NSW Resources Regulator

Dust safety in the metals and extractives industries

NSW GOVERNMENT

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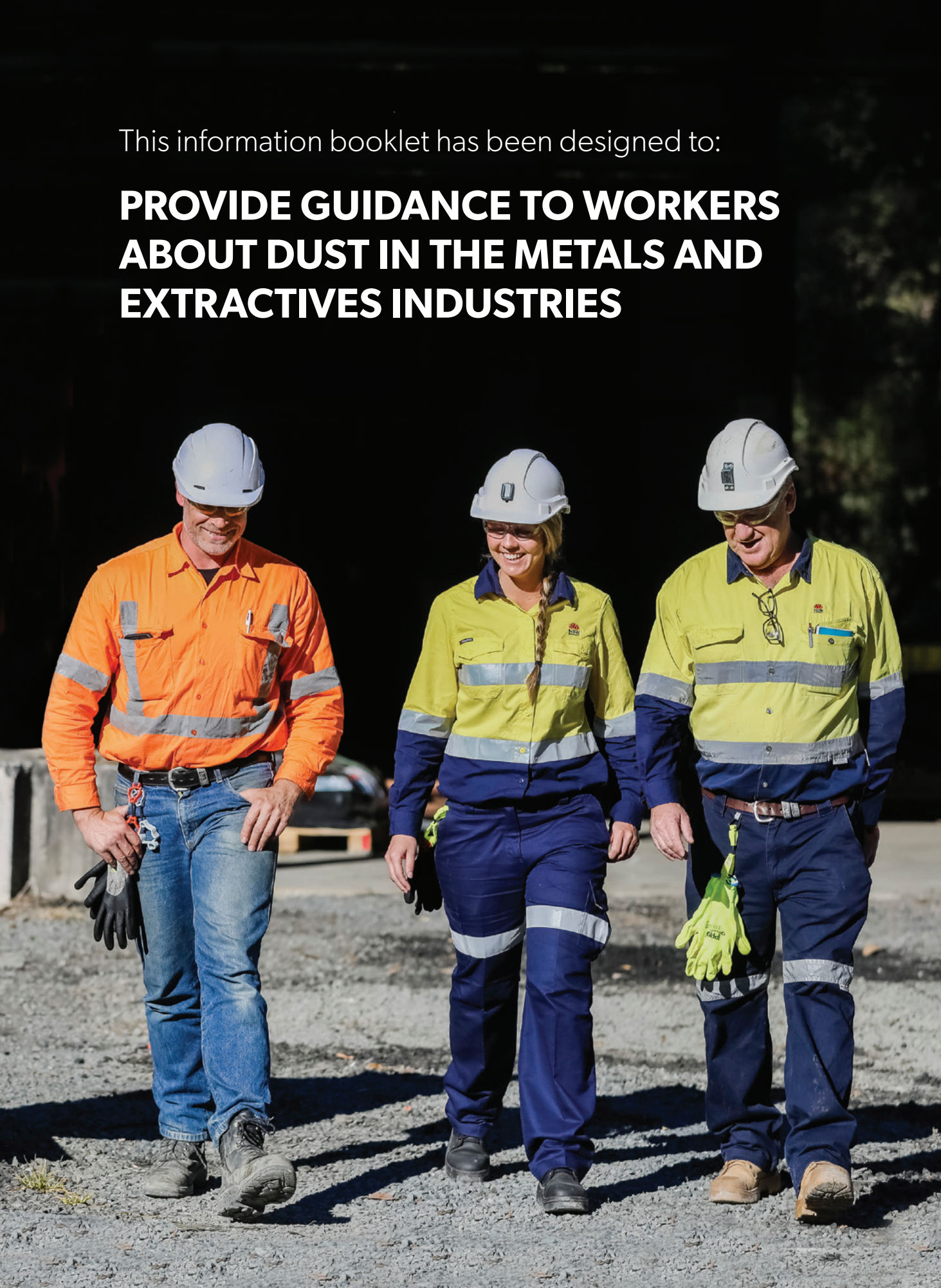
This information booklet has been designed to:

PROVIDE GUIDANCE TO WORKERS ABOUT DUST IN THE METALS AND EXTRACTIVES INDUSTRIES



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Why is the subject of dust important?

