Airborne dust exposure in mines and quarries

Worker information booklet

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Resources Safety & Health Queensland

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About this booklet

This booklet provides information to Queensland mine and quarry workers about controls to reduce exposure to airborne dust.

In mine and quarry environments, dust particles may contain coal, silica, asbestos, and other potentially harmful minerals. Some of the dust particles are so small they cannot be seen by the naked eye. This respirable dust can travel deep into the lungs and cause mine dust lung disease.

An understanding of dust control measures and mine dust lung disease, along with regular respiratory health surveillance, is critical in protecting the health of mine and quarry workers.

This booklet should be read alongside the following Resources Safety and Health Queensland (RSHQ) worker booklets:

- ***Health assessment information for coal mine workers*** – explanation of the health assessment process under the Coal Mine Workers' Health Scheme.
- ***Respiratory health surveillance for mineral mine and quarry workers*** – explanation of the respiratory health surveillance process for mineral mine and quarry workers.

The key to managing mine dust lung disease is early detection, which is why regular health surveillance is important to preserve respiratory health.



Protecting Queensland's mine and quarry workers

Mine and quarry workers can be exposed to a range of respiratory hazards, such as mineral dust from development, production and processing as well as welding fumes and diesel engine exhaust emissions.

Occupational exposure to harmful levels of respirable dust can lead to a range of lung diseases; these include forms of pneumoconiosis (e.g. silicosis), chronic obstructive pulmonary disease, and lung cancer. These diseases are collectively known as mine dust lung diseases.

Lung damage is irreversible, however if the damage is detected early, the progress to more severe stages of disease may be prevented or slowed.

Dust particles

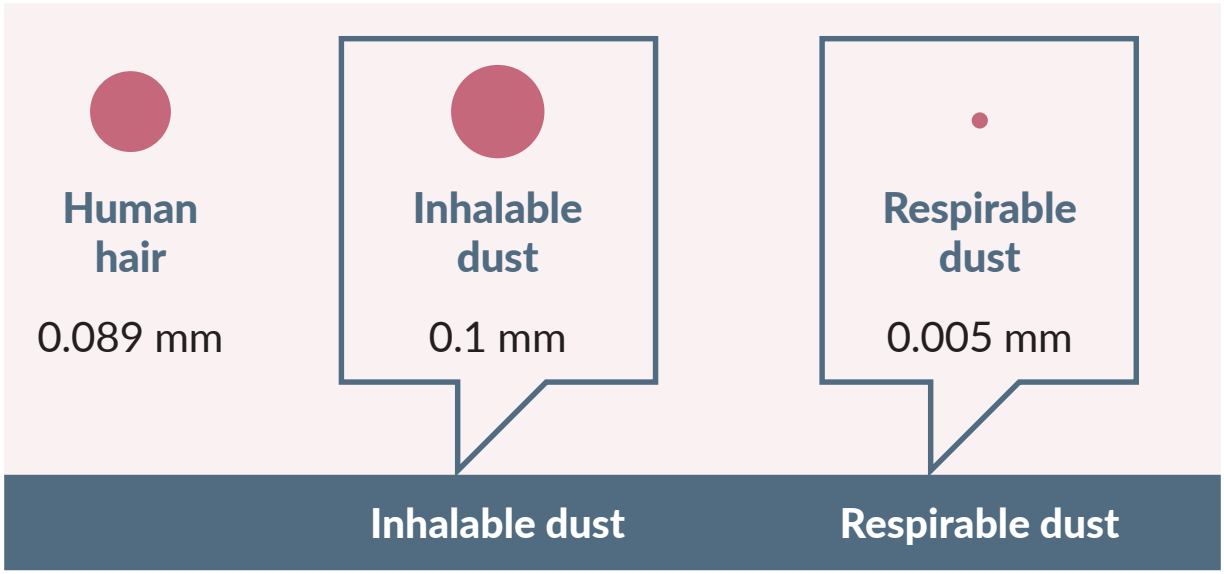
Dust is a word often used to describe fine, dry particles on the ground and in the air.

