

CMPPA

Respirable Crystalline Silica Dust (RCSD) Management Guideline



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Acknowledgements

The CMPA would like to acknowledge those who contributed to the development of this Guideline.

Author: David McKelvie – DMcK Management Pty Ltd trading as Safe Mix

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The guidelines here may not apply in all circumstances and should not replace a quarry manager's considered assessment of a particular situation before them.

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Attachments to this Guideline

- Attachment A, Field Monitoring Report
- Attachment B, RCSD Control Sheet
- Attachment C, Similar Exposure Groups
- Attachment D, RCSD Management Data Base
- Attachment E, RCSD Control Plan Template
- Attachment F, RCSD Controls Photo Gallery

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Overview

This Respirable Crystalline Silica Dust (RCSD) Management Guideline together with the CMPA's Work Safely Reference Manual aims to support members in meeting the requirements of the Victorian Occupational Health and Safety Act 2004 and Occupational Health and Safety Regulations 2017.

In doing so, this Guideline will:

- Provide members with appropriate management practices required to minimise potential health risks associated with RCSD arising from extractive industry and concrete recycling operations;
- Provide members with a template they can populate so as to establish a site specific RCSD Control Plan; and
- Assist members in establishing and maintaining a Work Plan that defines operational activity so as to obtain and sustain an Extractive Industry Work Authority.

It is noted within the Overview of this Guideline that:

- *Without effective training of managers and workers the control of exposure to RCSD will be a continual challenge and likely unattainable;*
- *The standard of housekeeping applied on site is paramount to the control of exposure to RCSD.*

There are many other physical and work practice controls required but without an intimate understanding of the hazard and its consequence these other controls may not be effective nor sustainable, therefore exposure to RCSD may not be controlled.

References and Guidance Materials:

- Safe Work Australia - Preparation of Safety Data Sheets for Hazardous Chemicals Code of Practice 28 August 2020
- Safe Work Australia – Health Monitoring Guide for Crystalline Silica
- Australian Institute of Occupational Hygienists - Dusts not otherwise specified and Occupational Health Issues, Position Paper 2014
- Australian Institute of Occupational Hygienists - Respirable Crystalline Silica and Occupational Health Issues, Position Paper 2018
- Coal Services Pty Limited, Dust safety in the metals and extractives industries 2nd edition 2016
- Workplace Health and Safety Queensland Silica – Technical guide to managing exposure in the workplace Work-related disease strategy 2012-2022
- State of Queensland, Silica and the Lung, Version 5 March 2020
- Queensland Department of Natural Resources, Mines and Energy, Guideline for management of respirable dust in Queensland mineral mines and quarries Mining and Quarrying Safety and Health Act 1999, Version 3 April 2020
- Crystalline Silica Discussion Paper, WorkSafe Victoria in October 2019
- NSW Resource Regulator Dust safety in the metals and extractives industries, 2nd edition
- Respirable Crystalline Silica Safe Work SA <https://www.safework.sa.gov.au/workplaces/chemicals-substances-and-explosives/silica>
- <https://www.dnrme.qld.gov.au/business/mining/safety-and-health/alerts-and-bulletins/mines-safety/management-of-dust-containing-crystalline-silica-quart>
- WorkSafe Dust containing crystalline silica in the extractive industry 3 Jan 2020 <https://www.worksafe.vic.gov.au/dust-containing-crystalline-silica-extractive-industry>
- WorkSafe British Columbia (BC). <https://www.youtube.com/watch?v=qBgwDvjs5Zc>
- Safe Work Australia Crystalline Silica and Silicosis https://www.safeworkaustralia.gov.au/search/site?search=Crystalline+silica+&sort_by=search_api_relevance&sort_order=DESC
- Australian Standard AS2985-2009 Workplace Atmospheres - Method for sampling and gravimetric determination of respirable dust

Relevant Legislation

- Victorian Occupational Health and Safety Act 2004;
- Victorian Occupational Health and Safety Regulations 2017;
- Mineral Resources (Sustainable Development) Act 1990;
- The Mineral Resources (Sustainable Development) (Extractive Industries) Regulations 2019.

Specific Workplace Health and Safety Legislation Duties

Duties under the OHS Act 2004:

Overview - Section 21 Duties of employers to employees:

- Provide and maintain a workplace that is safe and without risks to health;
- Ensure safe use, handling, storage or transport of plant or substances; and
- Provide information, instruction, and training to workers.

Overview - Section 22 Duties of employers to monitor health and conditions:

- Monitor health of workers;
- Monitor conditions at the workplace; and
- Keep information and records relating to the health and safety of workers.

Overview - Section 29 Duties of manufacturers of plant or substances

- Ensure that it is manufactured to be safe and without risks to health
- Carry out testing and examination as may be necessary
- Provide adequate information to each person the substance is provided to

Duties under the OHS Regulation 2017:

Exposures to inhalable dust and respirable dust including RCSD are regulated through the OHS Regulations 2017, part 4.1 Hazardous Substances.

Employers must ensure that they:

- Determine whether a dust is a hazardous substance and if so, establish and provide or make accessible a Safety Data Sheet;
- Determine whether employees may be exposed to dust containing respirable crystalline silica;
- Eliminate or reduce the risk associated with exposure to the dust through the implementation of controls aligned with the hierarchy of controls so that a worker is not exposed to dust levels that exceed the workplace exposure standard;
- Consult with relevant workers when making decisions in regards to dust control;
- Provide training, instruction, and personal protective equipment (PPE); and
- Provide ongoing health assessments to a worker who is exposed to dust that equals or exceeds the exposure standard.

WHS Responsibilities

As stated in the previous section of this guideline there are many specific Workplace Health and Safety duties under the OHS Act and the OHS Regulation specific to RCSD Control.

Depending on the workplace management arrangements these duties, i.e., responsibilities may be allocated to various persons, e.g., the Quarry Owner (Work Authority holder), Site Manager or Supervisor, OHS Representative or other workers.

It is important that these responsibilities are documented within position descriptions, responsibility statements or other documents. A review of the progress in enacting these responsibilities should be conducted on an annual basis or post monitoring where results identify exposure levels equal to or above the exposure standard.

All managers or workers with RCSD Control responsibilities should undertake RCSD Awareness Training to assist them in not only enacting their responsibilities but understanding the importance of those responsibilities.

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Introduction to Dust

Dust Definition

Dust is a generic term used to describe fine particles that are suspended in the atmosphere.

Within the quarry industry, asides from dust arising from surface soil, dust is generated through mechanical disintegration of solids, i.e., drilling, blasting, and crushing of hard rock.

Uncontrolled dust is known as an airborne contaminant and can be hazardous to personal health.

Dust Measurement, Weight & Classification

Dust particles are generally measured in microns/ micrometres using the symbol μm :

- 1 millimetre (mm) = 1000 microns
- A human hair is approximately 50 microns
- Respirable dust is invisible being less than 7 microns

Dust particles are generally weighed as milligrams (mg) or micrograms using the symbol μg :

- 1000 grams = 1 kilogram
- 1000 milligrams = 1 gram
- 1000 micrograms = 1 milligram

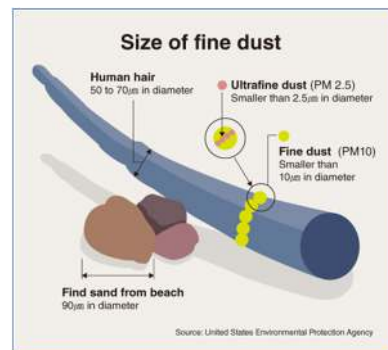
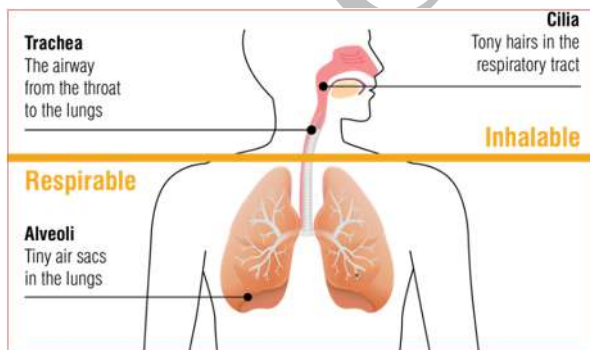
From an occupation perspective dust is typically classified as follows:

Inhalable Dust

- Dust particles below 100 microns that are trapped in the nose, throat, and upper respiratory tract

Respirable Dust

- Dust particles small enough (0.2 - 7 microns) to penetrate past the upper respiratory tract and deep into the lungs.



Respirable Crystalline Silica Dust (RCSD)

Crystalline silica is the scientific name for a group of minerals composed of silicon and oxygen.

There are many types of crystalline silica, but they are generally Quartz, Cristobalite and Tridymite

Quartz being the most common form is one of the most abundant minerals in the earth's crust and is estimated to be about 12% of the crust's mass.

There are crystalline and non-crystalline forms of silicon dioxide. The non-crystalline form of silica (amorphous) that is widely used in electronics does not cause lung damage.

Crystalline Silica as quartz when crushed, ground, drilled or cut generates dust particles that are small enough to penetrate deep into the lungs. These particles are deemed respirable e.g., RCSD and can cause lung damage. They are often referred to as invisible dusts because they are too small to be seen with the naked eye.



Hard rock

May contain



Crystalline Silica

Common Rock and Materials Sources Containing Quartz

The largest amount of quartz is contained in igneous rocks, in particular in granitoids, granites and related rock.

Very high concentrations of quartz can be found in certain sedimentary rocks like sandstone, as well as in alluvial and marine sands.

Metamorphic rocks also show large variations in quartz content. The quartz content often reflects the mineral composition of the precursor rock.

Typical Quartz Contents	
Manufactured Stone	>95%
Waste Concrete	>90%
Sandstone	70 – 90%
Hornfels	35 - 60%
Siltstone	45%
Granite	25 - 40%
Fly Ash	> 30 %
Brick	> 30%
Clay	20 - 30%
Shale	22%
Ignimbrite	>21%
Marble	2%
Scoria	0.5 - 2.0%
Portland Cement	> 1% and varies
Trachyte	< 1.0%
Basalt	< 1.0%

Quartz Content versus RCSD Exposure:

The quartz content of a rock source as listed above is defined as the total % of quartz in any rock sample.

The level of potential RCSD exposure is influenced by many other factors as well as quartz content, inclusive of processing methods, product type (aggregates or crushed rock), adopted controls such as containment, collection or suppression, and importantly education and housekeeping.

Determination of Quartz Content

The quartz content of rock can be determined by conducting either a Petrographic Analysis or X-ray Diffraction of representative samples of the rock source within the quarry.

