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National guidance for doctors assessing workers exposed to respirable crystalline silica dust

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Enquiries

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Disclaimer

The information in this document is current as of January 2026.

This guidance is intended for medical practitioners consulted by workers currently or formerly exposed to respirable crystalline silica. This document is intended to be a general guide to support appropriate clinical practice, subject to the medical practitioner's judgements and the patient's preferences in each individual case. It is not intended as a substitute for medical or legal advice for the patient.

This document is based on expert opinion guided by the best evidence available at the time of development and in consultation with key stakeholders.

This document interfaces with, and is not intended to replace, other medical guidance and medical guidelines issued by relevant clinical bodies.

This document is published by the Australian Centre for Disease Control on behalf of the National Guidance Working Group (the Working Group).

The role of the Working Group was to review and update the first version of the 'National guidance for doctors assessing workers exposed to respirable crystalline silica dust with specific reference to the occupational respiratory diseases associated with engineered stone' developed in December 2021 by the National Dust Disease Taskforce.

The Working Group acknowledges that the literature is evolving and that limitations remain in the evidence available to inform the development of this document. This guidance should be read in association with current Work Health and Safety (WHS) laws and state regulations. For further information refer to Safe Work Australia (1), Work Safe Victoria (2) and the Government of Western Australia, Department of Mines, Industry Regulation and Safety (3).

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- Asbestos Council of Victoria/GARDS Inc.
- Asbestos Silica Safety and Eradication Agency
- Australian and New Zealand Society of Occupational Medicine
- Australian Council of Trade Unions
- Australasian Faculty of Occupational and Environmental Medicine
- Australia and New Zealand Society of Respiratory Science
- Australian Rheumatology Association
- Australian Workers Union
- Construction, Forestry, Maritime Employees Union
- Department of Health, Disability and Ageing
- Department of Health, Resources Safety and Health Qld
- Lung Foundation Australia
- Mining and Energy Union
- Return To Work SA
- Royal Australian College of General Practitioners
- Royal Australasian College of Physicians
- SafeWork NSW
- Thoracic Society of Australia and New Zealand
- Victorian Infrastructure Delivery Authority
- WorkSafe Victoria
- WorkSafe WA

Glossary

Best practice	The best standards of practice based on what others are already doing and about which there may be limited evidence available.
Diagnosis	The identification of a disease, usually by clinical evaluation and a series of tests.
Engineered stone (artificial stone, reconstituted stone)	An artificial product that is created by combining natural stone materials with other chemical constituents such as water, resins or pigments, and becomes hardened. Engineered stone not banned in Australia includes: artificial stone benchtops, panels or slabs that contain less than 1% crystalline silica. porcelain or sintered stone products, including benchtops, panels or slabs that do not contain resin. finished engineered stone products (e.g. kitchen sinks). Engineered stone that is banned in Australia (legacy engineered stone) includes benchtop, panel, or slab that contains 1% or more crystalline silica as a weight/weight concentration. The ban applies to benchtops, panels, or slabs that were already installed prior to 1 July 2024 and uninstalled stock. Persons conducting a business or undertaking (PCBUs) are able to continue to work with banned engineered stone for limited purposes such as repair or removal of existing benchtops.
Fit checking (Respiratory Protective Equipment)	A fit check is a quick check to ensure the respirator, which has been fit tested, has been properly positioned on the face and there is a good seal between the respirator and face.
Fit testing (Respiratory Protective Equipment)	Fit testing is a process for detecting air leaks around the seal between the respirator's facepiece and face of the worker, and is conducted by a competent person, according to 'AS/NZS1715:2009 Selection, use and maintenance of respiratory protective equipment'.
Health-risk behaviour	Any behaviour or action with potentially negative effects on health.
Health (or medical) screening	A systematic method for detecting abnormalities in a person who is usually symptom-free, so that health problems can be either prevented or followed up, diagnosed and treated as early as possible.
Health surveillance	See Occupational health monitoring (below).