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

There are usually years between first exposure to dust and the appearance of symptoms. In some cases, very high exposures to dust may bring on symptoms of disease earlier than previously thought (e.g. silicosis).

People in control of mining operations must keep dust generation to a minimum. As a worker, make sure you understand dust control measures in place at your workplace. This booklet will help you understand the risks and what measures should be in place to minimise exposure to respirable dust, respirable crystalline silica and inhalable dust to as low as reasonably practicable.

What is airborne dust?

Dust suspended in the atmosphere is known as airborne dust. Dust may become 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 either an 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 less than 0.1 mm in diameter and can be easily seen.
- Particles are breathed in but trapped in the mouth, nose or upper part of the respiratory tract.

Respirable dust

- Particles (non-classified) are less than 0.005 mm and are invisible to the naked eye.
- Particles are breathed in and retained in the lung and penetrate deep into the lung (alveolar region) where gas exchange takes place.

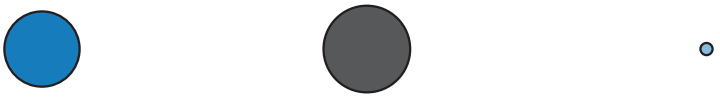
Respirable dust may be present in visible or inhalable dust, but it may also be present when there is no visible evidence of dust.

Respirable 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 size comparison



Human hair
89 microns
(0.089 mm)

Inhalable dust
< 100 microns
(0.1 mm)

Respirable dust
< 5 microns
(0.005 mm)

What are the legislated airborne dust limits?

In NSW, the specified exposure limits or standards are shown below:

Respirable dust = 3 mg/m^3

Respirable crystalline silica = 0.1 mg/m^3

Inhalable dust = 10 mg/ m^3

The limits above are based on 40 hours a week (8 hours a day, 5 days a week).

Should exposure limits be less for extended shifts?

Yes, if you work more than 40 hours a 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 April 2018).

What defence mechanism does your body have against dust?

- Trapping larger sized particles (inhalable dust particles) in the mucus of the upper airways.
- Sneezing or coughing to expel the larger particles .
- Airway constriction as a response to irritation, preventing particles from moving deeper into the lungs.
- Scavenger cells called macrophages in the lungs help dissolve smaller-sized particles (respirable dust particles). These cells dissolve dust particles by surrounding them. If there is too much respirable dust (an overload situation) the scavenger cells cannot completely clear the dust. The respirable dust and respirable crystalline silica that remains over a long period of time can lead to serious health issues (e.g. silicosis).

Figure 1. The 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.