Petrographic Analysis:

A Petrographic Analysis is an in-depth investigation of the chemical and physical features of a particular rock sample and is conducted by a Petrographer within a Mineralogy Laboratory and outlines the mineral content and the textural relationships within the rock sample.

Petrographic Analysis is conducted using a scanning electron microscope (SEM) to characterize the fracture surfaces from microstructures of the rock samples with energy dispersion X-Ray analysis to identify exact mineral assemblages of a rock. X-Ray diffraction can also be used where particle size analysis is not required.

Identification : Psammopelitic hornfels

Description :

The sample consisted of about 1 kg of clean, hard, robust, angular fragments (intermediate diameters about 6 to 12 mm) of finely crystalline, metamorphic rock. When a subsample was sorted it was seen to consist of 94% dark grey, unweathered fragments of hornfels, 3% dark grey fragments of hornfels with joint surface controlled brown, limonitic staining attributable to quite slight weathering and 3% light grey aplite (felsic microgranite).

A thin section was prepared to permit detailed examination in transmitted polarised light of 17 random fragments. An approximate average mineralogical composition of the aggregate, expressed in volume percent and based on a brief count of 100 widely spaced observation points falling within the sectioned random fragments, is :

34%	quartz
42%	biotite mica
19%	muscovite mica
3%	chlorite
2%	feldspar
< 1%	opaque grains (probably ilmenite and magnetite)
trace	sulphide
trace	limonite
trace	other minerals (tourmaline and zircon)

Example of a Petrographic Analysis Finding

X-ray Diffraction:

X-ray diffraction analysis is an easy, reliable and economical way to ascertain the presence and quantity of quartz in a rock sample.

Minute changes in the crystallization system can cause significant changes in the sample that may not be detectable by chemical analysis or microscopy, e.g., Petrographic Analysis.

To obtain more accurate data, particularly for quantification, the sample should be ground (micro milled) to particle sizes usually less than 10 µm.

The powdered sample is carefully mounted in the appropriate holder, and then inserted into the X-ray diffractometer.

The scattering of X-rays by the atoms of a crystal produces an interference effect so that the diffraction pattern provides information on the structure of the crystal or the identity and quantity of a crystalline quartz substance.

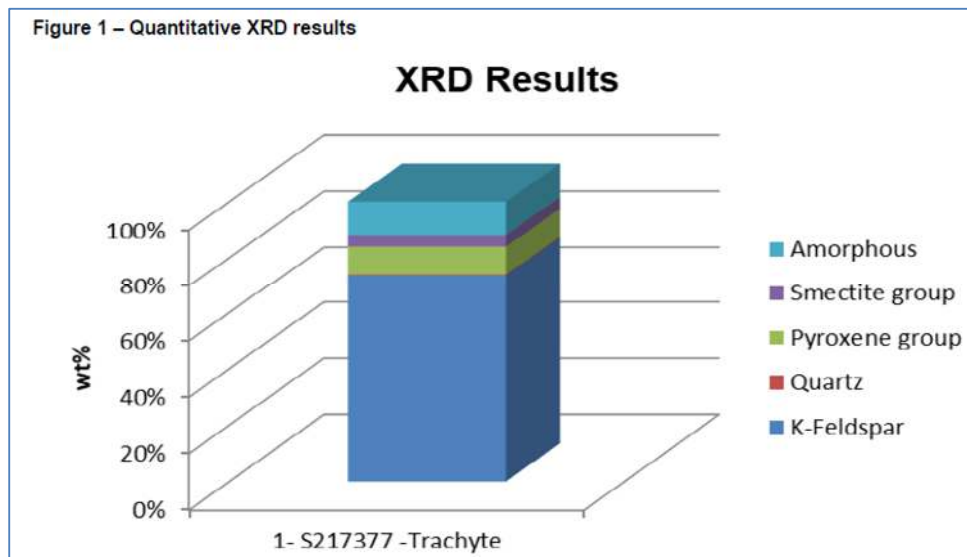


Table 2 - Quantitative XRD results

Mineral	Composition	1- S217377 -Trachyte
K-Feldspar*	KAlSi_3O_8	74
Quartz	SiO_2	<1
Pyroxene group*	ABZ_2O_6	10
Smectite group*	$\text{X}_{0.3}\text{Y}_{2.3}\text{Z}_4\text{O}_{10}(\text{OH})_2 \cdot n\text{H}_2\text{O}$	4
Amorphous	Unknown	12
Total		100

Example of X-ray diffraction Analysis Finding

Variation of Rock Source Samples:

As a quarry extracts rock from different locations the characteristic of the rock may change. It is important to maintain controls based on the highest level of quartz content identified.

Hazardous Substances and Safety Data Sheets (SDS)

RCSD is classified as a hazardous substance by Safe Work Australia and is listed within their document titled Workplace Exposure Standards for Airborne Contaminants 2019.

Hazardous substances are those that, following worker exposure, can have an adverse effect on health. Examples of hazardous substances include poisons, substances that cause burns or skin and eye irritation, and substances that may cause cancer.

A substance is deemed to be a hazardous substance if it meets the criteria for hazard classification set out in Part 3 (Health Hazards) of the Globally Harmonized System of Classification and Labelling of Chemicals.

Under the OHS Regulations a manufacturer and supplier of a potential hazardous substance has an obligation, before first supplying the substance to a workplace, to determine whether it is a hazardous substance and, if so to establish a Safety Data Sheet (SDS) for that hazardous substance.

An SDS is a document that provides information on the properties of hazardous substances, how they affect health and safety in the workplace and how to manage the hazardous substances in the workplace.

An SDS is an important tool for eliminating or minimising the risks associated with the use of hazardous substances in workplaces.

Safety Data Sheets for Hazardous Substances must be:

- Provided to the company or person purchasing the hazardous substance;
- Be accessible to all workers handling or exposed to the hazardous substance; and
- Reviewed and amended whenever necessary to ensure that it contains correct, current information and at least every 5 years.

Example of Section 2 of a Safety Data Sheet

3. COMPOSITION/ INFORMATION ON INGREDIENTS

3.1 Substances / Mixtures

Ingredient	CAS number	EC number	Content
QUARTZ (CRYSTALLINE SILICA)	14808-60-7	238-878-4	>60%
PORTLAND CEMENT	65997-15-1	266-043-4	>10%
NON HAZARDOUS INGREDIENTS	Not Available	Not Available	Remainder

Exposure Standards

Workplace Exposure Standards

Safe Work Australia (SWA) set exposure standards for hazardous substances which are then adopted by the state or territory Work, Health and Safety regulatory authorities such as WorkSafe Victoria.

Exposure standards are based on the airborne concentrations of individual substances that, according to current knowledge, should neither impair the health of, nor cause undue discomfort to, nearly all workers. They do not represent a fine dividing line between a healthy and unhealthy work environment.

Exposure standards are measured at the persons breathing zone.

Breathing zone means a hemisphere of 300 mm radius extending in front of a person's face and measured from the midpoint of an imaginary line joining the ears.



Exposure standards are measured by milligrams of substance within a cubic metre of air.

On 1 July 2020, the exposure standard for RCSD was reduced to 0.05 mg/m³.

Action Levels:

The objective on an action level is to trigger actions to control exposure ensuring all worker exposures stay well below the exposure standard.

WorkSafe has adopted an action level of 0.02 mg/m³ for RCSD that is just below 50% of the SWA exposure standard. Note the legal action level (Safe Work Australia) is 0.25 mg/m³.

Time Weighted Average (TWA):

TWA is the average airborne concentration of a particular substance when calculated over a normal eight hour workday, for a five day working week, i.e., 40 hour week.

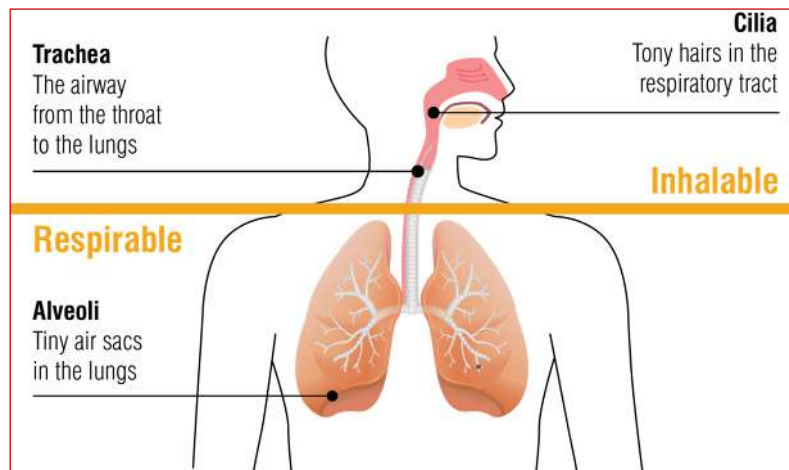
To ensure the exposure standards and action levels are representative of the time worked e.g., many formulas can be used to establish the TWA.

In simple terms to adjust the exposure standard to a 50 hour week the following calculation is used.

$0.05 \text{ mg/m}^3 \times (40 \text{ hours divided by } 50 \text{ hours}) = 0.04 \text{ mg/m}^3$.

Exposure to RCSD - Health Effects and Surveillance

The Respiratory System



The respiratory system is made up of the nose, throat and lungs.

It takes in 5 litres per minute of air while the individual is at rest, and up to 20 litres per minute while working or exercising.

The lungs are protected by a series of defence mechanisms in different regions of the respiratory tract.

When a person breathes in, particles suspended in the air enter the nose, but not all of them reach the lungs. The nose is an efficient filter. Most large particles are stopped in it, until they are removed by blowing the nose or sneezing.

Some of the smaller particles e.g., RCSD succeed in passing through the nose to reach the windpipe and the dividing air tubes that lead to the lungs.

These tubes are called bronchi and bronchioles. All of these airways are lined by cells. The mucus they produce catches most of the dust particles. Tiny hairs called cilia, covering the walls of the air tubes, move the mucus upward and out into the throat, where it is either coughed up and spat out, or swallowed.

The air and respirable dust reach the tiny air sacs (alveoli) in the inner part of the lungs that avoided the defences in the nose and airways. The air sacs are very important because through them, the body receives oxygen and releases carbon dioxide.

RCSD that reaches the sacs and the lower part of the airways where there are no cilia is attacked by special cells called macrophages. These are extremely important for the defence of the lungs. They keep the air sacs clean. Macrophages virtually swallow the particles. Then the macrophages, in a way which is not well understood, reach the part of the airways that is covered by cilia. The wavelike motions of the cilia move the macrophages which contain dust to the throat, where they are spat out or swallowed.

The most significant reactions of the lung occur in the deepest parts of this organ. Particles that evade elimination in the nose or throat tend to settle in the sacs or close to the end of the airways. But if the amount of RCSD is large, the macrophage system may fail. RCSD particles and dust-containing macrophages collect in the lung tissues, causing injury to the lungs.