High-risk silica work	Model WHS Regulation Part 1.1 Processing of a crystalline silica substance that is reasonably likely to result in a risk to the health of a person at the workplace. Victorian OHS Regulation 2017 work that involves crystalline silica-containing engineered stone, or is performed in connection with a crystalline silica process that is likely to result in i) airborne concentrations of RCS that exceed half of the workplace exposure standard (WES), or ii) a risk to the health of a person at the workplace.
High-resolution computed tomography (HRCT) chest	A volumetric thin slice, non-contrast, computed tomography (CT) of the chest using a radiation dose as low as reasonably achievable and reconstructed with a high spatial frequency algorithm according to a high-resolution protocol (https://www.ranzcr.com/search/silicosis-position-statement).
IL-1	Interleukin-1 (pro-inflammatory cytokine).
ILO	International Labour Organization; also, a shorthand descriptor for the International Classification of Radiographs of Pneumoconioses standardised system for assessing and grading the radiological signs of dust disease in the lungs, developed by the ILO.
Informed consent	Informed consent is a person's decision, given voluntarily, to agree to a healthcare-related activity, treatment, or procedure that is proposed by their medical practitioner after receiving accurate and relevant information about the activity, and understanding the benefits and risks of the options available.
Latency	The time between first exposure to a hazard and first detection of disease (discovered clinically or by specific investigation).
Medical practitioner	Refers to any medical practitioner registered with the Medical Board of Australia e.g., general practitioner (GP), respiratory physician, occupational physician, rheumatologist.
Multidisciplinary team	A team convened to provide formal input into diagnosis and/or case management, comprising at least three providers from three separate disciplines; in the case of occupational respiratory disease, it must include radiology and respiratory medicine, and other specialities such as occupational medicine, rheumatology, and pathology.
Occupational health monitoring	Monitoring a worker to identify changes in health status because of exposure to hazardous substances at work. The purpose of health monitoring is to identify if exposure to a workplace hazardous substance is impacting worker health. If carried out routinely it can be described as a health monitoring program. Occupational health monitoring is legislated for workers engaging in high-risk silica work.

Occupational hygiene	The discipline of anticipating, recognising, evaluating and controlling health hazards in the working environment with the objective of protecting worker health and wellbeing and safeguarding the community at large.
Occupational hygienist	The occupational hygienist's focus is on worker health protection by assessing the risk of hazards and improving work conditions and work practices.
Occupational physician	An occupational physician is a shortened reference to Occupational and Environmental Physicians, medical specialists who focus on the health of workers, workplaces and the environment. They assess and manage health risks associated with work and the environment and help organisations to create safe and healthy workplaces.
Occupational respiratory disease	A disease of the respiratory system which has been caused, aggravated or exacerbated by workplace exposure(s).
Person conducting a business or undertaking (PCBU)	Under the model WHS laws (in place in all jurisdictions apart from Victoria which has a similar law), a PCBU is an umbrella concept which intends to capture all types of working arrangements or relationships. A PCBU includes a: • company, • unincorporated body or association, and • sole trader or self-employed person. Each individual who is in a partnership that is conducting a business or undertaking will individually be a PCBU. A volunteer association or elected members of a local authority will not be a PCBU.
Pneumoconiosis	Any interstitial lung disease caused by the inhalation of organic or inorganic airborne dust and fibres.
Respirable crystalline silica	The crystalline particles of silica that can reach the alveolar region of gas exchange in the lung. They have an aerodynamic diameter less than 10 micrometres (μm), with a mean particle size less than 4.0 μm.
Silicosis	A parenchymal fibrotic lung condition caused by the inhalation of respirable crystalline silica dust.
Spirometry	A lung function test that measures the flow and volume of air inspired and expired from the lungs with maximal effort.
TGF-β	Transforming Growth Factor- Beta (a pro-inflammatory cytokine).