Dust particles fall into two categories, according to their size:

- ***inhalable dust*** (less than 0.1 mm or 100 µm diameter)
- ***respirable dust*** (less than 0.005 mm or 5 µm diameter).

To give you an idea of these sizes, the following diagram compares both types of dust with the diameter of a single human hair.

Dust particle size comparison



	Inhalable dust	Respirable dust
Size	Dust particles of all sizes (typically less than 0.1 mm diameter)	Smallest dust particles (typically less than 0.005 mm diameter)
Visibility	Can be seen with the naked eye	Cannot be seen with the naked eye

Sources of dust

The geology of the rock and mining activities to extract and process the rock will determine the type and quantity of dust particles generated.

There are many tasks and operations in a mine and quarry that, without effective controls, have the potential to expose workers to harmful levels of dust, such as coal dust or respirable crystalline silica. These include:

- land clearing in preparation for mining
- drilling or shot-firing operations, or dry drilling
- loading blast holes or blasting
- cutting stone
- ripping, digging or excavating
- mucking, loading or tipping
- spraycreting or grouting
- crushing or screening
- grinding or abrasive blasting
- bagging, palletising or load-out
- plant maintenance, and
- housekeeping or cleaning.



Hazards in mines and quarries

Each mine or quarry will have specific sources of dust. This will be dependent on the commodity, overburden and interburden, as well as the equipment being used. The first stage in controlling dust is to identify the hazard accurately before implementing controls.

Hazards in longwall coal mines

Longwall mining systems produce relatively high volumes of coal, which in turn can generate more respirable coal dust. Harmful exposure to dust on longwalls can result from workers located on the return side of the shearer and/or advancing supports.

Additional sources of dust include coal crushers, powered roof support movement and beam stage loader discharge to the conveyor belt. Pre-draining, a process that reduces the risk of a methane gas explosion, also reduces the moisture content and can increase the amount of airborne respirable dust.

Hazards in mineral mines, quarries or open-cut coal mines

Dust is generated whenever the rock or even the overburden is moved, broken, crushed or shaped. The most common sources are crushers or cutting equipment.

Underground mines have an additional factor in that the dust generated in one work area can be carried to contaminate another work area downstream.

Measuring dust levels

Regular monitoring allows mine and quarry operators to identify any areas or tasks within the mine that could potentially present a risk.

It also provides data for operators to review the effectiveness of existing controls.

For coal mines, information on conducting a monitoring program on site is provided in *Recognised Standard 14: monitoring respirable dust in coal mines*.

For mineral mines and quarries, information about identifying, analysing and monitoring risk associated with respirable dust is provided in *QGL02 Guideline for management of respirable dust in Queensland mineral mines and quarries*.

These guidelines require that the mine or quarry must ensure that:

- a respirable dust monitoring program has been developed and is part of the mine's safety and health management plan
- a respirable dust sampling plan has been developed by a competent person
- respirable dust sampling is conducted by a competent person
- an investigation is conducted when a personal sample exceeds the exposure limit, and
- the respirable dust monitoring program is reviewed by a competent person at regular intervals.

Specified dust exposure limits

Workplace exposure limits or standards are the maximum level of an airborne contaminant that most (but not all) people can be exposed to without harm to their health. Exposure limits do not identify a dividing line between a healthy or unhealthy working environment; they establish a legal or advisory maximum upper limit. Queensland mining legislation states that exposure to dust particles must not exceed exposure limits.

Where exposure cannot be eliminated, all reasonable steps should be taken to minimise exposure to a level well below the exposure limit.

For more information on dust exposure limits please visit: **www.business.qld.gov.au/industries/mining-energy-water/resources/safety-health/mining/hazards/dust/exposure-limits**.

Personal dust monitoring

Personal monitoring, also known as personal gravimetric sampling, allows mine and quarry operators to review the effectiveness of existing dust controls. It also helps mine and quarry operators identify any areas or tasks within the mine that could potentially present a risk to workers.