The amount of RCSD and the kinds of particles involved influence how serious the lung injury will be.

For example, after the macrophages swallow silica particles, they die and give off toxic substances. These substances cause fibrous or scar tissue to form. This tissue is the body's normal way of repairing itself. However, in the case of RCSD so much fibrous tissue and scarring cause the lung function to be impaired.

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The general name for this condition for fibrous tissue formation and scarring is fibrosis.

When fibrosis is caused by RCSD, the condition is called Silicosis.

For a practical illustration of how macrophages work please refer to the following video courtesy of WorkSafe British Columbia (BC).

<https://www.youtube.com/watch?v=qBgwDvis5Zc>



Silicosis:

Silicosis is a disease that occurs as a result of the body's own defence mechanisms trying to remove the RCSD from deep in the lungs. It causes irreversible scarring, known as fibrosis. As more fibrosis occurs, gas exchange through the lungs is reduced which makes breathing more difficult. Silicosis will also increase the risk of lung infection.

Silicosis is an irreversible, progressive condition and in severe forms can result in respiratory failure causing death.

Evidence suggests RCSD interacts with other respiratory hazards, like tobacco smoke, to cause airway diseases.

There are three types of silicosis:

- **Acute silicosis:** is very rare and results from very large amounts of exposure to RCSD over a very short time (less than one year, may be weeks or months);
- **Accelerated silicosis:** results from short term exposure to large amounts of RCSD (1 to 10 years exposure)—this was once rare but is now being seen in engineered stone benchtop workers;
- **Chronic silicosis:** results from long term exposure (10+ years of exposure) to low levels of RCSD.

Other Potential Health Issues Associated with Dust Exposure

Please note: All RCSD related diseases can be prevented by adopting effective controls to reduce the volume of RCSD in the workplace and exposure to that RCSD.

Irritation:

RCSD can irritate the eyes, skin, nose, and upper throat, leading to watery eyes, itchy nose and throat, dry cough and rough skin. Excessive levels may scratch the eye lens leading to vision impairment.

Dermatitis:

Repeated heavy contact to the skin may cause drying of the skin and can result in dermatitis, an allergic reaction that is manifested by one or more lines of red, swollen, blistered skin that may itch or seep.

Bronchitis:

Excessive exposure to RCSD can cause the airways to become inflamed due to constant irritation by the RCSD e.g., bronchitis. This can lead to breathing difficulties and causes persistent coughing.

Emphysema:

Emphysema is a lung condition that causes shortness of breath. In people with emphysema, the air sacs in the lungs (alveoli) are damaged. Over time, the inner walls of the air sacs weaken and rupture — creating larger air spaces instead of many small ones. This reduces the surface area of the lungs and, in turn, the amount of oxygen that reaches the bloodstream.

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Chronic Kidney Disease:

Chronic Kidney Disease is a decline in kidney function that may require dialysis if severe.

Scleroderma:

Scleroderma is an autoimmune disease of the connective tissue causing scar tissue formation in the skin, joints and other organs.


Rheumatoid Arthritis:

Rheumatoid Arthritis is an autoimmune disease causing joint pain and swelling.

Carcinogenicity:

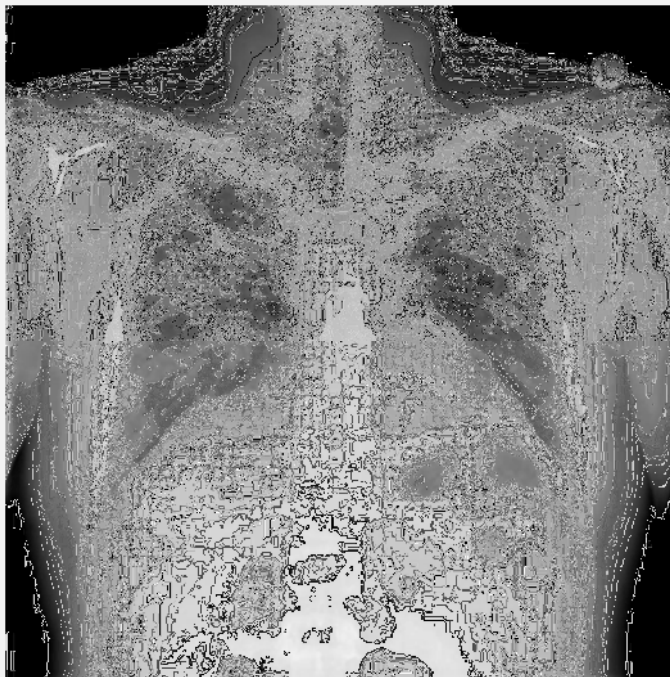
On 19 December 2019 Safe Work Australia amended the Advisory Carcinogen Category for Cristobalite, Quartz, Silica – Crystalline, Tridymite and to Carcinogen 1A

Safe Work Australia Advisory Carcinogen Category	
Category	1A (Carc. 1A) Known to have carcinogenic potential for humans
	1B (Carc. 1B) Presumed to have carcinogenic potential for humans.
	2 (Carc. 2) Suspected human carcinogen.

RCSD and the Lung – Figure 1
<i>Courtesy of the State of Queensland, document titled Silica and the Lung Version 5 March 2020</i>

Chest X-ray showing healthy lungs in a 45-year old.

RCSD and the Lung – Figure 2

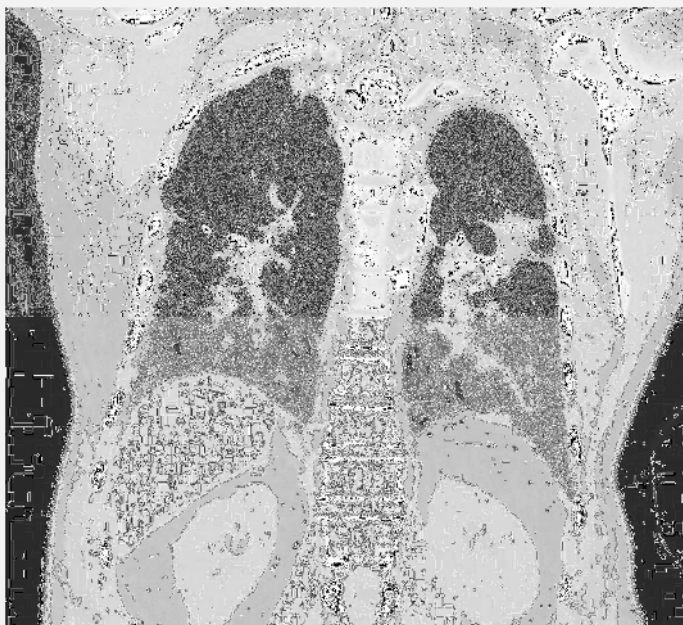
Courtesy of the State of Queensland, document titled Silica and the Lung Version 5 March 2020



Chest X-ray showing silicosis with progressive massive fibrosis in a 45-year old stone mason.

RCSD and the Lung – Figure 3

Courtesy of the State of Queensland, document titled Silica and the Lung Version 5 March 2020



Chest CT scan showing silicosis with progressive massive fibrosis in a 64-year old former sand blaster.

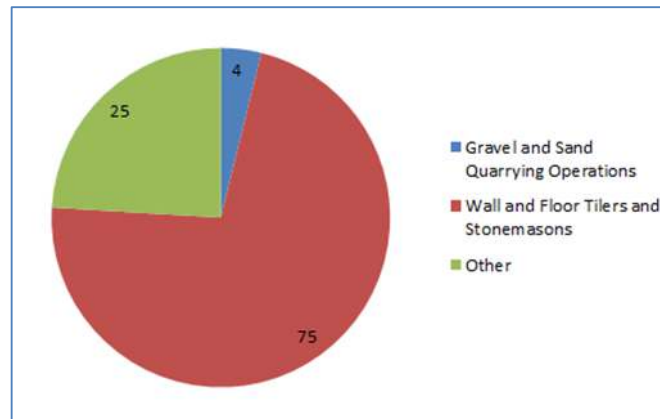
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Worker's Compensation Statistics:

Worker's compensation statistics indicate there are very few new cases of silicosis arising from the extractive industries in Victoria but there has been a significant surge in cases arising from the engineered stone industry.

Of the 107 worker's compensation claims received from 1 July 2016 – 5 September 2019 for health issues associated with RCSD, 4 claims only arose through the category titled as gravel and sand quarrying operations.

It is understood that the 4 claims have arisen through the processing of high purity quartz sands in a contained environment at the one site.



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Health Surveillance

Overview:

Employers must provide health monitoring for any employees exposed to RCSD at levels likely to exceed the exposure standard.

The Australian Institute of Occupational Hygienists (AIOH) recommends “where there is a continued likelihood of 50 per cent of the exposure standard being exceeded, i.e., the Action Level, exposure monitoring and health surveillance should apply”.

The health surveillance regime should begin at the pre-employment stage, be ongoing at required intervals during the course of employment and conclude on termination of employment.

Prior to the health surveillance appointment, you must provide specific details to the medical practitioner as follows:

- Name of the employer;
- Name and date of birth of the worker;
- The nature of the work the worker undertakes and how long the worker has been doing this work;
- The levels of RCSD the worker has been exposed to.

Health Surveillance Resources:

CMPA Medical Practitioner Guidelines and Medical forms are available at www.cmpavic.asn.au

These guidelines and medical forms are designed to assist employers who operate construction material processing businesses in meeting the requirements of the *Occupational Health and Safety Act 2004* and its Regulations in relation to monitoring their employees' health.

Pre-employment health assessment - the objectives are to determine whether an employee is fit for the proposed job and to obtain a baseline assessment for future health monitoring.

Periodic health monitoring - is aimed to assess at the earliest opportunity the detrimental effects on ongoing employees from the identified construction material processing hazards but also to assess those employees with a medical condition that may expose them or other employees to risk to their health and safety.

Silica specific periodic health monitoring –

Periodicity of health monitoring in regard to RCSD will be determined by the results of personal exposure levels:

- For those employees who are exposed to crystalline silica (i.e., $> 0.02 \text{ mg/m}^3$), health monitoring should include spirometry and a medical examination every year and a chest x-ray every 4 years;
- For those employees who are exposed to low levels of silica (i.e., $< 0.02 \text{ mg/m}^3$), health monitoring should include spirometry and a medical examination every 4 years and a chest x-ray only when there is a significant change identified on monitoring results.

Exit health assessments – is aimed to assess the possible detrimental effects on health of employees of construction material processing hazards at the time they leave the company.

A spirometry test assesses how well you actually breathe.

You breathe into the mouthpiece of a spirometer to measure the volume of air that you can inhale and exhale over a period of time.