Abbreviations

ADDRI	Australian Dust Diseases Research Institute	ILD	Interstitial lung disease
ACOEM	American College of Occupational and Environmental Medicine	ILO	International Labour Organization
AFOEM	Australasian Faculty of Occupational and Environmental Medicine, a Faculty within RACP	LLN	Lower limit of normal
ANA	Antinuclear antibody	MDT	Multidisciplinary team
ANCA	Antineutrophil cytoplasmic antibodies	NIOSH	National Institute for Occupational Safety and Health
Anti-CCP	Anti-cyclic citrullinated peptide antibodies	OEM	Occupational and Environmental Medicine
Anti-dsDNA	Anti-double stranded deoxyribonucleic acid	OHS	Occupational Health and Safety
ANZSOM	Australian and New Zealand Society of Occupational Medicine	OSHA	Occupational Safety and Health Administration (USA)
ANZSRS	Australian and New Zealand Society of Respiratory Science	PCBU	Person conducting a business or undertaking
COPD	Chronic obstructive pulmonary disease	PMF	Progressive massive fibrosis
CSS	Crystalline silica substance	PPE	Personal protective equipment
CT	Computed tomography	RACGP	Royal Australian College of General Practitioners
CXR	Chest X-ray	RACP	Royal Australasian College of Physicians
DLCO	Carbon monoxide diffusing capacity	RANZCR	Royal Australian and New Zealand College of Radiologists
ENA	Extractable nuclear antigen	RCS	Respirable crystalline silica
FEV1	Forced expiratory volume in one second	RPE	Respiratory protective equipment
FVC	Forced vital capacity	SSN	Sub-solid nodules
GLI	Global Lung Function Initiative	TGF-β	Transforming Growth Factor- Beta
GP	General Practitioner	TSANZ	Thoracic Society of Australia and New Zealand
HRCT	High-resolution computed tomography	TWA	Time weighted average
ICOERD	International Classification of HRCT for Occupational and Environmental Respiratory Diseases	WES	Workplace exposure standard (From 1 December 2026, terminology will convert to https://www.safeworkaustralia.gov.au/safety-topic/managing-health-and-safety/workplace-exposure-limits-airborne-contaminants/changes-between-wes-and-wel - WEL)
IL-1	Interleukin-1	WHS	Work Health and Safety

Introduction

The past 15 years have brought occupational respiratory diseases into greater focus in Australia, due to the re-emergence of silicosis and coal workers' pneumoconiosis.

Silica (SiO2) is a naturally occurring and abundant mineral found in many rocks and soils, with forms including both crystalline and non-crystalline (amorphous) silica. Amorphous silica (e.g., diatomaceous earth) does not have the same hazard profile as crystalline silica, however amorphous silicates are documented to cause pneumoconiosis, and if calcined (heated to a high temperature) may transform into crystalline silica.

Respirable crystalline silica (RCS) is a long-recognised occupational hazard. Crystalline silica is a natural constituent of the earth's crust and is the basic component of sand and most rocks. Occupational exposure may occur when workers are undertaking mechanical processing of crystalline silica-containing materials (such as sandstone, granite, concrete or sand) including crushing, drilling, grinding, sawing, quarrying, tunnelling and polishing. These activities, along with other workplace processes (e.g., mixing silica flour in a foundry or sweeping floors containing dust from clay or concrete) may generate dust which contains RCS which can be inhaled deep into the lungs. Risk of RCS exposure can occur in any job where there is dust created from a silica-containing material such as sand, stone, concrete, and pottery (refer Appendix A Table 1 for a list of examples).

Inhalation of respirable crystalline silica (RCS) is associated with a range of diseases, primarily affecting the respiratory system. The most prevalent condition is silicosis, an irreversible fibrotic lung disease. Exposure to RCS also elevates the risk of lung cancer and chronic obstructive pulmonary disease (COPD). The latency period for silica-related diseases commonly spans from 10 to 30 years following initial exposure; however, it may be considerably shorter, occurring within months, in cases of extremely high intensity exposure.

The development timeline for these diseases is largely determined by both the intensity and duration of silica exposure. Greater exposure levels can result in shortened latency periods and accelerated progression of disease (see Appendix A for additional background information).

From the mid-2010s, an increasing number of silicosis cases were detected in Australia, and several other countries, associated with use of high-silica content (>90%) engineered (artificial) stone to produce stone benchtops. From 1 July 2024, Australia became the first country in the world to ban the manufacture, supply, processing and installation of crystalline silica-containing engineered stone (containing 1% or more crystalline silica) benchtops, panels and slabs, thereby reducing the risk to workers. However, since engineered stone was introduced in the early 2000s, many workers in Australia have been exposed to high doses of RCS in this industry. The legacy of engineered stone will remain in Australian domestic and commercial settings for many years to come, creating risks for workers who modify or remove this stone product. Moreover, there are many workers who are potentially exposed to RCS outside of the engineered stone sector (e.g., in construction or tunnelling work), where exposures to RCS have, and may continue to, result in the development of silica-related diseases. It is estimated that approximately 4% of the Australian working population is at risk of high exposure to RCS (4).