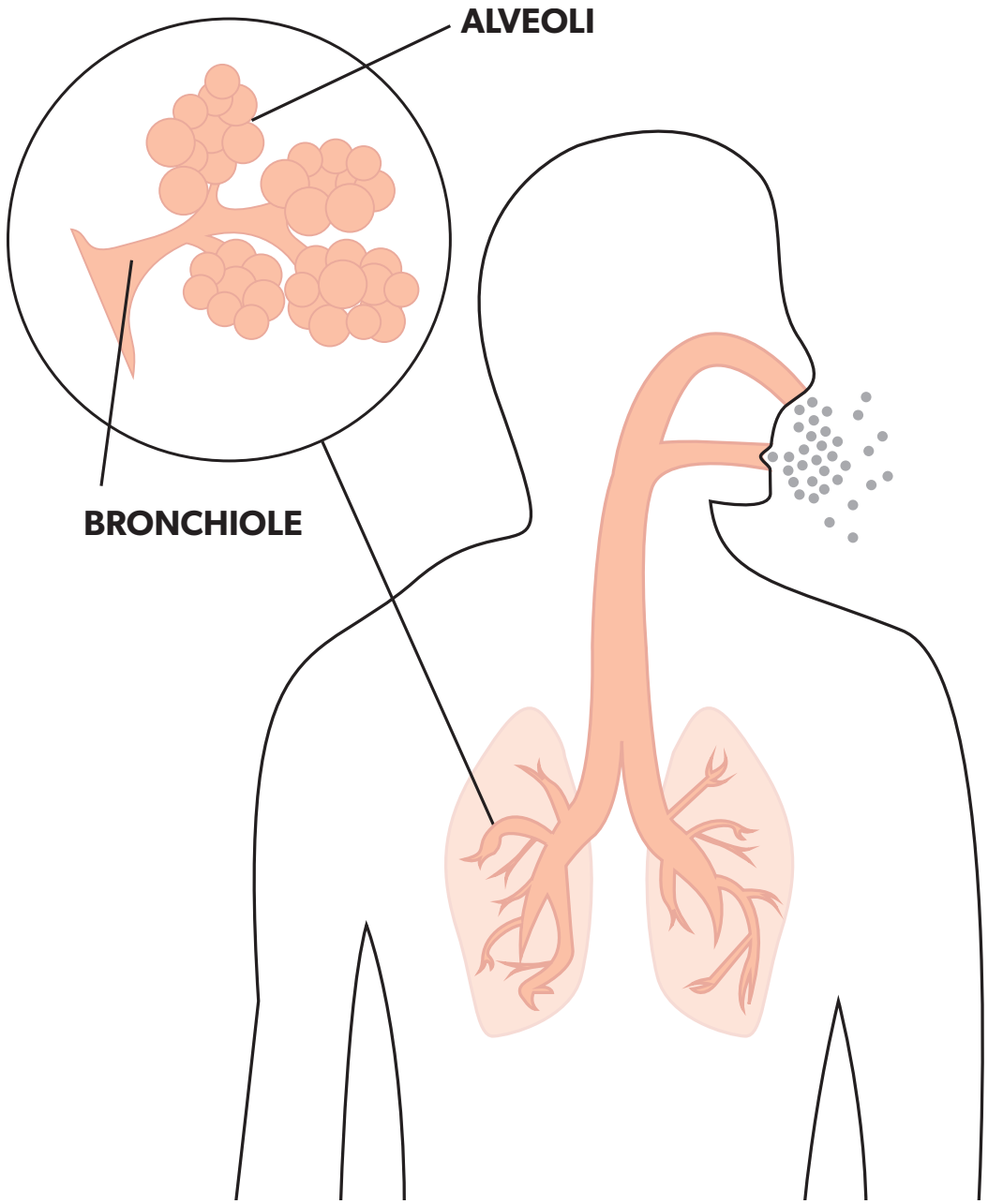


Figure 2. Removal of foreign particles from the lungs. Macrophages, a type of blood cell, collect foreign particles and carry them where they can be coughed out or swallowed.

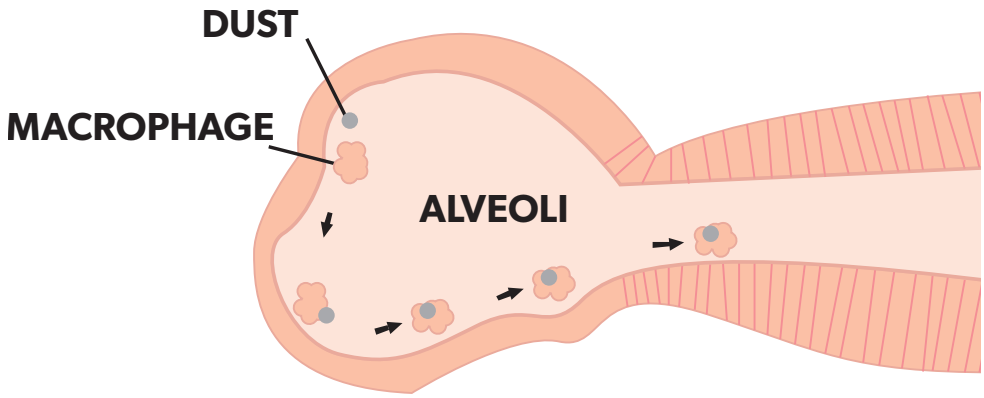
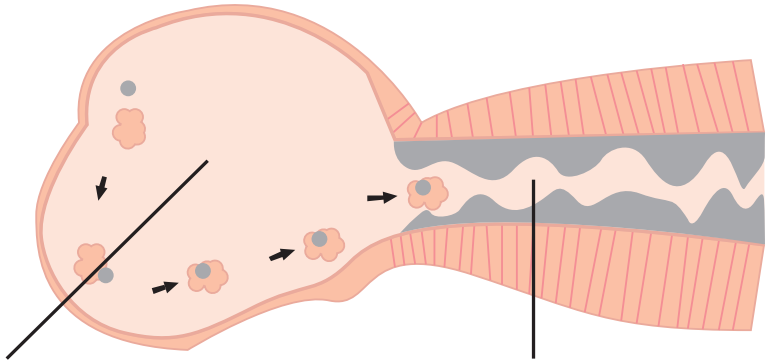