This can be done at a doctor's surgery or at a respiratory clinic at a local hospital.



Safe Work Australia provides guidance resources as listed below that may be useful for the General Practitioner in making a determination:

- About crystalline silica;
- Health monitoring before starting work in a crystalline silica process;
- During exposure to a crystalline silica process;
- At termination of work in a crystalline silica process;
- Potential health effects following exposure to crystalline silica;
- Crystalline silica - Health monitoring assessment and report.

Refer to:

Safe Work Australia – Health Monitoring Guide for Crystalline Silica

Health Surveillance Records:

The OHS Regulations require that:

- An employer must provide the worker with access to a copy of their health surveillance report;
- Reports of health monitoring to be kept confidential unless authorised by the worker or if the employer is required by the regulations to provide WorkSafe with a copy of the report; and
- Records of health monitoring records are kept for 30 years post-employment unless another period is deemed by WorkSafe.

Employers should check the accuracy of any health surveillance report received as members have reported issues with incorrect dates, names and other information which may be detrimental to the company if not corrected.

RCSD Monitoring and Measurement

Objective of Workplace RCSD Monitoring

The primary objective of personal RCSD monitoring is to identify a worker's exposure to RCSD so as controls can be established to either eliminate or reduce the exposure.

Personal RCSD monitoring is also utilised to identify, improvements, deteriorating trends and review and address controls.

The objective of static RCSD monitoring is used at time to identify sources and volumes of dust being released into the workplace or alternatively to assess the effectiveness of controls once those controls have been established, e.g., before and after.

It must be noted that the results of static RCSD monitoring do not necessarily reflect a worker's exposure to that RCSD as the worker may not spend any or little time in the area where the static RCSD monitoring was conducted.

Planning Personal RCSD Monitoring – see Attachment A

Planning of personal RCSD monitoring should be conducted by a qualified Occupational Hygienist in consultation with the responsible manager and worker representative.

The Occupational Hygienist should have proven experience in RCSD monitoring of quarries and hold AIOH Professional Grade membership. CMPA has associate members who are Occupational Hygienists and undertake RCSD monitoring.

The selection of workers who shall be monitored shall be based on their potential exposure; this may be inclusive of both short and long term contractors.

Industry wide measurement and analysis prove that in a well-managed quarry, workers with the most potential exposure to RCSD are working in and around the fixed plant, being plant/pugmill operators and maintenance/cleaning personnel.

The standard of housekeeping applied on site generally determines the likelihood of other potential exposures.

If mobile equipment operators apply basic controls inclusive of the following potential exposures will be significantly reduced:

- Removal of overalls, removal of dirty boots prior to entering the cabin;
- Regularly vacuuming cabins with HEPA filter vacuum and or wet wiping cabins;
- Maintaining and cleaning air conditioner filters with HEPA filter vacuum; and
- Keeping cabin windows closed.

When identifying potential or actual RCSD hazards present on site and who may be exposed the following should be taken into account:

- Where materials are disturbed or carried to;
- Work practices where workers are confined to or contained within enclosed areas;
- The results of any previous monitoring;
- Crusher runs for specific aggregates/crushed rock mixes;
- Process changes on site e.g., introduction of a bagging product process within a shed;
- Hazard reports regarding RCSD release and or exposure; and
- Consultation with workers and contractors.

CMPA - RCSD Management Guideline

When scheduling a date for RCSD monitoring the following should be taken into account:

- The advice of the Occupational Hygienist;
- 'Weather conditions should be as reasonably representative as possible and not extreme, e.g., high rainfall, overly humid, stronger than normal winds, higher than normal temperatures; and
- Operating conditions, e.g., normal production outputs (tonnes per hour), typical crusher runs; not shut down days for maintenance unless planned to specifically monitor maintenance workers.

The responsible manager should ensure on the day of monitoring:

- All existing RCSD controls are in place and operating as they normally do;
- Workers and contractors have been informed of the monitoring program and have been briefed as to their role in the program;
- The Occupational Hygienist is fully inducted to the site and introduced to relevant workers.

The following factors can potentially influence the monitoring result and the worker's level of exposure:

- Ambient condition, for example wet or dry, temperature, relative humidity, air movement, wind;
- Work location and worker activity;
- Operating conditions, e.g., abnormal occurrences, dust spill;
- Influence of nearby activities e.g., rock breaker, grading haul road;
- Influence of neighbour's activities, e.g., construction, demolition, materials processing;
- Stripping and moving overburden;
- Dust suppression and control equipment being operational or not;
- Breakdowns and blockages.

To undertake RCSD monitoring the quarry workers carries a small battery powered pump affixed to the trouser belt.

The pump is connected to a sampling unit (or cyclone) with a piece of plastic hosing that contains a filter.

The sampling unit is clipped to the workers shirt collar within their breathing zone.

The pump and sampling unit will be fitted by the Occupational Hygienist and should be worn for the duration of the shift to ensure coverage of all activity in that shift.

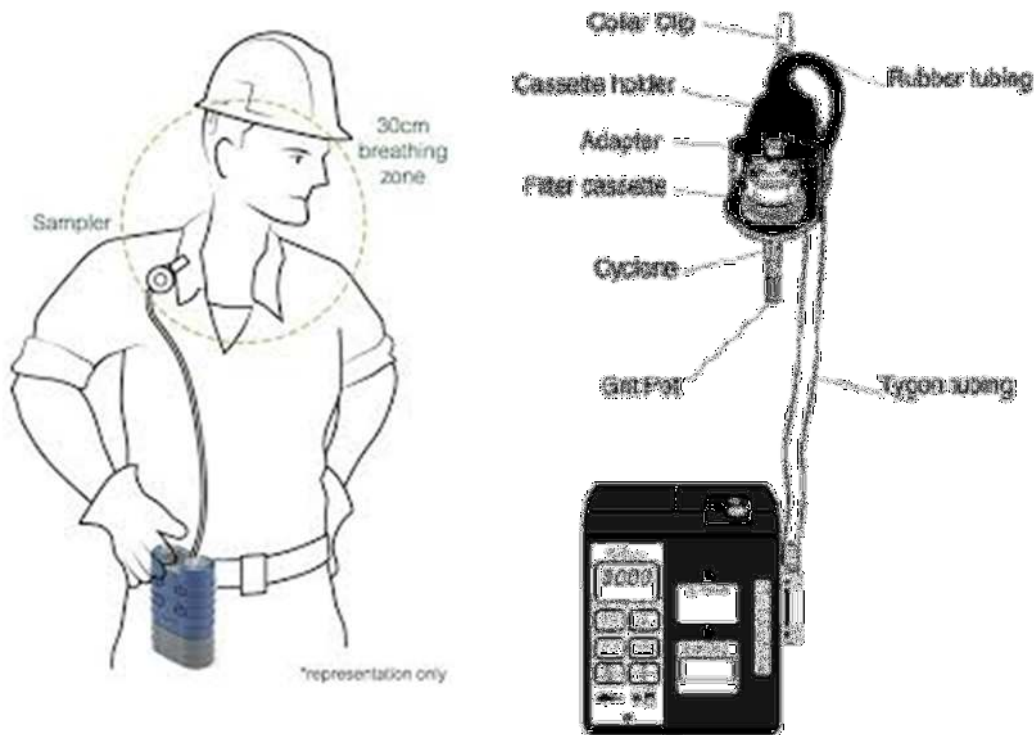
A steady stream of air is drawn through the sampling unit where the coarse dust settles out and only the very fine respirable dust is collected on a filter.

Following the air monitoring post weighing of the filters is performed. For quartz determination, the dust on the filters is analysed by X-ray diffraction (XRD) or by Fourier-transform infrared spectroscopy (FTIR).

The airborne concentration is calculated from the quartz weight and air sampling volume sample volume (determined from the duration of the monitoring and the flow rate). The result is then compared to the exposure standard.

CMPA - RCSD Management Guideline

This analysis must be carried out by a NATA accredited laboratory for the analysis of crystalline silica.



The Occupational Hygienist should complete a **Field Monitoring Report** for each worker being monitored that:

- Outlines the activities the worker was involved in, the amount of time and the sections of the site the worker accessed and any other factors that have the potential to influence results/exposures;
- Assists in making a risk-based decision as to whether a RCSD Control Sheet needs to be established;
- Records all information required to establish a RCSD Management Data Base.

Refer - Attachment A. Field Monitoring Report

The use of a body camera worn by the worker during the monitoring period would assist in understanding more accurately where the worker has been and what activities were undertaken.

RCSD Monitoring Reports

The Occupational Hygienist shall arrange for collected samples to be assessed at a NATA accredited laboratory for the analysis of RCSD.

The assessment of total airborne respirable dust shall be performed in accordance with Australian Standard AS2985 - Workplace Atmospheres - Method for sampling and gravimetric determination of respirable dust.

The Occupational Hygienist shall prepare a RCSD Assessment report based on the findings of the assessment and forward that report to the responsible manager.

Within the report tabled below the Exposure Standards - mg/m^3 has been adjusted to align with hours worked ranging from 55 hours ($0.036 \text{ mg}/\text{m}^3$) to 66.5 hours ($0.030 \text{ mg}/\text{m}^3$). All exposures were below the TWA exposure standard.

CMPA - RCSD Management Guideline

Table 3: Results of Airborne Personal Respirable Crystalline Silica Monitoring (11 th , 12 th and 17 th March 2020)							
Location			Result				
Date	Name	Position / Task / Machinery Type	Sample Number	Duration	Total Respirable Dust (mg/m ³)	Respirable Crystalline Silica (mg/m ³)	Applicable (adjusted) SWA Silica Exposure Standard ⁽²⁾ (mg/m ³)
11 th March 2020		Dump truck operator	S218226	0715-1553	0.04	<0.02 ⁽¹⁾	0.030
11 th March 2020		Maintenance	S218227	0718-1330	0.24	<0.02 ⁽¹⁾	0.033
11 th March 2020		Supervisor	S218220	0720-1512	0.03	<0.02 ⁽¹⁾	0.033
11 th March 2020		Sales Loader / water cart operator	S218230	0723-1459	0.05	<0.02 ⁽¹⁾	0.030
12 th March 2020		Excavator operator	S218206	0949-1907	0.02	<0.02 ⁽¹⁾	0.033
12 th March 2020		Sales Loader	S218341	0946-1906	0.08	<0.02 ⁽¹⁾	0.033
17 th March 2020		Maintenance	S218364	1459-2259	0.10	<0.02 ⁽¹⁾	0.036
17 th March 2020		Maintenance	S218363	1506-2300	0.03	<0.02 ⁽¹⁾	0.036

mg/m³ - milligrams of contaminant per cubic metre of sampled air.