Determining respirable dust concentrations

In the case of respirable dust, the approved sampling method adopted by the Queensland mining and quarrying industry is personal gravimetric sampling according to *AS 2985 – Workplace atmospheres – Method for sampling and gravimetric determination of respirable dust*.

Respirable dust is collected from the air within the breathing zone of a worker (close to the nose and mouth).

The samples are taken by means of a small battery powered pump worn by the worker. The pump is connected with a piece of plastic hosing to a sampling unit (or 'cyclone') that is clipped to the worker's shirt within their breathing zone.



The cyclone sampling unit only allows respirable sized dust particles to be collected – those particles small enough to be deposited in the lowest parts of the lungs.

A steady stream of air is drawn through the sampling unit. The coarse dust is removed first and only the very fine respirable dust is collected on a filter and weighed.

Controlling dust

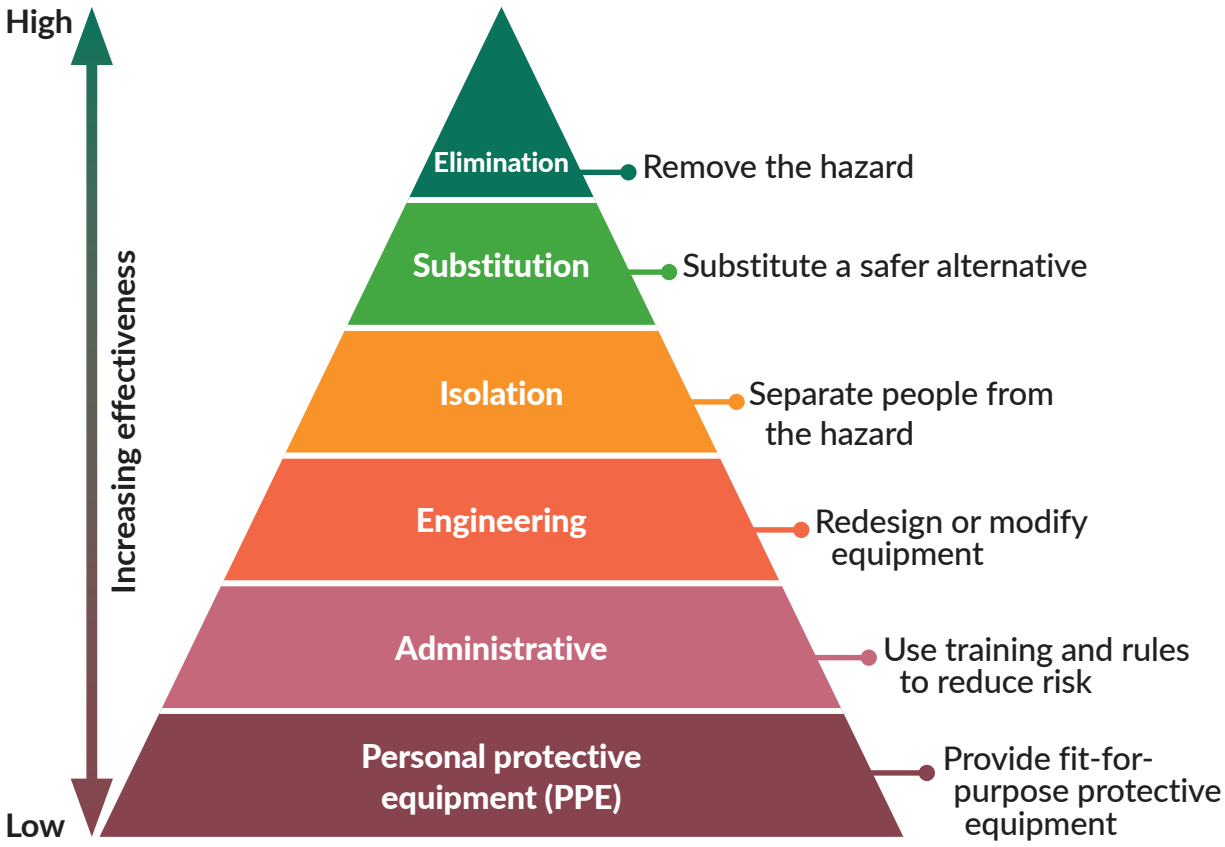
The potential for mine and quarry workers to be exposed to harmful levels of respirable dust particles should be managed using the hierarchy of controls (*page 12*). The higher order controls (elimination, substitution and isolation of the hazard) are the more reliable and effective means of treating the hazard.