Figure 3. Scarring. If too much dust is inhaled over an extended period of time, some particles and dust-laden macrophages collect permanently in the lungs.



ALVEOLI
Years of cleaning out dust deposits cause the alveoli walls to become weaker and less elastic. This leads to emphysema.

BRONCHIOLE
Dust deposits lead to scarring and inflammation, which clogs passageways, obstructing airflow and causing chronic bronchitis.

What are the health effects of inhalable dust?

- Irritation of the eyes and nose
- Aggravation of pre-existing conditions such as asthma
- Potential bronchitis

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

What are the health effects of respirable dust?

Lung disease caused by inhaling mineral dust such as crystalline silica, asbestos and coal dust are collectively known as “pneumoconiosis”. These diseases result in formation of fibrotic tissue in the lungs. This causes the lungs to stiffen and hinders the normal exchange of oxygen and carbon dioxide. Silicosis, coal

workers' "black lung" and asbestosis are all types of pneumoconiosis.

What about other non-specific respirable dust?

Other respirable dust not mentioned above can cause health problems such as congestion, coughing, shortness of breath and respiratory failure.

What is silicosis?

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

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

Simple silicosis

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

Accelerated silicosis

- is the rapid onset of simple silicosis that develops within 5–10 years after 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

- has fibrotic nodules greater than 10 mm in diameter
- can become “complicated” by the development of severe scarring, where the small nodules gradually join, reaching a size of 1 cm or greater
- symptoms are more severe than simple silicosis and may include increasing breathlessness and eventual respiratory failure.

There is no specific treatment for silicosis but 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.

The activities below are examples of activities that can generate these types of dust:

- 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. For example, stone masons cutting caesarstone or granite are at risk.

What do you need to do to manage 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) should have a personal exposure monitoring program that checks the levels of respirable dust, respirable crystalline silica and inhalable dust. If you are at significant risk of exposure to high levels of dust, your employer must ensure that dust controls are implemented and health monitoring is provided to you.

Questions to ask about dust controls are:

- What is the silica content of the material being mined?
- What is the silica content of the dust generated?
- Has baseline assessment of areas where dust is generated been carried out and what was the silica content? (For information on safe levels, go to the Regulator's Health Control Plan web page.)
- Is there a personal exposure monitoring program and how often is it undertaken?
- What controls are being used to prevent or minimise dust or protect against breathing in airborne dust?
- Is there a health monitoring program and what medical practitioner do they use?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What is health monitoring and personal exposure monitoring?

Health monitoring and personal exposure monitoring, also known as personal airborne dust monitoring, are not the same thing and are sometimes confused.

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, breathing assessments such as spirometry and may include a chest X-ray at a frequency recommended by the medical practitioner.

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

Health monitoring

Why do I need health monitoring medicals?

Work-related illnesses may take many years to develop. Regular health assessments allow early detection and treatment as well as management of exposure to airborne dust at work.

What medical qualifications are required for dust disease health monitoring?