Recent outbreaks of silicosis have revealed limitations in regulatory systems, workplace control measures, worker health and safety education, as well as gaps in the training and experience of medical professionals (5). In 2019, the Australian Government established the National Dust Disease Taskforce to '…inform a national approach to the prevention, early identification, control and management of dust diseases in Australia'. The Taskforce reported that there was a lack of knowledge about occupational respiratory diseases among currently practising medical practitioners. Few felt well-supported or sufficiently educated to be able to identify workers at risk or diagnose or care for people with silicosis or other occupational lung diseases (5). Inconsistency in the practices of health monitoring for workers exposed to RCS were also identified.

As a result of the findings, the National Dust Disease Taskforce developed the first Australian edition of National Guidance for doctors assessing workers exposed to RCS (with a focus on engineered stone and silicosis).

Purpose of the National Guidance

The National Guidance for doctors assessing workers exposed to RCS dust (the National Guidance) has been developed to provide a consistent framework to:

- support medical practitioners to carry out occupational health monitoring for RCS; and
- assist medical practitioners to assess if individuals have been exposed to significant levels of occupational RCS dust at any time during their working lifetime.

The National Guidance is a guide to appropriate practice which should be followed, subject to clinical judgement and individual patient preferences. It is applicable to all industries where there is risk of silica exposure, including mining. The National Guidance is not a comprehensive overview of legal requirements pertaining to health monitoring, and all legal information should be sourced from relevant jurisdictional regulators/legislation.

Target Audience

The National Guidance is intended for use by registered medical practitioners collaboratively with their patients. The National Guidance recommends shared decision-making processes for assessing the respiratory health of a person who has been exposed to RCS dust.

Scope of the National Guidance

The National Guidance covers clinical evaluation and strategies to effectively identify and assess people at risk of health conditions from RCS dust exposure and carry out occupational health monitoring.

Treatment of workers diagnosed with silicosis or other occupational respiratory diseases is outside the scope of this document.

Throughout this document 'occupational health monitoring' will be used in place of 'health surveillance' and 'case identification'. Occupational health monitoring, in the context of this document, is related to RCS dust exposure in any occupational setting including mining.

References to the Model WHS Regulations are included to provide some context for the mandated health monitoring that applies to workers in high-risk silica work environments. The National Guidance also has a scope beyond health monitoring covered by the Regulations, namely, guidance for the assessment of individuals who have retired from employment or left the high-risk silica workplace. Because of the long latency period for the effects of RCS, such individuals may develop occupational respiratory disease related to RCS dust exposure.

Note: Queensland mining and quarrying sectors operate under specific legislation that is separate to WHS laws and applies specific requirements and standards for that industry that may vary from some of the information provided in this National Guidance.

Development

The National Guidance has been developed under the direction of an interdisciplinary Expert Working Group.

The literature referenced in this document is not intended to be a comprehensive evidence-based literature review but rather a selective reference to the relevant literature to inform the reader about available evidence, gaps in knowledge and the rationale for the recommendations. Consequently, the National Guidance has been developed based on a consensus of members of the Expert Working Group as well as the best available evidence at the time of publication. It is important to note that there are new and emerging industrial materials that may contain high levels of RCS. For this reason, the National Guidance requires ongoing review.

