Managing worker exposure to dust in mines and quarries

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Health and Safety in NZ extractives

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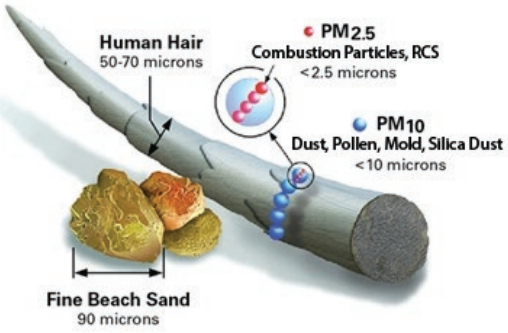
1 Introduction

At least 600-900 people die each year from work related diseases in New Zealand.

Silica dust is created when materials containing silica are cut, crushed, ground, drilled or otherwise disturbed.

Exposure to *very fine* silica dust – Respirable Crystalline Silica (RCS) – is dangerous and can cause serious lung disease. This very fine dust, usually less than 2.5 micron in size (PM2.5), can be breathed in and is rarely visible to the naked eye.



While there is little evidence of anyone other than workers facing any risks from RCS, to ensure worker health and safety, it is important to eliminate RCS from a workplace, or minimise worker exposure to it.

It is also important to note that not all quarries and not all processes will lead to exposure to RCS. The level of risk to workers will differ depending on the concentration of RCS in the rock source, processing methods, how the site is designed and operated, and the effectiveness of controls deployed at the site.

The intent of this booklet is to provide you with ways to recognise and manage hazards, and reduce risks associated with worker exposure to dust, particularly RCS.

2 Terminology

Silica – is a mineral found in concrete, bricks, rocks, stone, sand and clay.

Respirable Crystalline Silica (RCS) – silica particles of a crystalline structure small enough to be breathed deep into the lungs and cause damage (below 2.5 micron in size).

Exposure monitoring – sampling to determine whether the concentration of a substance hazardous to health at the workplace, exceeds the relevant prescribed exposure standard.

Health monitoring – medical examination to ensure that the controls in place are effective, and that airborne contaminants are not causing adverse effect on the health of workers.

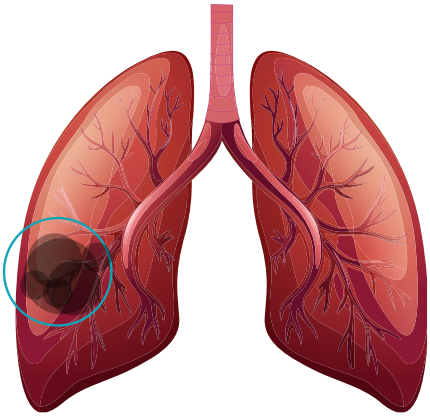
Spirometry – measures lung function, specifically the amount (volume) and/or speed (flow) of air that can be inhaled and exhaled.

3 Identifying worker exposure to harmful dust

If RCS is inhaled into the lungs it can stay there for many years. RCS in the lungs can cause silicosis – people with this are at an increased risk of tuberculosis and lung cancer.

It can also cause chronic obstructive pulmonary disease (COPD). This can cause breathlessness, often with a cough. Because of these concerns the exposure level for RCS has recently been reduced to 0.025mg/m3.

Environmental or community exposures to RCS are much lower than those encountered in the workplace and are not sufficiently high to cause occupational disease. In essence, if the risk to workers is being managed effectively then the risk to the community will also be managed.



It is important that you conduct exposure monitoring to identify worker exposure and determine the level and length of exposure. Exposure monitoring must be carried out, or supervised by, a competent person (such as an occupational hygienist) who has the knowledge, skills and experience in the appropriate techniques and procedures, including interpretation of results. Exposure monitoring must be conducted in accordance with AS 2985. Multiple samples allow better understanding of exposure. Professional associations are a useful source for competent persons (e.g. HASANZ, NZOHS).