Health monitoring for lung diseases must be carried out or supervised by a registered medical practitioner with an interest in occupational medicine. X-rays should be taken by registered radiographers and these should be assessed by doctors, called radiologists, who have training in reading and interpreting X-rays for any sign of abnormalities.

Identifying changes that indicate fibrotic changes 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, they are different. 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 population of workers.

Personal exposure monitoring

Why is personal exposure monitoring important?

Personal exposure monitoring should be carried out in the workplace to make sure the respirable dust, respirable crystalline silica and inhalable dust levels are below the exposure limits. This is to protect the long-term health of workers.

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

How is personal exposure monitoring undertaken?

On-site personal exposure monitoring should be carried out by a competent person. A sampling head is positioned within a 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 weighed. This analysis must be carried out by a NATA (National Association of Testing Authorities, Australia) accredited laboratory.

How often should the personal exposure monitoring be undertaken?

The frequency depends on the exposure risk. For lower risk work, monitoring may be less frequent. Workers performing different tasks, working in different areas and on different shifts should also be monitored.

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

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

Dust control measures

Employers are required to minimise worker dust exposure levels to as low as reasonably practicable. The best way to do this is to control dust at the source – the point where the dust is generated.

The information below may assist workers to understand what measures can be taken to protect them 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 control all dust at the source.

Isolating workers from dust and ensuring workers wear properly fitted respiratory protection (e.g. P2 respiratory mask) if they need to perform work in a dusty environment is an important part of the dust control plan.

What are the most effective dust control measures?

i. Isolation controls such as

- enclosed crushing and screening plants
- removing workers from dusty environments through ventilated/pressurised and sealed cabins in vehicles or operator booths/rooms or automation (filters/booths/rooms need to be cleaned and seals maintained for this control to be effective).

ii. Engineering controls such as

- an extraction system that draws the airborne dust away from the place where people are working (e.g. crushing or bagging area)
- applying water as near as possible to the point where dust is generated to prevent it from becoming airborne (additives or misting devices can assist with water spray)

- covers on screens and covering or enclosing material transfer points
- positive pressure dust masks where pressure within the cover is higher than outside air pressure ensuring that air movement is always outward.

iii. Operator positioning – analyse tasks in crushing areas and conveyors to identify high dust areas and safe positions for operators.

iv. Wash down processes or procedures before maintenance is performed.

v. Controlling dust on travelling roads.

vi. Worker rotation on high-risk tasks to manage exposure.

vii. Personal protective equipment (PPE) or respiratory protective equipment (RPE) (e.g. P2 respiratory mask).

How important is respiratory protective equipment (RPE) as a control measure?

RPE plays a very important role as a dust control measure. Although PPE or RPE are at the bottom of the hierarchy of controls, they can be very effective in minimising worker exposure to airborne dust including respirable dust, respirable crystalline silica and inhalable dust.

For RPE to be effective:

- workers must be provided with appropriate RPE for the task
- workers should also be provided with training on how to properly use, fit and maintain RPE (e.g. for a P2 respirator to fit properly a seal must be created around the nose and mouth).

Regular fit testing should be carried out at a frequency and alignment with the level of risk. For men, facial hair such as a beard or 2-3-day facial hair growth will break the seal on a P2 respirator.

Maintaining control measures

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

Your employer should regularly check the effectiveness of the dust control plan. Personal exposure monitoring is an important part of reviewing how effective the controls are in keeping dust levels below the legislated limits.

CONTROL MEASURES ARE ONLY EFFECTIVE IF THEY ARE MAINTAINED

Further information

For more information on dust (airborne contaminants) and managing worker health go to the Resources Regulator Health Management web page: www.resourcesregulator.nsw.gov.au

Specific resources and fact sheets are available on airborne contaminants, exposure monitoring and health monitoring. Dust management is part of a Health Control Plan, which mine and quarry operators are required to have by law.

Acknowledgements

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This booklet was developed in consultation with Health Management Advisory Committee and the Mine Safety Advisory Council.


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