
Dust safety in the metals and extractives industries

3rd edition

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Foreword

Long term exposure to high concentrations of dust generated by mining and quarrying activities can cause disabling and potentially fatal lung diseases such as silicosis (caused by respirable silica dust).

There may be 5 to 10 years between the first exposure to dust and the appearance of symptoms, however, short term exposure to very high levels of silica dust may bring on symptoms of disease much earlier.

Dust disease is entirely preventable, however this is only achievable if all stakeholders, from the quarry operator to the quarry worker, understand the risks associated with dust and implement effective controls to manage those risks.

Individuals in control of mining operations must minimise the exposure of workers to dust and ensure workers are not exposed to dust concentrations exceeding the prescribed standards.

More generally, they also have a duty to provide:

- safe plant
- safe systems of work
- information, training, instruction or supervision to protect workers from risk

- health monitoring of workers.

Workers need to ensure they understand the dust control measures that are in place at their workplace. Workers also have a duty to:

- take reasonable care for their own health and safety, and the health and safety of others
- comply with reasonable instructions
- comply with reasonable policies and procedures relating to health and safety at the workplace.

This booklet is intended to assist workers to understand the risks and what measures should be in place to reduce exposure to respirable dust, respirable crystalline silica and inhalable dust, to as low as reasonably practicable.

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What is airborne dust?

Dust suspended in the atmosphere is known as airborne dust. Dust becomes airborne for a variety of reasons (e.g. mining activities including blasting, digging and drilling, crushing, driving vehicles over dirt roads and wind).

What is inhalable and respirable dust?

The normal action of breathing can result in the inhalation of dust particles.

Dust particles vary in size and it is the size of the particle that determines its classification as being either inhalable or respirable dust. The size of the particle plays an important role in the development of disease. The size of the particle influences the type and extent of health impacts that can result from exposure.



Inhalable dust

- Particles are < 0.1 millimetres ($100\mu\text{m}$) in diameter and can be easily seen.
- Breathed in but trapped in the mouth, nose or upper part of the respiratory tract.
- Respirable dust may be present in visible or inhalable dust, but it may also be present when there is no visible evidence of dust.

Respirable dust

- Particles (non-classified) are < 0.01 ($10\ \mu\text{m}$) millimetres and invisible to the naked eye.
- Particles are retained in the lung and penetrate deep into the alveolar region where gas exchange takes place.

Respirable crystalline silica

- Quartz is the most common form of crystalline silica and is the second most common mineral on the Earth's surface. Crystalline forms of silica have been associated with a variety of diseases primarily affecting the lungs.
- Respirable crystalline silica is the respirable dust fraction of crystalline silica.



Dust particle comparison

Dust suspended in the atmosphere is known as airborne dust. Dust becomes airborne for a variety of reasons (e.g. mining activities including blasting, digging and drilling, crushing, driving vehicles over dirt roads and wind).



Human hair

89 microns

(0.089 mm)



Inhalable dust

<100 microns

(0.1 mm)



Respirable dust

<10 microns

(0.01 mm)

What are the legislated airborne dust limits?

In NSW, the specified exposure standards based on 40 hours per week (8 hours, 5 days per week) are:

- respirable dust = 3 mg/m^3
- respirable crystalline silica = 0.05 mg/m^3
- inhalable dust = 10 mg/m^3 .

Should exposure standards be less for extended shifts?

Yes, if you work more than 40 hours per week, the exposure limit is lower. For more information refer to *Guidance on the interpretation of workplace exposure standards for airborne contaminants* (Safe Work Australia in April 2012).