(1) - crystalline silica not detected above the detection limit. The concentration has been calculated based on the stated detection limit of 20 micrograms total for each sample.

(2) - SWA Exposure Standard has been adjusted on the basis of employee working hours as advised.

A record of the communication should be held.

The RCSD Monitoring Report should also be accessible to workers to review upon request.

A copy of the RCSD Monitoring Report should be shared with medical practitioners who are conducting health surveillance for workers.

RCSD Monitoring Reports should be held for 30 years post-date of monitoring or unless otherwise stated by WorkSafe.

RCSD Control Sheet - see Attachment B.

A RCSD Control Sheet should be completed for each monitoring result equal to or greater than the TWA amended action level or trigger value.

A RCSD Control Sheet is not a legislative requirement although reducing the exposure to below to the exposure standard is.

The RCSD Control Sheet is a means of directing control actions to lower the ongoing exposure and provide evidence of having done such.

The RCSD Control Sheet should:

- Be conducted in consultation with the worker whose exposure was monitored;
- List current control measures in place on day of monitoring;
- List possible reasons for monitoring result, e.g., abnormal operating conditions;
- List description of controls to be implemented inclusive of by who, by when, date of completion and date of review.

Refer - Attachment B. RCSD Control Sheet

Frequency of Workplace Monitoring

The OHS Regulation directs that to ensure exposures remain below the exposure standard employers must carry out monitoring for RCSD generated at their workplace where:

- There is uncertainty about whether the exposure standard is or may be exceeded;
- It is necessary to determine whether there is a risk to employee health, and therefore if health monitoring and further controls are required.

The OHS Regulation does not direct a specific frequency of monitoring.

The responsible manager should consult with the Occupational Hygienist to determine the appropriate frequency of RCSD monitoring based on the previous results and operational activities.

Quarries may elect to conduct another round of RCSD monitoring where an exposure has exceeded the exposure standard and controls have since been established to reduce that exposure. The purpose of this second round is to validate those controls.

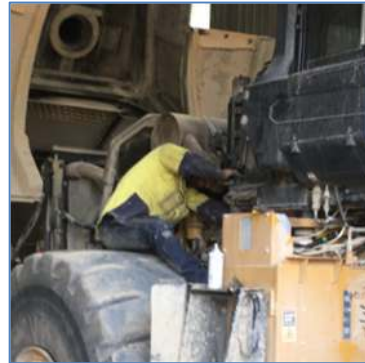
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Workplace Exposure Groups – see Attachment C.

Where the quarry owner has more than one site, the categorisation of monitoring results into similar exposure groups may enable an efficient means of benchmarking the monitoring results.

Similar exposure groups list the various operational roles inclusive of roles undertaken by contractors in a typical quarry and identify those roles by title and code, such as the example below:

- Q1 Driller;
- Q2 Face Loader Operator;
- Q3 Primary Haul Truck Operator;
- Q4 Crusher Operator;
- Q5 Sales Loader Operator;
- Q6 Bin Truck Operator;
- And so, on up to Q21.



These titles and codes should be applied as relevant to the persons being monitored in Attachment A- Field Monitoring Report.

Recording RCSD monitoring results under similar exposure groups allows easy identification of what operational roles are more likely to be exposed.

Refer Attachment C. Similar Exposure Groups



RCSD Management Data Base – see Attachment D.

The RCSD Management Data Base is utilised to record and analyse in a collective manner all information relevant to the RCSD monitoring results as reported in the Field Monitoring Report

RCSD Generation and Carriage

Any process that disturbs construction materials can become a source of potential RCSD generation and carriage, therefore exposure:

RCSD Generation

- Drilling and blasting rock;
- Crushing rock;
- Screening aggregates;
- Driving on haul roads;
- Stockpiles;
- Loading and unloading materials from stockpiles/trucks;
- Conveying materials and dropping materials from conveyors, into chutes, trucks or onto stockpiles;
- Repairing, or maintaining plant and equipment, e.g., screen changes;
- Buffing and grinding any backing surface for manganese placement;
- Sweeping or compressed air blowing of workshops, amenities, mobile equipment cabins;
- Heating materials so as to measure moisture contents;
- Grading materials using a sieve shaker;
- Drilling, cutting, or grinding masonry products.

RCSD Carriage

- Wind
- Overall, shirt and trouser cuffs and pockets;
- Work boot treads;
- Tyre treads;
- Truck draw bars;
- Open bodied trucks.



RCSD although not necessarily visible may be suspended in confined areas or rooms that lack ventilation. Where practical, these areas should be wet down or well ventilated prior to entry.

RCSD monitoring has identified levels of RCSD higher than the WES in lunchrooms, plant rooms and mobile equipment cabins that has been carried there by operator clothing and footwear.



This unacceptable standard of housekeeping applied has a significant influence on the level of potential RCSD Carriage.



Commitment to a high standard of housekeeping significantly reduces the level of potential RCSD Carriage.



RCSD Control

Introduction to Controls:

Without effective training of managers and workers the control of exposure to RCSD will be a continual challenge and likely unattainable.

The standard of housekeeping applied on site is paramount to the control of exposure to RCSD.

There are many other physical and work practice controls as listed in this section, but without an intimate understanding of the hazard, its consequence and the required controls and a clean and orderly workplace these other controls will not be effective or sustainable, therefore exposure to RCSD cannot be controlled.

Hierarchy of Controls

It is a legislative requirement that controlling RCSD hazards must be conducted:

- In alignment with the Hierarchy of Controls. This ensures the focus is on both a safe site and a safe workforce;
- In consultation with those workers and contractors whose health and safety may be affected by the RCSD hazard;
- To ensure exposure levels are below the WES as far as is reasonably practicable.

Reasonably practicable is defined as that regard must be had to the following matters in determining what is (or was at a particular time) reasonably practicable in relation to ensuring health and safety:

- The likelihood of the hazard or risk concerned eventuating;
- The degree of harm that would result if the hazard or risk eventuated;
- What the person concerned knows, or ought reasonably to know, about the hazard or risk and any ways of eliminating or reducing the hazard or risk;
- The availability and suitability of ways to eliminate or reduce the hazard or risk;
- The cost of eliminating or reducing the hazard or risk.

The Hierarchy of controls ensure we focus on both a safe site and a safe workforce and assists in deeming what is reasonably practicable.

Hierarchy of Controls			
↓	Elimination	Safe Site	Source rock cannot be eliminated or substituted
	Substitution		
	Isolation		Isolate workers from the RCSD source or carriage
	Engineering		Contain, collect & or suppress the RCSD
	Administration	Safe Workforce	Training, procedures, signage, and health surveillance
	PPE		Respiratory protection, safety glasses, overalls, gloves
↓			↓

Refer Attachment F, RCSD Controls Photo Gallery

RCSD Control by Quarry Activity

Drilling, Blasting and Secondary Breaking:

- Provision of water for drillers dust suppression;
- Wet suppression or dry cyclone filtration systems for drilling;
- Wetting down of access roads and work area.

Load and Haul:

- Water cannon on shot rock prior to load and haul to crusher at regular intervals throughout the day and well in advance of use;
- Regular application of water or dust suppressants or surface stabilisers on roads and other surfaces;
- Use of classed material on haul road as against lower quality materials with higher silt content;
- Dedicated water truck driver during dry season or as required;
- Use of water sprays in heavy traffic zones;
- Minimise and contain vehicle movements;
- Reduce onsite vehicle speeds, particularly in dry and windy conditions;
- Install bends on haul or sales access roads where practicable to reduce speed.

Crushing, Screening and Conveying Materials:

- Water sprays, foams or fog injectors used to suppress RCSD;
- Install interchangeable spray nozzle heads;
- Dust extraction systems used to collect and/or contain dust at transfer points;
- Enclose RCSD generating sections of plant within purpose built enclosures, e.g., crushers, screens, transfer points;
- Adjust belt speed and size to reduce airflow and extend life of belt scrapers;
- Install impact beds (rather than rollers) under skirting systems to reduce belt sag;
- Isolate operators from generated RCSD as far as is practicable;
- Minimise the fall height of materials from conveyors to stockpile;
- Use Linatex socks to contain RCSD falling from conveyors;
- Installation of skirts around transfer point;
- Install belt cleaning sprays in opposite direction to travel;
- Restrict access to the work area to authorised personnel only;
- Consider zoning out (restricting access) to high dust areas with fencing;
- Climate controlled operator cabin with self-closing doors and air locked entry;
- CCTV systems to view required areas of operational plant;
- Rock breakers controls located in operator control cabin;
- Screens enclosed with covers;
- Minimise material spillage from conveyors, particularly at transfer points;

CMPA - RCSD Management Guideline

- Install scrapers or brushes on conveyor belts to avoid carry back;
- Install concrete hardstand under all conveyors, crushers and screens with full wash-down systems including sediment pits;
- Ensure aggregates surfaces are damp, but not so wet as to cause blockages in screens and chutes.

Testing and Grading of Aggregates:

- Laboratories should be climate controlled and segregated from RCSD generation areas or carriage pathways;
- Installation of RCSD extraction units above benches where heating aggregates or within enclosed cupboard rooms where sieve shaking aggregates;

Stockpiling:

- Use water cannons, sprinklers or vehicular based sprays for small stockpiles;
- Where water is available consider washing all aggregates
- Ensure processed materials with fines are wet-mixed with optimal moisture content before being placed in stockpile;
- Establish tree wind rows on boundary of stockpile areas where practicable to reduce wind speed and RCSD carriage;
- Place large size aggregate stockpiles on boundary of stockpile areas where practicable to reduce wind speed and RCSD carriage;
- Place dust stockpiles in the centre of stockpile area at a lesser height than other stockpiles where practicable;
- Minimise stock on ground where able;
- Use environmentally appropriate dust containment agents on dust stockpiles where required.

Mobile Equipment General Operations:

- Doors and windows of equipment are closed at all times;
- Cabins should be well sealed and regularly checked to ensure effectiveness;
- Air conditioning installed within equipment cabins filtered through high efficiency particulate air (HEPA) filters;
- Cabins regularly cleaned using filter vacuum systems containing HEPA filters and wet wiping;
- Do not use compressed air to blow out cabins or filters
- Removal of overalls, removal of dirty boots prior to entering the cabin;
- Slip on clean shoes (not work boots) worn in cabins.

Traffic Areas:

- Establish sealed roads and carparks surrounding office and amenities areas where practicable;
- Use road sweeper in these areas and at quarry entrances;
- Install speed humps or bends on roads to reduce speed;
- Ensure traffic movements are reduced as far as is practicable;
- Restrict traffic movements to defined areas;
- Install wheel washes for vehicles leaving the quarry.