Structure

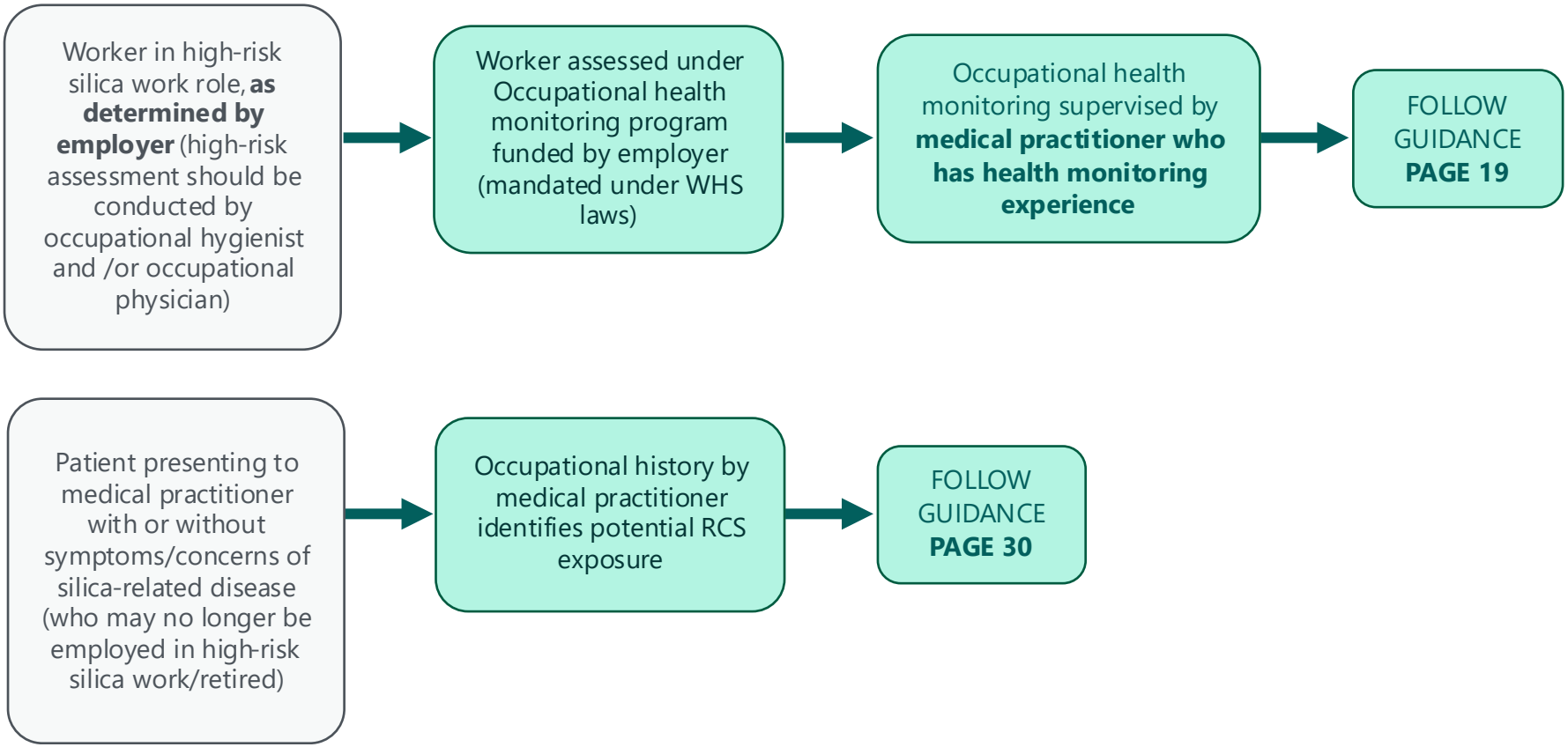
This document has been structured for use by medical practitioners according to two main scenarios (Figure 1):

1. For medical practitioners assessing workers engaged in high-risk silica work, within an occupational health monitoring program, who have been referred by their PCBU or employer.
2. For general practitioners, specialists, or any other medical professionals who encounter patients—whether symptomatic or not—with possible exposure to RCS dust, or who express concerns regarding prior high-risk work involving silica (patients may no longer be employed)[1].

It may be necessary for the practitioner to refer the worker or patient to an occupational physician or respiratory physician with expertise in occupational respiratory disease, who will advise on occupational health monitoring requirements and the necessary testing to confirm diagnosis of a silica-related disease.

[1] At the time of publication, in NSW all workers who were previously monitored, but are no longer working in a high-risk silica work role, can register for free health monitoring through ICARE. In Qld, ex-miners and quarry workers can continue to receive free health monitoring from RSHQ after they leave the sector; in Vic ex-stone benchtop workers and stonemasons can access free health monitoring at the Alfred Occupational Respiratory Disease Clinic which is funded by the Victorian government; in SA ex-quarry workers have access to free health monitoring via the Mining and Quarrying Occupational Health & Safety Committee.

Figure 1. Pathway to assessment



Establishing which workers are at risk of silica-associated disease

Occupational health monitoring

Occupational health monitoring is the ongoing, systematic collection, analysis, interpretation and dissemination of clinical and/or physiological assessments of workers (6), in response to exposure to hazardous substances at work. The purposes of occupational health monitoring are to:

- identify clinical abnormalities, detect early stages of disease and reduce disease severity by ceasing exposure
- provide an opportunity to reinforce safe work practices and provide health education
- Assess fitness to work with hazardous substances from the perspective of adapting the work to the worker
- provide a rationale for control measures in the workplace to protect workers
- support counselling of workers regarding exposure, work practices and controls in the workplace
- guide regulators in allocation of resources to investigate and enforce control measures.

