine the true likely exposure and the likelihood of compliance with the regulatory exposure standard. Regular sampling should be conducted every 12 to 18 months or more often if there are process changes indicating increased risk.



Most monitoring is conducted by consultant laboratories, private consultants or occasionally by government Workplace Health and Safety Queensland inspectors.

The exposure standard for respirable crystalline silica

The National Occupational Health and Safety Commission in 2004 declared a National Workplace Exposure Standard for crystalline silica of 0.1 mg/m³ pertaining to dusts containing quartz, cristobalite or tridymite, measured as respirable dust. The sampling protocol to be used is that contained in Australian Standard 2985 – 2009 *Workplace Atmospheres - Method for sampling and gravimetric determination of respirable dust*. Analytical techniques commonly used for measuring quartz are either infrared spectrometry or X-ray diffractometry of the dust deposited on the collecting filter.

Step 4: Selecting the means for controlling the risk

Section 35 of the WHS Regulation establishes overall duty to manage risk, the steps used to introduce controls are found in s.36. This is the hierarchy of control and is to be followed where it is not reasonably practicable to eliminate the risks from RCS. Since silica is a fundamental component encountered in many building products, construction and extractive industries, its elimination is virtually impossible.

Section 36 of the WHS Regulation specifically requires that the duty holder to use methods other than the use of personal protective equipment to prevent or reduce the exposure. What this implies is that duty holder must consider each of the higher order controls – substituting, isolating or engineering through ventilation before reaching the conclusion that personal protective equipment in the form of respirators is the most appropriate way to control the exposure to the silica.

The Safe Work Australia Code of Practice *Managing Risks of Hazardous Chemicals in the Workplace* provides additional guidance on how to meet the control needs when working with hazardous chemicals.

Different controls and their utility for use with RCS include:

Elimination	Often difficult; sand is integral part of much construction; unavoidable in tunnelling and excavation.
Substitution	Suitable for abrasive blasting agents (e.g. garnet is substituted for sand); aluminium oxide polishing powders in place of silica.
Engineering controls	<ul style="list-style-type: none"> • Containment (enclosed abrasive blasting chambers) • Ventilation (local exhaust ventilation [LEV] prevents contamination of workplace air; use on pouring, grinding, moulding, fettling, bagging, mixing, crushing, drilling, chasing, polishing, blasting). • LEV available as either enclosing or external hoods. • Suppression (use of water sprays in tile and brick cutting, on masonry saws).
Administrative controls	Housekeeping, signage, restricting time of exposure, rotation of staff away from dusty areas.
Respiratory protective equipment	<p>Applicable for short term applications; suitable for all emergency applications; useful when higher order controls cannot fully control the risk.</p> <p>Available in range from simple P1 or P2 disposable half-face respirator to powered air purifying respirator (PAPR) and air supplied positive pressure demand respirator.</p> <p>Minimum required protection factors may need to be determined for correct respirator selection. See AS/NZS 1715 or WHSQ's silica documentation for further assistance.</p>

For many workplaces with a RCS issue, such as concrete construction and foundries, elimination and even substitution of silica containing sands is an impractical control strategy. In addition, preventing exposure totally is likewise an impractical control aim, as some crystalline silica dusts will be produced wherever sands are encountered.

Therefore, as eliminating exposure is an impractical goal where so much of silica related industry is concerned, the risk of exposures must be minimised so far as is reasonably practicable.

Respirators for particles are graded in terms of their performance in removing particles from air to be inhaled. The *Australian New Zealand Standard 1715 Selection Use and Maintenance of Respiratory Protective Equipment (2009)* contains the full guidance on selecting respiratory equipment suitable for dealing with mechanically generated particulates such as silica dusts.

Step 5: Health monitoring

Health monitoring for crystalline silica may be required under Chapter 7.1, Division 6 of the WHS Regulation. Although crystalline silica is listed in Schedule 14 of the WHS Regulation, health monitoring is required only if a number of conditions are met. The principal one is *"if there is a significant risk to the worker's health because of the exposure to a hazardous chemical (silica)"*. As a guide, regular long-term unprotected exposure of workers > 0.5 WES is considered a significant risk requiring review for possible health monitoring.

The PCBU must arrange for health monitoring to be done by a registered medical practitioner with experience in health monitoring. Schedule 14 of the WHS Regulation 2011 lists the requirements which the medical practitioner will conduct in the health monitoring. This may include chest X-ray, lung function testing, questionnaire and taking an exposure history.

Step 6: Keeping records

Record keeping is important for workers exposed to this RCS hazard where diseases may have long latency (e.g. two or three decades). Records need to be kept for a period of 30 years in the following circumstances:

- an airborne monitoring result obtained (s.50 (2) WHS Regulation)
- a health monitoring record obtained (s.378 WHS Regulation).

Note that exposed workers must be able to readily access their exposure records and must be provided with a copy their health monitoring report.

Step 7: Induction, information, training and supervision

The PCBU must provide induction, and training about silica hazards and must supervise the safe use of silica hazards in the workplace. Information provided should cover:

- the health risks from inhaling RCS
- where to gain information about RCS (e.g. safety data sheet or labels)
- how the work operations will expose workers
- how the control processes are intended to operate
- any use of respiratory protection and worker respirator fit and check processes
- what air monitoring results indicate
- the health monitoring process and the health monitoring report
- accessing all appropriate records on their work with and exposure to RCS.

The training given has to take into account the level of risk posed by the RCS exposure. Keep a record of who was trained, who conducted the training, when it was given, and the topics covered.

For more information

Visit www.worksafe.qld.gov.au or call us on 1300 362 128.

Visit the website to download:

- *Silica and the lung*—fact sheet
- *Work Health and Safety Act 2011*
- *Work Health and Safety Regulation 2011*
- *Safe Work Australia Managing Risks of Hazardous Chemicals in the Workplace Code of Practice 2012*
- *Hazardous Chemicals Code of Practice 2003*
- *Foundry Code of Practice 2004*
- *Abrasive Blasting Code of Practice 2004*
- *Tunnelling Code of Practice 2007*
- *Silica – Technical Guide to managing exposure in the workplace – Work-related Disease Strategy 2012 – 2022*