CMPA - RCSD Management Guideline

Sales Loading:

- Wet down areas where loading from and surrounding traffic routes;
- Ensure stockpiles being loaded from are wet down prior to loading using water cart cannon or sprinklers;
- Enclose loadout bays where practicable;
- Truck drivers to remain in cabins whilst being loaded with windows closed;
- Install wheel washes for vehicles leaving operational areas or the quarry;
- Prohibit opened bodied trucks and mandate use of tarpaulins.

General Housekeeping:

- Clean mobile equipment, workshops, buildings and other work areas using HEPA vacuums or wet cleaning methods (never use dry brush, brooms, rags, or compressed air);
- Install wet or dry fixed boot brushes at entrances to offices and amenities;
- Install dust booths external to change rooms and other amenities;
- Prohibit the wearing of work boots/overalls in offices and other amenities;
- Do not take any RCSD soiled clothing off site.

Maintenance:

- Maintenance should be undertaken wearing overalls that should be removed before entering mobile equipment cabins or offices and amenities;
- Utilise worker rotation to reduce exposure times;
- Wash down dusty areas well before performing maintenance work; taking into account you may create slip and fall hazards in doing so;
- Use dust extraction systems in restricted or confined areas
- Wear Full-face respirators or Powered Air Purifying Respirator (PAPR), i.e., air fed hoods where able.

General Administrative Controls:

- Training and education of workers;
- Housekeeping inspections and practices;
- Control of movement in and around plant;
- Personal and static dust monitoring;
- Health surveillance;
- Safe work procedures;
- Signage;
- Worker rotation to reduce exposure times;
- Dust management plans and audits;
- Reporting of dust related hazards and incidents;
- Monitoring community complaints;
- Observation of weather forecasts and scheduling work activities to suit;
- Ongoing visual monitoring.

CMPA - RCSD Management Guideline



Housekeeping



Dust Containment at source

Initially controls can be short or long term:

- Short-term controls are generally safe workforce controls. These controls may not be adequate or sustainable to lower the risk over a long-term duration;
- Short-term safe workforce controls may allow the safe continuation of work whilst long-term safe site controls are being implemented;
- Long-term safe site controls may take longer to resource and establish
- Where short-term controls cannot reduce the risk to an acceptable level, the exposure of people to the activity or environment must cease until long-term controls are implemented and the risk has been reduced to an acceptable level.

Details of all controls, both short and long term and actions associated with implementing those controls should be entered into the RCSD Control Sheet and implemented as per the agreed time frames.



Bends in Haul road to ensure reduction of speed.

Personal Protective Equipment

Overview:

Respiratory protective equipment (RPE) is commonly used to control exposure to RCSD.

In many workplace situations, higher order controls will not necessarily be adequate by themselves to reduce RCSD exposure to a level below the WES and therefore those controls may be supplemented by Respiratory Protective Equipment (RPE).

Respirator Standards:

Respirators and filters must meet the requirements of AS/NZS 1716 2012: Respiratory Protective Devices that categorises particulate filters into three classes being P1, P2 and P3:

- **CLASS (P1)** Intended for use against mechanically generated particulates, has a low to medium absorption capacity filter (Filters at least 80% of airborne particles)
- **CLASS (P2)** Intended for use against both mechanically and thermally generated particulates, Has a medium absorption capacity filter (Filters at least 94% of airborne particles)
- **CLASS (P3)** Intended for use against all particulates including highly toxic materials, Has a high absorption capacity filter. This can only be achieved in a full face respirator. (Filters at least 99.95% of airborne particles)

The AS/NZS number, being 1716 and the filter class number being P2 should be marked on the respirator filter. Filters for powered air-purifying respirators are specially designed and marked with the prefix PAPR.



Disposable P2



Half Face Respirator



Full Face Respirator



Powered Air Purifying Respirator (PAPR)

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PAPR consists of a helmet/hood and face shield. A fan forces air through a replaceable filter in the back of the helmet/hood and around the face.

The PAPR puts a positive pressure in the face piece so contaminated air cannot get in even and clean air is blown out instead.

The filtered clean air is pushed into the helmet, providing the wearer with fresh, cool air which enables easier breathing, and reduces heat and moisture build up.

Positive pressure works to keep airborne contaminants out of the helmet. With a loose seal around the neck of the helmet, and clean air being pushed in, there is more pressure inside the helmet than out. This means that particles and contaminants in the air will be pushed away from any potential entry points.

The PAPR can be more comfortable than having a non-disposable mask sealed against the skin and is effective for some but not all people with facial hair.

A PAPR can cause issues such as entanglement when working in restricted spaces such as screens or chutes.

Protection Factor:

Protection factor is the level of protection required of the respirator for the dust concentration in the air.

To calculate the required minimum protection factor, use the following formula.

$$\frac{\text{Observed Dust Concentration}}{\text{Workplace Exposure Standard}}$$

Example of Protection Factor Determination			
Concentration of RCSD mg/m ³	Workplace Exposure Standard mg/m ³	Required Minimum Protection Factor	Minimum Respirator Group Type
0.2	0.05	4	A
0.6	0.05	12	B
3.0	0.05	60	C
6.0	0.05		D

Protection Factors for RCSD		
Protection Factor	Suitable respirator type for mechanically generated silica dusts	Group
Up to 10	Any of P1, P2 or P3 filters with half face piece, disposable or non-disposable	A
Up to 50	P2 filter in full face piece PAPR with – P2 filter, any head covering PAPR with P3, any head covering Half face piece respirator with positive pressure demand or continuous flow airline	B
Up to 100	P3 filter in full face piece Full face piece air hose type.	C
100 plus	PAPR with P3 filter, head covering and blouse Head covering airline respirator –continuous flow Protection factor may not be achieved with facial hair Full face piece – continuous flow or positive pressure demand air supply	D

Selection of Respiratory Protection Equipment:

Respiratory Protective Equipment (RPE) requirements are to have at least a P2 filter and be fit tested for each person to ensure it fits correctly.

RPE that requires a facial seal, such as half-face respirators, should not be used by people with beards or even facial stubble. Where facial hair interferes with the fit of the RPE, a powered air purifying respirator (PAPR) that does not rely on a facial seal needs could be used. Potential users should refer to supplier for further information.

RPE needs to be selected, used and maintained in accordance with AS/NZS 1715 – Selection, use and maintenance of respiratory protective equipment. Employers must provide employees with information, instruction and training in RPE use and maintenance.

Refer to Protection Factor Table for more detail.

Points to consider when selecting which type of respirator to use:

- What other PPE you will need to wear, such as earmuffs, hard hat and goggles, and how these will affect the respirator fit;
- The task to be carried out, the workload, the possibility of heat stress, entanglement and the need for mobility;
- Any facial hair or other facial features that may influence the respirator fit;
- The airborne concentration of dust in the area you are working.

Fit, Test, Care & Maintenance of Respiratory Protection Equipment:

Disposable Respirators:

- Adjust strap and nose clip to suit;
- Completely cover the mask with both hands and inhale sharply. The respirator should sink onto your face and should be tested prior to each use;
- If you feel a stream of air around the edges (particularly at the bridge of the nose) then you have a poor seal;
- Adjust strap and nose clip and re-test;
- Used respirators must be disposed of into a bin.

Non-disposable Respirators:

- Cover the inlets of the filters and inhale gently so that the face piece collapses slightly;
- Hold your breath for about 10 seconds, if the face piece stays slightly collapsed then you have a good seal;
- Cover outlet valve and attempt to exhale;
- The respirator should be tested prior to each use;
- After use, these masks need to be washed in warm water and detergent/disinfectant, rinsed, and stored in plastic bag/box in a safety equipment cabinet.

Note:

All respirator filters will eventually become ineffective and must be replaced. Dust filters may actually increase in efficiency (as the filter blocks up) but their resistance to air flow also increases gradually with use, making them harder to breathe through.

Reasons for poor fitting respirators:

- Beards, moustaches, sideburns, 1-7 day growth;
- Poor or damaged seal;
- Incorrectly fitted/wrong size;
- Strapping adjustment;
- Other PPE intruding;
- Sweaty, wet, dirty, or dusty.

Other PPE Requirements inclusive of Clothing:

Overalls should be worn whilst working in RCSD environments and then removed so RCSD is not carried into the operator cabin, lunchroom, office, car or home:

- Remove overalls while you are still wearing a respirator;
- Use dust booth where available;
- Do not shake out dusty overalls;
- Do not take dusty overalls home;
- Arrange contract supply and cleaning;
- Place in the bin provided for cleaning;
- Replace on a daily basis.



Gloves:

- Riggers gloves worn when carrying out maintenance tasks;
- Rubber gloves worn whenever handling cement dust or wet concrete.



Work Boots & Shoes:

- Work boots worn outside should not be worn in mobile equipment, internal workstations and office or amenities;
- Slip on shoes should be provided for this purpose.



Wrap around Safety Glasses and Sealed Goggles:

- Wrap around safety glasses worn at all times while in the vicinity of the processing plant;
- Sealed goggles worn when working in areas where airborne dust is visible and in enclosed areas such as screens;



- Eye protection equipment must be appropriate for the task;
- Best practice quarries mandate use across whole of site excluding administration and amenities areas.

Storage and care of PPE:

- PPE must be stored correctly so that it does not become damaged, worn or contaminated;
- Disposable dust masks will be stocked in appropriate storage cabinets around the work site;
- PAPR should be stored in the site's safety equipment cabinet and cleaned after every use.

Signage Requirements

Wherever PPE is to be worn the relevant signpost should be installed.



RCSD Awareness Training

Workers potentially exposed to RCSD hazards must be provided with training that covers the following subjects:

- The sources of RCSD generation in the workplace;
- The hazards and health effects associated with working with RCSD;
- The health surveillance regime;
- How RCSD exposures are monitored and reports are read;
- How to control RCSD exposure following the hierarchy of controls;
- Why you are required to wear respiratory protection at work;
- The purpose and process of respirator fitting;
- How to use and care for your respiratory protection provided;
- What other PPE is provided for protection against RCSD in your workplace.

An assessment should be conducted on completion of the training and records of that assessment and training content maintained within the worker's employment file.

Training should be conducted on a routine basis, preferably annually prior to the dry season where potential RCSD is more prevalent.

Site WHS Inductions must refer to RCSD and workers should undertake training on commencement of employment.

Review of RCSD Controls

On completion of the implementation of controls it is imperative that they are reviewed in consultation with the relevant workers to ensure that the controls are effective by:

- Providing the protection that they are intended to;
- Being practical to use, e.g., PPE fit and comfort;
- Not causing any operational issue, e.g., material blockages, out of specification materials.

Scheduled routine workplace inspections should include the monitoring of controls to ensure they remain effective and are being maintained in the appropriate manner.