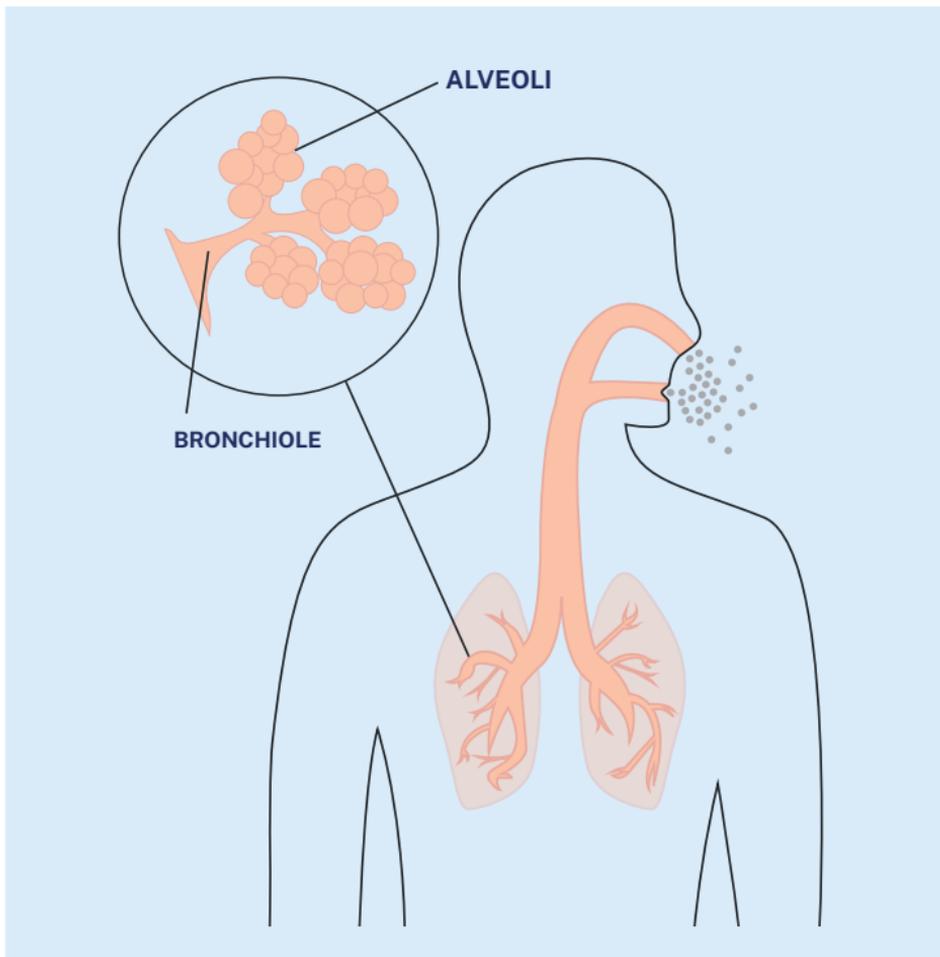


What defence mechanism does your body have against dust?

- Mucus traps larger-sized particles (inhalable dust particles) in the upper airways.
- Sneezing or coughing expels the larger particles.
- Airways become constricted as a response to irritation, preventing particles from moving deeper into the lungs.
- Scavenger cells in the lungs, called macrophages, help dissolve smaller-sized particles (respirable dust particles). These cells dissolve dust particles by surrounding them. If there is too much respirable dust, the scavenger cells cannot completely clear the dust in the lungs.
- The respirable dust and respirable crystalline silica that cannot be cleared can lead to serious health issues, such as silicosis, over a long time.

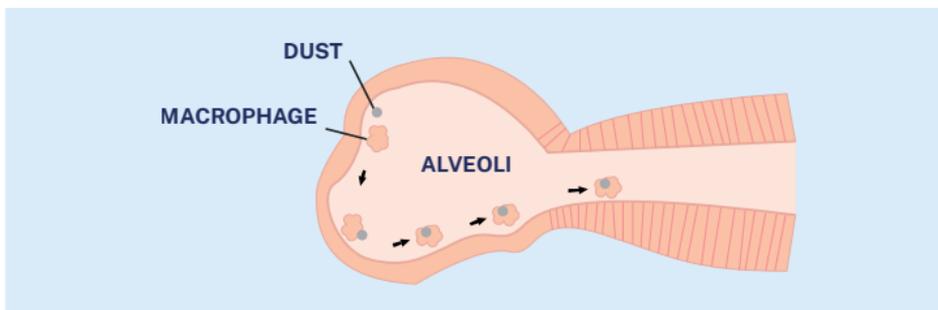
Structure of the respiratory system

The alveoli, or air sacs, are responsible for exchanging gases with the blood. They are located at the ends of each bronchiole.



