Silica Dust in Building and Construction

This pamphlet is for employers, operators and suppliers of masonry cutting and drilling equipment, and for those responsible for dust monitoring in workplaces. It was compiled to provide advice for dust control, dust extraction or dust monitoring in the workplace. The figures come from extensive testing carried out by Worksafe Western Australia.

What is silica dust?

Silica or silicon dioxide is the main component in sand and in most rocks, particularly sandstone, quartz and granite.

Silica dust is created when rocks or building products that contain sand, quartz or granite are cut, crushed or abraded in a way that causes fine particles of silica to become airborne.

Inhaled over a long period, silica dust can cause silicosis, or scarring and stiffening of the lung, which can be disabling.

In Australian industry, silicosis is now a rare disease. It occurred among workers exposed to extremely dusty conditions more than 30 years ago, particularly in mining, tunnelling, quarrying and stone masonry.

What Does the Law Say?

Under the *Workplace Health and Safety Act 1995*, employers are obliged to:

- ensure the workplace health and safety of the employers' workers
- ensure that they are not affected by the way the employer undertakes things
- ensure that the risk of disease or injury from a workplace is minimised

More specifically, under Part 13 (Hazardous Substances) of the Workplace Health and Safety Regulation 1997, employers can have a number of obligations when using silica-based product in the workplace, which have been classified as hazardous substances.

Employers have an obligation to obtain and provide information to the workplace in the form of an MSDS and correctly labelled products.

The employer must undertake risk assessments and control the risk in accordance with the outcome of a proper risk assessment. The risk assessment may include monitoring the worker's exposure to silica dusts.

Where the risk from handling or using silica containing products is found to be significant, the employer then may be required to carry out health surveillance on the workers.

For those workers who work with silica dust, employers must also carry out training and induction about the hazards of using silica containing products and of the ways of working safely with them.

Decisions on safe work procedures and dust control measures should be made through consultation between employers and employees and their elected representatives.

However, for most construction processes, the materials used such as bricks, a concrete wall or a block are articles and are not considered hazardous substances themselves. Consequently, there may be no specific obligations created Part 13 (Hazardous Substances) of the Workplace Health and Safety Regulation 1997 in relation to

many silica dusts generated at a work place. Nonetheless, the Workplace Health and Safety Hazardous Substances Advisory Standard 1998 provides the guidance on what an employer ought to do to meet their obligations under the Workplace Health Safety Act 1995. General guidance on the risk management process for dusts containing silica may also be obtained from the Workplace Health and Safety Risk Management Advisory Standard 2000.

What Causes Silica Dust?

Building products that contain silica include clay bricks, calcium silicate bricks, concrete, tiles, fibre cement products and older style clay earthenware pipes.

Excessive amounts of silica dust may be generated when power tools are used to cut, grind, chip, scrape, crush or blast these materials. Building tasks that can produce high levels of silica dust unless properly controlled are chasing (cutting channels for piping and cables), drilling and jack hammering and concrete grinding for floor levelling.

Other processes that may generate silica dust, to a lesser degree, include sweeping, cleaning, dismantling building equipment and demolition.

Highly visible dust caused by earthmoving equipment on building sites or other earthworks sites is unlikely to contain hazardous levels of respirable silica dust. On the other hand, hazardous silica dust levels produced by other activities may be barely visible.

What Effect Does Silica Dust Have on Health?

In the short term, silica dust can cause irritation of the eyes, nose and throat, in a similar way to other dusts. However long term exposure to silica can cause scarring and stiffening of the lungs, known as silicosis. This causes shortness of breath, reduces lung capacity, and can result in disability.

Silicosis is caused by respirable silica dust particles, small enough to enter deep into the lungs, breathed in over a long period. The risk of disease is directly related to the amount of dust breathed in. There is some evidence that people with silicosis have an increased risk of developing lung cancer.

How Can Silica Dust Be Controlled?

The best way to eliminate silica dust is to design buildings with pre-built recesses for plumbing, gas and electric wiring, so there is less need for masonry to be cut or drilled.

However where masonry needs to be cut or concrete floors are ground, priority should be given to processes that will remove dust at the source, such as wet process cutting and built-in dust extraction.

New tools have been developed that emit less dust during cutting and grinding. These include an impact chisel that cuts channels in bricks and produces only small amounts of dust, and others that incorporate a dust extraction unit.