Re-monitoring of potential exposures should be conducted to verify the suitability of the controls in reducing RCSD exposure levels to well below the action limit/trigger value.

RCSD Control Plan – see Attachment E.

It is recommended by the CMPA that sites with a rock source containing quartz content over 1% or sites that are recycling concrete establish and implement a RCSD Control Plan.

The overall objectives of the RCSD Control Plan are to ensure that:

- Quarry operational activities inclusive of recycling concrete are managed in a manner that reduces the risk of uncontrolled occupational exposure to RCSD as far as is reasonably practicable;
- Any exposures to RCSD are below the Workplace Exposure Standard (WES) of 0.05 mg/m³;
- Current/existing controls are reviewed and amended as practicable when RCSD personal exposure monitoring reveals results equal to or above the WorkSAFE action level of 0.02mg/m³;
- All workers and routine contractors are aware of the consequence to personal health through uncontrolled exposure to RCSD;
- All workers are aware of and have the ability to maintain the required controls to reduce exposure to RCSD;
- All workers who are exposed to RCSD at levels above the WorkSafe action level of 0.02mg/m³ are subject to a health surveillance program.

The implementation of the plan is the responsibility of the responsible manager but its establishment and implementation should be conducted in consultation with relevant workers.

CMPA

CMPA RCSD Management Guideline Attachment A Field Monitoring Report

1. General Information (may be completed once for the day)			
Site:		Survey Date:	
City:		State:	
Hygienist (Name):		Consultant Company:	
Consultant's Project Number:		Typical Work Hours Per Week on Site:	
Ambient Conditions: Dry / Wet	Air Temperature (Celsius):	Relative Humidity (%):	
Air Movement (kph):			
Production Rate (Units/ t/p/h etc.) (or other relevant information):			
2. Worker Information (per each sample)			
Worker Name:		Job Title:	
Work Area:		Job/Task:	
S.E.G		Major Work Activities:	
Description of Task(s) Being Performed:			
Respirator Task? Yes / No		Worker Wearing Respirator? No / Full Shift / Partial Shift	
Respirator Type:			
Dust Suppression (e.g. water sprays, dust extraction, A/C in cabin, etc.):			
Operating Conditions (abnormal occurrences, e.g., sweeping up dust influence of nearby activities/processes e.g. stockpiles/road traffic): (ask worker)			
3. Sampling Data (per each sample)			
Sample Number:		Rotameter Number:	
Pump Number:		Time Started:	
Initial Flow Rate L/min:		Time Finished:	
Final Flow Rate L/min:		Sampling Time (min):	
Average Flow Rate:		Sampling Volume (l):	
4. Laboratory Analysis (per each sample)			
Respirable Quartz (mg/m ³): (personal exposure)		RCSD mg/m ³ : (personal exposure)	
5. Risk Control Sheet (RCS) – required when personal exposure is equal to or above the TWA amended action level of 0.05 mg/m ³ .		Required - Yes	Not Required - No

CMPA RCSD Management Guideline Attachment B – Risk Control Sheet

To be completed for each monitoring sample result = to or > than the TWA amended action level or trigger value					
Site	Date of this RCS	Name of person who was monitored			
Person(s) Completing the RCS					
Similar Exposure Group Title and Number		Work area / location within site			
Sample Number	Monitoring Result	Action level or trigger value	Monitoring Date		
Job <i>(list dusty tasks/activities)</i>		Current control measures in place on day of monitoring			
List possible reasons for monitoring result <i>(e.g. weather, breakdowns, plant shutdowns, etc, which could make the job more dusty)</i>					
Description of controls to be implemented:		By Whom:	By When:	Date Completed:	Date Reviewed:

[Type text]

CMPA RCSD Management Guideline Attachment C - Similar Exposure Groups

SEG Code	SEG Titles	SEG Description
Q1	Driller	Drill operator drilling benches, etc. for blasting. Most likely a contractor and only on site from time to time to conduct a drilling campaign.
Q2	Face Loader Operator	Loaders working at quarry face, loading blasted rock into haul trucks.
Q3	Primary Haul Truck Operator	Truck carting blasted rock from quarry face to the primary crusher or ROM pad.
Q4	Crusher Operator	Operator responsible for the operation on the crushing circuit.
Q5	Sales Loader Operator	Loader working in stockpile area, loading product into trucks for transport to client.
Q6	Bin Truck Operator	Truck carting product from crushing circuit to the sales stockpiles.
Q7	Quarry Supervisor	Supervisor or foreman of the quarry. At smaller sites, may also be the quarry manager.
Q8	Excavator (rock pick) Operator	Excavator working at face, loading blasted rock into haul trucks or breaking over size rock to as suitable size.
Q9	Pug Mill Operator	Operator responsible for the operation of the Pug Mill circuit.
Q10	Quality Technician	Sampler and or laboratory technician. Prepares and processes samples from the crushing circuit for QA.
Q11	Truck Driver (road transport)	Truck operator transporting product offsite to clients.
Q12	Quarry Cleaners (dust and other build up)	Removing re settled dust from around plant and equipment.
Q13	Maintenance Workers	Quarry maintenance operators. May include mechanical / electrical fitters and boilermakers.
Q14	Dredge Operator	Operating the dredge in a sand plant that extracts sand from the pit and pumps to the washing plant.
Q15	Water Truck	Driving water truck and operating water cannon to suppress dust around the site.
Q16	Weighbridge Person	Administering weighbridge duties.
Q17	Excavator Operator, (not Rock Pick)	Excavator operator in involved in quarry stripping, moving or loading sand, Not hard rock or rock pick work.
Q18	Dozer Operator	Operating dozer to push up sand, other stockpiles or strip overburden prior to drill and blast
Q19	Grader Operator	Grading roads around site.
Q20	Scraper Operator	Operating scraper to deliver sand to feeder or strip overburden.
Q21	Front End Loader Operator	Loader loading product into feeder bins.

NOTE:

In some instances an operator will fulfil more than one of the SEG descriptions above.

Where completing the Field Monitoring Report Form the SEG Code for the operator's **primary** activity shall be listed first.

SEG Codes for **secondary** activities and duties shall follow and be in brackets.

{Company and Site Name}

Respirable Crystalline Silica Dust (RCSD) Control Plan

{Date & Issue Number}

CMPA

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How to populate this RCSD Control Plan Template

CMPA members can use this template as a guide to establishing a site specific RCSD Control Plan.

When populating this template, utilise the CMPA RCSD Management Guideline for general information and guidance.

Follow the prompts provided by the coloured text in this template:

- Black text is proposed headings/text that may be left as is or amended to suit your site specific requirements
- Blue text is hints on what text should be included and must be removed before finalisation
- Red text is sample texts that would require customisation before finalisation

The RCSD Control Plan is a risk based management plan that assembles the overall approach to the control of occupational exposure to RCSD.

Where and if applicable Safe Work Procedures, Safe Work Methods Statements, checklists and so forth should be referred to in your RCSD Control Plan.

CMPA

Introduction and Authorisation

This RCSD Control Plan referred to as (the plan/this plan) has been prepared by XXXX Quarries {add Company Name} for the XXXX Quarry site {add Quarry Site Name}.

Quarry Name	
Quarry Address	
Work Authority Number	
Authorised by	{Add Name}
Position or Title	{Add position e.g. Managing Director}
Version/Issue Number	{Add version/issue number and date}

CMPA

Objectives of the RCSD Control Plan

The overall objectives of our RCSD Control Plan are to ensure that:

- Quarry operational activities, inclusive of recycling concrete are managed in a manner that reduces the risk of uncontrolled occupational exposure to RCSD as far as is reasonably practicable
- Any exposures to RCSD are below the Workplace Exposure Standard (WES) of 0.05 mg/m³
- Current/existing controls are reviewed and amended as practicable when RCSD personal exposure monitoring reveals results equal to or above the WorkSAFE action level of 0.02 mg/m³
- All workers and routine contractors are aware of the consequence to personal health through uncontrolled exposure to RCSD
- All workers are aware of and have the ability to maintain the required controls to reduce exposure to RCSD
- All workers who are exposed to RCSD at levels above the WorkSAFE action level of 0.02 mg/m³ are subject to a health surveillance program

CMPA

General Responsibilities

The following general responsibilities are to be established to implement and maintain this RCSD Control Plan.

Quarry Manager

- Ensure all quarry workers and routine contractors are aware of the requirements of this plan as applicable
- Ensure compliance with the requirements of this plan
- Ensure the quartz content of the rock source being processed is identified as required
- Initiate RCSD personal exposure monitoring as required
- Review results of the RCSD personal exposure monitoring in consultation with relevant workers
- Review and amend current/existing controls as practicable when RCSD personal exposure monitoring reveals results equal to or above the WorkSAFE action level of 0.02mg/m³
- Ensure workers and routine contractors undertake RCSD Awareness training on an as required basis
- Ensure all workers and routine contractors are aware of and have the ability to maintain the required controls to reduce exposure to RCSD inclusive of the fit, use and maintenance of Respiratory Protective Equipment (RPE)
- Ensure workers who are exposed to RCSD at levels above the WorkSAFE action level of 0.02mg/m³ are subject to a health surveillance program
- Maintain this plan and initiate the review of this plan on an annual basis

{Add any other site specific responsibilities}

Quarry Workers and Contractors

- Comply with the requirements of this this plan
- Comply with requirements as listed in SWMS and SWPs
- Report dust hazards immediately on observation
- Use RPE as instructed
- Attend and participate in RCSD training as requested

{Add any other site specific responsibilities}

Training & Awareness

The following training and awareness initiatives are to be communicated to all workers and routine contractors to ensure the successful application of the RCSD Control Plan:

- The sources of RCSD generation in the workplace;
- The hazards and health effects associated with working with RCSD;
- The health surveillance regime;
- How RCSD exposures are monitored and reports are read;
- How to control RCSD exposure following the hierarchy of controls;
- Why you are required to wear RPE at work;
- The purpose and process of RPE fitting;
- How to use and care for your RPE provided;
- What other PPE is provided for protection against RCSD in your workplace.

{Add any other site specific training and awareness initiatives, e.g. induction processes}

{Add any detail in regards to the assessment of understanding of training and induction processes}

CMPA

Identification of Quartz

The following processes were undertaken to identify the quartz content of the rock source being processed.

{Add details of the process, e.g. who undertook the analysis, petrographic analysis or X-ray diffraction analysis, date of most recent analysis, location in quarry of rock source sampled}

Quartz Content			
{Add title of Rock Type, e.g. Hornfels}	{Add % of quartz content}	{Add location of last sample analysed}	{Add date of last analysis}
{If recycling concrete use title Waste Concrete}	{>90%}	{N/A}	{N/A}

Variation of Rock Source Samples

The Quarry Manager shall ensure that as the quarry extracts rock from different locations and the visual characteristics of the rock change an investigation into the benefits of another quartz analysis is undertaken.