4 Controls for managing exposure to dust

Once potential sources of dust have been identified, the following controls should be applied to reduce worker exposure to potentially harmful dust.

Suppression by design

Dust can come from stockpiles, old workings and processes – but can be easily minimised and eliminated if these steps are considered when planning. For example:

- ensure stockpiles are kept low and are built in sheltered spaces to limit the amount of dust caused by environmental factors
- make sure the distance drop-height of product onto the stockpile is limited or that the drop is covered
- areas which are no longer being worked but are still exposed should be planted out
- haul roads should be designed for efficiency, so the least amount of distance is needed to transport product to processing plants
- sites used by external transport operators should ensure trucks have their loads covered prior to leaving the site
- ensure plant is easy to maintain and cleaned regularly to avoid dust build-up.

Water cart

Apply water to roadways, including haul roads, underground mines and tunnel roadways, to control dust generation. Water can be applied using a mobile tanker with sprays, fixed water sprays, or loader buckets.

Enclosed cabins

Crushing plant control rooms and vehicles operating on haul roads should have enclosed cabins and be equipped with filtered air conditioning or heating ventilation air conditioning system (HVAC). Make sure doors and windows are always closed in control rooms and when the vehicle is operational. Check cabin filters on a regular basis and replace and clean them as required.

Wet dust suppression

Dust should be controlled wherever it is generated. Make sure you identify all likely sources of dust.

Water sprays and enclosures are the most effective methods of dust control. Use water sprays and curtains to control dust at hoppers and transfer points. These need to use water at approximately 1% of the weight of material being moved or processed.

Stockpiles need to be wetted regularly to control dust. Fogging systems can be very effective at controlling dust in the fixed plant and at stockpiles.

Dry dust extraction

Where processes are dry, vacuum or dry dust extraction systems that draw the airborne dust away from the place where people are working can be useful. These can be particularly effective in crushing or bagging areas. Covers on screens and covering or enclosing material transfer points will assist the effectiveness of dry dust extraction systems and the generation of dust generally.

Separation of workers

Keep workers away from areas where dust is being put into the air, so far as is reasonably practicable (e.g. where excavation and/or crushing is taking place). The use of sealed control rooms and air-conditioned cabins will assist with this separation.

Where work can be scheduled to take advantage of these, the following significantly reduce the amount of dust in the air:

- low wind
- rainfall
- early mornings when dew is present.

Personal protection equipment (PPE)

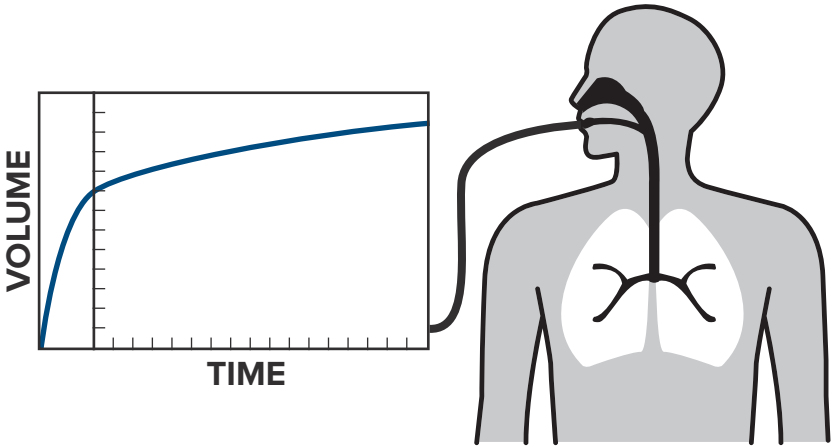
PPE controls such as dust masks are the last choice because they do not reduce the hazard but only reduce the amount of dust that can be inhaled, and only if it's working effectively. If controls at the worker fail, there is no fall-back position and workers are likely to be injured or become ill.

Respiratory protective equipment can still be provided even if other controls are effective.

Workers are required to wear PPE supplied by their employer. It is important to ensure that the respirator fits comfortably to the workers face. Fit testing can be done by the supplier.