Where the silica is covered by Part 13 (Hazardous Substances) of the WHS Regulation 1997, the employer is required to prevent exposure, or, if not practicable, reduce exposure to respirable silica so that it does not exceed 0.2 mg/m^3. This is the Time Weighted Average Airborne Exposure Standard for respirable silica in Australia at the time of writing, but is currently under review.

Levels of Control

Safe working procedures should aim to eliminate or control the hazard at its source. If that is impracticable, alternative levels of control should be followed.

For silica dust, safe procedures for construction sites should aim to:

- Eliminate dust hazards at their source by arranging pre-built wall channels for plumbing and wiring
- Make the process safe through engineering controls – add dust extraction or a wet process.

As a last level of control, provide respirators where dust is likely to exceed permissible levels.

Dust Suppression for Wet Processes

Only non-electrical equipment should be used to drive a wet process cutting tool. The blade should be fully cowled with a spring loaded extension covering the entire cutting blade. Water should be supplied, at approximately half a litre per minute, to the whole area of the cutting edge in contact with the job.

Dust Extraction for Dry Processes

EXTRACTION UNITS Extraction capacity will depend on the design of the extraction unit.

- ***Drilling*** - Requires an extractor dust capture velocity in excess of 10 metres per second (m/s) at the working face.
- ***Cutting*** - The blade should be fully cowled with a spring loaded extension designed to encompass the entire cutting edge. A minimum extraction rate of 17 cubic metres per second (m^3/s) is required per square metre of a cowl open face area. The sole plate width should be a minimum of 50mm and the leading edge should be upturned.
- ***Grinding*** - Hand-held angle grinders should be fully cowled and adjustable to achieve an extraction rate of at least 17 m^3/s per m^2 of cowl open face area. Floor grinders should be fully cowled with captive velocity in excess of 10m/s.

EXTRACTION DUCTING - All ducting should be flexible and reinforced. The duct velocity should be 15m/s or more.

VACUUM UNITS - Vacuum units must comply with AS3544-1988. Filter bags must have sufficient dust holding capacity for the job.

Dust Monitoring

Workplaces that do not have the equipment or expertise to conduct monitoring tests should seek specialist advice. In the absence of proper monitoring techniques safe-working procedures should be in place.

Controlled tests may be necessary for the manufacturer or supplier of a powered abrasive tool to prove that dust levels are not excessive. A suggested way of monitoring dust generated by a particular tool is to cut about 20 metres of chasing in clay bricks in an unventilated space. This should take about 15 minutes. A personal monitor should be worn by the operator during chasing. The monitor usually consists of an air pump fitted to the operator's belt and attached by tubing to a sampling head containing a dust filter, worn on the lapel.

An airborne concentration of less than 0.2 mg/m^3 of quartz meets the requirements of the Part 13 (Hazardous Substances) of the WHS Regulation 1997 where it applies, and also the Workplace Health and Safety Hazardous Substances Advisory Standard 1998 where the Regulation does not apply.

A higher reading means that dust control procedures are required for that particular tool.

Dust sampling should be done in accordance with *AS2985-1987- Workplace Atmospheres- Method for Sampling and Gravimetric Determination of Respirable Dust.* Detail monitoring results and sampling conditions in the test report. Results of dust monitoring need to be communicated to workers.

It is essential that all equipment be well maintained as specified by the manufacturer.

Is Respirator Protection Needed?

Where respirable silica dust levels have not been monitored, and are likely to exceed exposure limits, respiratory equipment must be used.

Remember, a respirator should be seen as the last level of control, and is not to be used as a substitute for controls that will remove dust at the source.

Respirators should comply with AS/NZS 1716:1994 and selected in accordance with AS/NZS 1715/1994.

If respirators are likely to be needed, workers must be trained in their safe use and maintenance.

Guide to Selecting A Respirator

QUARTZ LEVEL	**SUITABLE RESPIRATOR** AS/NZS 1715:1994
Under 0.2 mg/m^3	respirator optional
Up to 2mg/m^3	class P1 filter with half face piece, disposable or replaced filter type
Up to 10mg/m^3	class P3 filter in full face piece
Over 10mg/m^3	airline respirator positive pressure full face piece PAPR with class P3 filter, full face piece or head covering & blouse

For further information refer to AS/NZS 1715:1994, available from Standards Australia.

NOTE: For wet cutting processes, ensure only blades designed for wet cutting are used. Dry cutting blades used in a wet process are very dangerous and will fail explosively.