CMPA

Safety Data Sheet

A Safety Data Sheet (SDS) has been established for the {Add title of Rock Type} and is dated {Add date}.

The SDS is accessible to all workers and is located {Add location, e.g. lunch room. SDS registers}.

The SDS or access to the SDS has been provided to all {Add Quarry Name} customers.

{Add detail of provision or access, e.g. post out to all account customers, letter to all account customers informing of access via website, register of post out and or letters to inform, process to hand out at weighbridge to COD customers}

CMPA

RCSD Generation and Carriage

Generation

RCSD can be generated at varying levels through many activities when processing rock or sand to serve as a construction material.

The following activities have the potential to generate RCSD at {Add Quarry name}:

- Drilling and blasting rock;
- Crushing rock;
- Screening aggregates;
- Driving on haul roads
- Extracting and drying slimes from slimes ponds
- Loading and unloading materials from stockpiles/trucks;
- Conveying materials and dropping materials from conveyors, into chutes, trucks or onto stockpiles;
- Cleaning, repairing, or maintaining plant and equipment;
- Sweeping or compressed air blowing of workshops, amenities, mobile equipment cabins;
- Heating materials so as to measure moisture contents;
- Grading materials using a sieve shaker;

{Add any other activities that have the potential to generate RCSD}

Carriage

RCSD can be carried and moved to another location through many activities when processing rock or sand to serve as a construction material:

- Wind
- Overall, shirt and trouser cuffs and pockets;
- Work boot treads;
- Tyre treads;
- Truck draw bars;
- Open bodied trucks

{Add any other activities that have the potential to carry RCSD}

RCSD Controls

The objective of our RCSD controls are to ensure that personal exposure levels are below the WES as far as is reasonably practicable.

All RCSD controls shall be:

- Established taking into consideration the Hierarchy of Controls to ensure a focus is on both a safe site and a safe workforce
- Established in consultation with those workers whose health may be affected by the RCSD hazard
- Inspected by the Quarry Manager or his/her representative on a {add frequency} basis to ensure they are operable, provide the required protection and are not causing any operational issue, e.g. material blockages, out of specification materials.

{Add Quarry name} RCSD controls are directly linked to where RCSD hazard is generated or carried, e.g. the key steps in processing rock or sand to serve as a construction material.

To establish these controls and ensure coverage of all key steps in these processes our RCSD Control Checklist follows the order of the CMPA's - RCSD Management Guideline section titled RCSD Control by Quarry Activity processes.

CMPA

RCSD Control Checklist

The table/checklist below lists these key steps and the RCSD controls that have been established.

{Once the table below is populated with the required controls the table can be used as a checklist to conduct the inspections to ensure controls are effective as listed above. Records of these inspections must be maintained}

RCSD Control Checklist			
Completed By			Date
Key Steps	Required Controls are Effective?	Yes	No
Drilling, Blasting and Secondary Breaking:	{Work through each key step in this table and list controls you have established, Refer CMPA - RCSD Management Guideline section titled RCSD Control by Quarry Activity for advice on potential controls}		
Load and Haul:			
Crushing, Screening and Conveying Materials:			
Testing and Grading of Aggregates:			
Stockpiling:			

CMPA RCSD Management Guideline, Attachment E – RCSD Control Plan Template

Mobile Equipment General Operations:			
Traffic Areas:			
Sales Loading:			
General Housekeeping:			
Maintenance:			
General Administrative Controls:			

Respiratory Protective Equipment (RPE)

All {Add Quarry name} workers shall undertake training in the Fit, Test, Care & Maintenance of RPE on an {Add frequency basis}.

Where RPE is mandatory to be worn the area shall be sign posted accordingly.

Safe Work Procedures (SWPs), Safe Work Method Statements (SWMSs) and other operational; procedures shall lists the RPE requirement for the task or activity.

{Add Quarry name} has deemed P2 Disposable masks as the minimum RPE standard of protection against RCSD exposure.

P2 Disposable masks shall be made accessible to all workers shall be stored {Add location/s of storage}.

Where a higher standard of protection is required such as Half Face or Full Face Respirators or Powered Air Purifying Respirators (PAPRs) these will devices shall be made accessible to workers.

In considering a higher standard of protection the “Protection Factors for RCSD table” as listed in the CMPA RCSD Management Guideline shall be referenced.

Personal Protective Equipment (PPE)

Wrap around safety glasses shall be worn on all areas across the site where there is potential for exposure to RCSD.

Riggers gloves shall be worn, as far as is practical, when carrying out maintenance tasks where there is potential for exposure to RCSD.

Overalls shall be worn whilst working in environments such as within screens, chutes and crushers or activities such as general maintenance.

Overalls shall be removed (whilst still wearing RPE) prior to entering and carrying RCSD operator cabins of mobile equipment, lunchrooms, offices, cars or home.

Arrangements have been made for contract supply and cleaning of overalls. An SDS has been provided to this supplier.

Work Practices

The following documents direct safe work practices in regards to controlling exposure to RCSD.

{Add titles and issue dates of any SWPs or SWMS that direct safe work practices in regards to controlling exposure to RCSD}

Personal RCSD Monitoring

Personal RCSD Monitoring shall be conducted on {Add frequency} basis by an Occupational Hygienist or his / her qualified representative following the requirements of AS 2985 Workplace Atmospheres - Method for Sampling and Gravimetric Determination of Respirable Dust.

All workers who are potentially exposed to RCSD shall undertake Personal RCSD monitoring.

Personal RCSD Monitoring shall be undertaken when weather conditions are as reasonably representative as possible and not extreme, e.g. high rainfall, overly humid, stronger than normal winds, higher than normal temperatures. The Occupational Hygienist and the Quarry Manager shall agree to a reasonably representative time to conduct the monitoring.

Personal RCSD Monitoring shall generally be undertaken during normal operating conditions, e.g. normal production out puts (tonnes per hour) and typical crusher runs with all existing RCSD controls in place and operating as they normally do.

Personal RCSD Monitoring may at times be undertaken during shut down days for maintenance to specifically monitor maintenance workers.

Workers will be informed of their responsibilities to ensure the effectiveness of the monitoring prior to the commencement of the monitoring.

Worker locations and activities undertaken during the monitoring period shall be recorded on a Field Monitoring Report.

(Refer attachment A - Field Monitoring Report, CMPA RCSD Management Guideline).

On completion of the monitoring the samples shall be analysed for respirable dust and RCSD. The Occupational Hygienist shall prepare a RCSD Monitoring report (inclusive of the Field Monitoring Reports for each worker) and forward the report to the Quarry Manager.

On receipt of the report the Quarry Manager shall communicate the results of the report to all workers who undertook Personal RCSD Monitoring

Where the results of the monitoring are at levels above the WorkSAFE action level of 0.02mg/m³:

- **An RCSD Control Sheet shall be established and implemented in consultation with relevant workers**
- **The worker concerned shall be enrolled in the health surveillance program**
- **Further monitoring shall be scheduled for that worker or that position at a time advised by the Occupational Hygienist**

Details of all controls, both short and long term and actions associated with implementing those controls should be entered into the RCSD Control Sheet and implemented as per the agreed time frames.

(Refer attachment B, RCSD Control Sheet, CMPA RCSD Management Guideline).

CMPA RCSD Management Guideline, Attachment E – RCSD Control Plan Template

To maintain a collective history of results and the circumstances surrounding those results relevant data from the RCSD Monitoring report and the attached Field Monitoring Reports shall be entered in to the RCSD Management Data Base

(Refer Attachment D. Dust Management Data Base, CMPA RCSD Management Guideline).

CMPA

Health Surveillance Program

{Add quarry name} health surveillance regime begins at the pre-employment stage, is ongoing at required intervals during the course of employment and concludes on termination of employment.

All workers on site shall be subject to the pre-employment stage of the Health Surveillance Program.

Health Surveillance Resources:

CMPA Medical Practitioner Guidelines and Medical forms are available at www.cmpavic.asn.au

These guidelines and medical forms are designed to assist employers who operate construction material processing businesses in meeting the requirements of the *Occupational Health and Safety Act 2004* and its Regulations in relation to monitoring their employees' health.

Pre-employment health assessment - the objectives are to determine whether an employee is fit for the proposed job and to obtain a baseline assessment for future health monitoring.

Periodic health monitoring - is aimed to assess at the earliest opportunity the detrimental effects on ongoing employees from the identified construction material processing hazards but also to assess those employees with a medical condition that may expose them or other employees to risk to their health and safety.

Silica specific periodic health monitoring –

Periodicity of health monitoring in regard to RCSD will be determined by the results of personal exposure levels:

- For those employees who are exposed to crystalline silica (i.e., $> 0.02 \text{ mg/m}^3$), health monitoring should include spirometry and a medical examination every year and a chest x-ray every 4 years;
- For those employees who are exposed to low levels of silica (i.e., $< 0.02 \text{ mg/m}^3$), health monitoring should include spirometry and a medical examination every 4 years and a chest x-ray only when there is a significant change identified on monitoring results.

Exit health assessments – is aimed to assess the possible detrimental effects on health of employees of construction material processing hazards at the time they leave the company.

The medical practitioner shall be provided with copies of Personnel RCSD monitoring reports applicable to the worker being examined.

Health Surveillance Records

Workers will be provided with a copy of the health surveillance report.

Health surveillance reports shall be secured and kept confidential unless authorised by the worker or if the employer is required by the regulations to provide WorkSafe or another body such as insurer with a copy of the report.

Health surveillance reports shall be kept for 30 years post-employment unless another period is deemed by WorkSafe.

RCSD Control Plan Review

The RCSD Control Plan shall be reviewed and amended as required by the Quarry Manager in consultation with relevant workers:

- On an annual basis
- Post RCSD monitoring where results are equal to or over the WES of 0.05 mg/m³
- On the establishment of new RCSD controls
- After an internal/external investigation relating to an RCSD incident
- After a modification to the Work Authority or Work Plan where relevant

CMPA



Water Truck and Designated Driver



Screen Washing



Conveyor Irrigation



Dowsing Raw and Additive Materials



Enclosed Screen House



Enclosed Conveyors



Enclosed Conveyors



Enclosed Crusher



Enclosed Crusher



Enclosed Feeder



Enclosed Screen



Enclosed Screen



Enclosed Screen



Screen Flaps



Conveyor Curtains



Conveyor Curtains



Enclosed Sieve Shaker



Dust Extraction System in Laboratory



Filtered Room Pressurised Air Pump



Extraction Fan for use when working in restricted areas



Dust Extraction Booth



Water injected Boot Wash



Sediment Collection Pit

CMPA