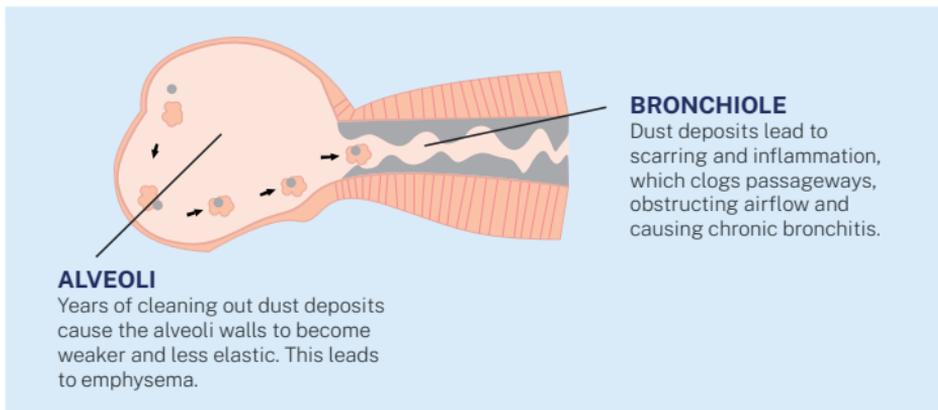
Removing foreign particles from the lungs

Macrophages, a type of blood cell, collect foreign particles and carry them where they can be coughed out or swallowed. Macrophages, a type of blood cell, collect foreign particles and carry them where they can be coughed out or swallowed.



Scarring

If too much dust is inhaled over an extended period of time, some particles and dust-laden macrophages collect permanently in the lungs.



What are the health effects of inhalable dust?

- Irritation of the eyes and nose.
- Aggravating pre-existing conditions, such as asthma.
- Increased risk of developing bronchitis.

There is not enough evidence to infer that inhalable dust causes chronic obstructive pulmonary disease (COPD).

What are the health effects of respirable dusts?

Lung disease caused by inhaling mineral dusts such as crystalline silica, asbestos and coal dust are collectively known as pneumoconiosis. These diseases result in the formation of fibrotic tissue in the lungs, causing the lungs to stiffen and hinder the normal exchange of oxygen and carbon dioxide. Silicosis, coal worker's black lung and asbestosis are all types of pneumoconiosis.

Other respirable dusts can also cause health problems such as congestion, cough, shortness of breath and respiratory failure.



Lung diseases caused by inhaling mineral dusts are collectively known as **pneumoconiosis**

What is silicosis?

Silicosis is caused by the exposure to respirable crystalline silica. Respirable crystalline silica can cause inflammation of the lungs and eventually results in nodular lesions in the lungs.

Silicosis may exist as a simple disease, accelerated silicosis or complicated silicosis, including progressive massive fibrosis.

Simple silicosis

- has fibrotic nodules of less than 10 millimetre in diameter
- usually occurs after long term exposure (10 years) to relatively low levels of silica
- usually has no symptoms to indicate simple silicosis.

Accelerated silicosis

- develops within 5 to 10 years after the first exposure to higher levels of silica dust
- progresses more rapidly than simple silicosis
- has a greater risk for complicated disease, including progressive massive fibrosis (PMF).

Complicated silicosis and PMF

- Complicated silicosis has fibrotic nodules greater than 10 millimetres in diameter.
- Silicosis can become 'complicated' by the development of severe scarring, where the small nodules gradually join, reaching a size of 1 centimetre or greater.
- Symptoms of PMF are more severe than simple silicosis and may include increasing breathlessness and eventual respiratory failure.

There is no specific treatment for silicosis. Management is aimed at limiting further damage to the lungs, treating symptoms and improving the quality of life.