Typically, maintenance workers are among the most highly exposed workers as the systems that normally operate to protect workers are not active or available during the maintenance phase.

More than one control may need to be used to adequately control the hazard and ensure a level of redundancy. Any controls used must be monitored and maintained to ensure they continue to remain effective.



Hierarchy of controls



Examples of dust controls

Elimination of controls

- Redesign or modify production processes to eliminate or significantly reduce dust generation at the source, for example, wet methods are likely to generate less dust than dry processes.

Substitution with a lesser hazard

- Substitute with a less hazardous substance, for example, the use of pellets rather than powders, or replacement of sand with garnet as an abrasive blasting agent.

Separation/isolation of workers from the hazard

- Place a physical barrier between dust-generating tasks and workers (e.g. the use of enclosed and pressurised cabins).
- Use remotely operated machinery (e.g. remotely controlled conveyors).

Engineering controls

- Choose appropriate equipment (e.g. correct cutting blades for ore body).
- Replace and maintain equipment regularly to ensure cutting blades and picks remain sharp.
- Suppress dust by using water sprays on stockpiles and roads, and when using machinery and cutting equipment. Use additives in water sprays where appropriate to suppress dust and adjust the droplet size of the spray according to dust particle size.
- Use enclosures (e.g. covered conveyors, enclosed cabs on vehicles, plant and equipment).
- Rehabilitate exposed mine land to reduce environmental dust load.
- Use ventilation and filtration to minimise dust (e.g. adjust ventilation rates for maximum efficiency, use local exhaust ventilation when necessary).
- Cover loads for road haulage where practicable.
- Treat the dust at its point of generation, as this is more effective than capturing airborne dust. The size of the water droplet is a critical consideration.
- Treat the dust on its transmission path using dust suppression techniques (e.g. water sprays, chemical additives, local exhaust ventilation (LEV), and vacuum).

Administrative controls

- Develop, implement and maintain a site-specific Dust Management Plan that includes TARPs.
- Ensure regular maintenance and housekeeping of vehicles and mine workings.
- Position personnel away from dust-generating activities by establishing and enforcing exclusion zones.
- Maintain unmade roads and ensure ground conditions throughout sites are appropriate to the machines using them.
- Provide workers with training and information on the hazards, risks and controls of dusty tasks, as well as adequate supervision.
- Limit the duration and magnitude of individual dust exposure (e.g. worker rotation, job task changes).
- Ensure work schedules have adequate rest periods to limit cumulative dust exposure over a shift.
- Change the location of dumping operations or modify blasting programs to suit weather conditions.
- Provide adequate signage.

Personal protective equipment (PPE)

- Ensure higher-order controls are adopted before resorting to PPE.
- Select the most appropriate respiratory protection for the task (e.g. P1 or P2, full face, half face, powered air, purifying). Refer to AS/NZS 1715 – Selection, use and maintenance of respiratory protective equipment for guidance.
- Provide training, comfort and fit testing before use and periodically after. Respirators should not be shared between workers.
- Maintain and store respiratory protective equipment in accordance with the manufacturer's instructions. Conduct regular inspections and replace components at recommended intervals or sooner if damaged.

For more information about dust control please see:

Coal mines

- **Recognised standard 15:** Underground respirable dust control, and
- **Recognised standard 20:** Dust control in surface mines.

Mineral mines or quarries

- **Guideline QGL02:** Guideline for management of respirable dust in Queensland mineral mines and quarries.

For more information on dust exposure limits please visit: **www.rshq.qld.gov.au**



More information

To keep up to date with the latest advice on airborne dust exposure and other mine safety and health information, visit the RSHQ website at **www.rshq.qld.gov.au**

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