To reduce exposure from RCS a minimum of a P2 mask should be used. If in doubt, consult an occupational hygienist for advice on appropriate PPE.

5 Respiratory health monitoring



Where workers may be at risk from exposure to dust, controls should be put in place, and sites must ensure annual health monitoring is carried out to the appropriate standard. Spirometry is to be conducted to the prescribed standards and the medical officer carrying it out is to be either:

- an occupational health physician or occupational health nurse
- a respiratory physician
- a GP who has completed a postgraduate course in spirometry.

If workers may be at risk from exposure to airborne contaminants and after controls have been applied, site managers should offer annual monitoring that consists of:

- medical examination emphasising the respiratory system
- lung function tests (FEV1 and FVC).

6 Monitoring effectiveness of controls

You need to continually monitor the effectiveness of dust control measures. Development of a Silica Dust Management Plan (refer Appendix 1) is useful as a management tool and workplace inspection checklist to monitor controls and their effectiveness. Regular exposure monitoring and health monitoring will also assist gauging the success of a dust exposure mitigation measure.

Appendix 1

Development of a Silica Dust Management Plan

Task/Area	Control methods	Comment
Crushing and screening plant	• Restrict access to dusty work area • Ensure control room door and window seals are working Check regularly as part of routine maintenance • Keep control room clean (Vacuum regularly - do not dry sweep) • Check filters and air conditioning • Check water sprays/fogging system is working effectively • Ensure P2 respiratory masks are used where workers are exposed to dust for short periods (<20mins) • Restrict the drop from conveyors onto stockpiles • Cover conveyors where practicable	
Workshop	• Restrict access to dusty work area • Keep workshop floor and work area room clean • NOTE: Sharp tools generate less dust than blunt tools or draw bits	
Mobile equipment	• Ensure cabin door and window seals are working. Check seals regularly • Keep cabin clean (vacuum regularly) • Check and maintain filters and air conditioning • Wait 20 seconds before opening door once machine is turned off • Ensure trucks are covered after being loaded	

Amenities	• Wet wipe/mop any surfaces or vacuum regularly • Keep doors and windows clean • Check air conditioning filters weekly • Do not sweep office floors. Use a heavy-duty vacuum or a wet mop • Workers should be able to wash and shower at the end of each shift, or alternatively should remove dusty clothing prior to leaving site • Dusty clothing should remain at work to be cleaned or put into airtight container for transportation to cleaner • Workers need to wash their hands and faces before eating, drinking and smoking	
Haul roads	• Construct haul roads using suitable material • Water haul roads (sprays or water cart) • Restrict movement of light vehicles and pedestrians • Locate amenities away from haul roads • Dedicated light and heavy vehicle parking areas • Enforce speed limit controls	
Stockpile and loading areas	• Water loading areas (sprays or water cart) • Restrict movement of light vehicles and pedestrians • Locate amenities away from loading areas • Dedicated light and heavy vehicle parking areas	

Useful resources

Silica dust in the workplace – WorkSafe New Zealand
https://www.worksafe.govt.nz/topic-and-industry/dust/silica-dust-in-the-workplace/

Management of Respirable Crystalline Silica in Quarries 2021 – Cement Concrete & Aggregates Association Australia
www.minex.org.nz/regulations-and-guidelines/documents-and-guidelines/CCAA-Management-of-Respirable-Crystalline-Silica-in-Quarries.pdf

Dust Control Handbook for Industrial Minerals Mining and Processing March 2019 – National Institute for Occupational Safety and Health
https://www.cdc.gov/niosh/mining/works/coversheet2094.html

Good Practice Guide – NEPSIThe European Network on Silica
https://guide.nepsi.eu/wp-content/uploads/2023/10/NEPSI-Good-Practice-Guide-revised-0821.pdf

COSHH essentials in Quarries – Silica Guidance Series – UK Health and Safety Executive
https://www.hse.gov.uk/pubns/guidance/qyseries.htm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