For simple silicosis, avoiding exposure to harmful dusts, fumes and smoke may stabilise the disease.

Who is at risk of developing silicosis?

Workers undertaking activities that generate airborne dust that includes respirable crystalline silica are at risk. Both surface mine/quarry workers and underground miners can be exposed to crystalline silica.

Examples of activities that can generate these types of dust are:

- removal of overburden if not protected by proper cabin sealing
- cutting or drilling and extraction of rock
- shot firing/blasting
- crushing and screening
- working near conveyors, particularly transfer points
- working in and around road transport that generates dust
- maintaining plant
- air blasting or sanding.

Other industries, where people are working with material that includes silica, are also at risk (i.e stone masons cutting granite, kitchen installers cutting caesarstone).

Managing your health

If you are concerned about dust control at your workplace, talk to your supervisor or operations manager about dust controls.

Your employer (person conducting a business or undertaking –PCBU) must have an airborne dust monitoring program that checks the levels of respirable dust, respirable crystalline silica, and inhalable dust. If you are at risk of exposure to high levels of dust your employer must ensure that health monitoring is provided to you.

Questions to ask about dust controls

- Has silica been identified as a hazard at your workplace?
- What is the silica content of the materials and products used and/or extracted at the site?
- Has a baseline risk assessment been completed for each area where dust is generated?
- Was exposure monitoring conducted to assess the risk?
- What was the silica content measured?
- Is there a personal airborne dust monitoring program, and how often is it undertaken?
- What controls are being used to prevent or minimise dust, or protect against breathing airborne dust?
- Is there a health monitoring program and what medical practitioner is used?
- Is your site required to undertake personal exposure monitoring in accordance with Schedule 6 of the Work Health and Safety (Mines and Petroleum Sites) Regulation 2022?



Monitoring

Health monitoring and personal exposure monitoring are not the same and are sometimes confused.

Health monitoring

Health monitoring is a medical assessment undertaken by a competent medical practitioner to check lung function and for signs of disease. This usually involves work history, medical history, physical examination and other breathing assessments such as spirometry. It may include a chest X-ray at a frequency recommended by the medical practitioner.

Why do I need health monitoring medicals?

Work-related illnesses may take many years to develop. Regular health assessment allows early detection and treatment, as well as managing exposure to dust at work.

What medical qualifications are required for lung dust disease health monitoring?

Health monitoring is a medical assessment undertaken by a competent medical practitioner to check lung function and for any signs of disease. This usually involves work history, medical history, physical examination, other breathing assessments such as spirometry and may include a chest X-ray at a frequency recommended by the medical practitioner.

Identifying changes that indicate fibrotic presence typical of silicosis requires a trained and experienced radiologist.

If X-rays show any abnormalities, further investigation and referral to a respiratory physician is required, to determine whether these changes would indicate a dust disease.

Is health monitoring the same as health surveillance?

No. Health monitoring is about monitoring an individual person's health. Health surveillance combines all the individual health monitoring results to make some assessment of the health effects of work-related dust exposure for a group of workers.



Personal airborne dust monitoring

Personal airborne dust monitoring assesses the respirable dust, respirable crystalline silica, or inhalable dust levels in a workers' breathing zone. This gives an indication of the dust levels a worker is being exposed to in the workplace.

Why is personal dust monitoring important?

Personal airborne dust monitoring must be carried out in the workplace to make sure the respirable dust, respirable crystalline silica and inhalable dust levels are not exceeding the workplace exposure standards, or to determine whether there is a risk to health. This is so the long-term health of workers can be protected.

Personal exposure monitoring allows the mine or quarry operator to identify areas or tasks that could be a risk to workers' respiratory system. It also provides information about the effectiveness of controls.

How is personal airborne dust monitoring undertaken?

On-site personal airborne dust monitoring should be carried out by a competent person. A sampling head is positioned within the workers' breathing zone. A small battery-powered pump draws a steady stream of air through the sampling unit.

Dust collected on the filter in the sampling head is measured by weighing the dust.

This analysis must be carried out by a National Association of Testing Authorities accredited laboratory.



How often should the personal airborne dust monitoring be undertaken?

The frequency depends on the exposure risk, so for lower risk work, monitoring may be less frequent.

Sites that have identified silica as a hazard are required to undertake compliance monitoring in accordance with Schedule 6 of the WHS (MPS) Regulation 2022.

Workers performing different tasks, working in different areas and on different shifts should be included in the monitoring.

If a sample exceeds the exposure standard, an investigation needs to be conducted to determine why a high level has been recorded. The employer must tell workers in that area, or those who carry out similar tasks, about the exceedance. The exceedance must also be reported to the Regulator. A re-sample needs to be conducted on a similar exposure group (a group of workers doing similar work) to determine if the exposure is ongoing or was a one-off event.

Dust control measures

Employers are required to minimise dust exposure to as low as reasonably practicable. The best way to do this is to control dust at the source.

The information below may assist workers to understand what measures can be taken to protect themselves if required.

The first step is to identify all the potential sources of airborne dust. Workers may contribute by reporting areas where they believe dust is problematic. Mining processes, however, generate dust and it may not always be possible to eliminate dust at the source.

If workers need to work in a dusty environment it is an important part of the dust control plan to isolate them from dust, suppress dust and ensure workers wear properly fitted respiratory protection.

What are typical dust control measures?

Isolating the hazard

- Involve enclosing crushing/ screening plants.
- Include removing workers from dusty environments (i.e. ventilated/ pressurised and sealed cabins in vehicles or operator booths/ rooms or via automation (note for this control to be effective air filters/cabin or room interiors and workboots need to be cleaned and door seals maintained in good condition).

Engineering controls

- Use an extraction system that draws the airborne dust away from the place where people are working (i.e. crushing or bagging area).
- Apply controlled water sprays, as near as possible to the point where dust is generated, to prevent it from becoming airborne (note additives or misting devices can assist with water spray).
- Covers on screens, covering or enclosing material transfer points.

Administrative controls

- Consider operator positioning. Analyse tasks in crushing areas and conveyors to identify areas of high dust exposure.
- Wash down processes or procedures before maintenance is performed.
- Control dust on roads.
- Rotate workers when undertaking tasks with high dust exposure risk.

Respiratory protective equipment (RPE)(i.e. P2 respirator minimum)



How important is RPE as a control measure?

RPE plays an important role in limiting exposure to the harmful effects of dust, but only if workers wear and use the RPE correctly. Using RPE and PPE is generally the least effective means of minimising risk, as it does not control the hazard at the source and relies on human behaviour and supervision.

RPE as a risk control should only be used:

- to supplement higher order control measures (as a back-up), or
- as a short-term interim measure, until a more effective way of controlling the risk can be used.

For RPE to be effective:

- workers must be provided with appropriate RPE for the task, and fit-tested for that RPE
- workers should also be provided with training on how to properly use, fit and maintain RPE (i.e. for a P2 mask to fit properly an airtight seal must be created around the nose and mouth)
- supervisors should closely monitor compliance with RPE policies and procedures.

Fit-testing should be carried out regularly in accordance with the level of risk. For men, facial hair or two to three-day facial hair growth will break the seal on a P2 respiratory mask.



Workers must be provided with appropriate RPE for the task, and fit-tested for that RPE

Maintaining control measures

Control measures are only effective if they are properly maintained. Water sprays, cabin seals and RPE all need to be maintained in good operating condition.

Your employer should check the effectiveness of the dust control plan regularly.

Personal airborne dust monitoring is an important part of reviewing how effective the controls are in keeping dust levels below the legislated limits.

Further information

For more information on dust (airborne contaminants) and managing worker health, visit the NSW Resources Regulator's website:

www.resourcesregulator.nsw.gov.au

Specific resources and fact sheets are available on airborne contaminants, exposure monitoring and health monitoring.

Dust management must be addressed as part of a health control plan, which mine and quarry operators are required to have in place by law.

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