Occupational health monitoring takes into account not only the disease(s) from which the individual might be at increased risk but also encompasses the multidimensional nature of a person's health (psychological and social).

Pre-employment medicals are comprehensive health examinations commonly used by employers to identify candidates who meet the health and safety requirements of a particular role. These assessments may include tests that can contribute to occupational health monitoring baseline data.

WHS legislation in Australia

The Commonwealth States and Territories, other than Victoria, have adopted the model WHS Regulations (refer link below in the Resources section). Victorian workplaces operate under the Victorian Occupational Health and Safety (OHS) Regulations 2017.

In all Australian jurisdictions, a person conducting a business or undertaking (PCBU)/employer has a duty to provide, and pay for, health monitoring for all workers carrying out the processing of a crystalline silica substance (CSS) that is high-risk (1, 2). In the model WHS Regulations, 'high-risk' work means work that is *'… reasonably likely to result in a risk to the health of a person at the workplace'* (7).

Victorian regulations define high-risk work as work that involves crystalline silica-containing engineered stone, or is performed in connection with a crystalline silica process that is likely to result in i) airborne concentrations of RCS that exceed half of the workplace exposure standard (WES), or ii) a risk to the health of a person at the workplace.

In Queensland, the mining and quarrying sectors are covered by separate WHS legislation which also includes mandatory health monitoring in certain situations (8, 9). Resources, Safety and Health Queensland (RSHQ) is the regulatory body that is responsible for administering the legislation. In addition, obligations include submitting all air monitoring results to the regulator (not just exceedances).

In all states, except Victoria, exceedances of the WES are reported to the Regulator as per the WHS Regulations.

PCBU responsibilities

It is the responsibility of the PCBU/employer to determine whether the workplace involves high-risk silica work as per the legislation, and therefore, whether they are required to provide health monitoring. An occupational hygienist or occupational physician should be engaged by the employer to determine the level of risk if there is any uncertainty.

In all states and territories, the PCBU/employer has a duty to engage a registered medical practitioner with experience in occupational health monitoring to carry out or supervise their occupational health monitoring program. Ideally, occupational health monitoring programs should be supervised by an occupational physician.

In Victoria, occupational health monitoring must be conducted by an occupational physician or respiratory physician if the worker has been exposed to crystalline silica-containing engineered stone. The duty to provide and pay for occupational health monitoring exists for a worker while the worker continues to be engaged by the PCBU/employer.

PCBU/employers are also required to undertake air monitoring for RCS if:

- they are not certain, on reasonable grounds, whether or not the airborne concentration of RCS at the workplace exceeds the WES for RCS
- monitoring is necessary to determine whether there is a risk to health from RCS, or
- the processing of a CSS is high risk.

PCBUs must ensure the results are readily accessible to those who were exposed. See Resources section for more detail.

Types of workers at risk

High-risk silica work environments include any job where there is dust created from a silica containing material such as sand, stone, concrete and pottery. Examples include:

- Abrasive blasting
- Concreting
- Construction / Demolition
- Dental technicians manufacturing dentures
- Excavation / Earth Moving
- Foundry casting
- Gas/oil well fracturing
- Mining / Quarrying
- Pottery / Ceramics
- Stone benchtop industry
- Stone masonry
- Tiling / Paving
- Tunnelling / Road Construction

Further information on types of jobs that may expose workers to high levels of RCS can be found on the Australian Institute of Occupational Hygienists website (refer Resources section below).

Although a type of work may be defined as high-risk, at the time of publication of this document, there is no validated tool for assessing an individual worker's level of silica exposure risk from a given activity. Several factors can affect an individual's level of exposure including duration in a role, the frequency and magnitude of possible exposures, the concentration of silica in the work material, and use of respiratory protective equipment. Respiratory protective equipment is often poorly fitted and does not provide consistent adequate protection. An occupational hygienist can assist in assessing exposure.

There is clear evidence for an increasing risk of silicosis with cumulative RCS exposure, including at levels below the current Australian work exposure standard (WES) (0.05 mg/m^3) (10). Current exposure limits are likely to be insufficient to entirely protect against silicosis and other silica-related conditions. For this reason, there is a need to keep exposures as low as reasonably practicable (11-15).

Resources

- Australian Institute of Occupational Hygienists, list of high-risk silica processes https://www.aioh.org.au/resources/silica-resource-hub/

Information on the duties of PCBUs/employers

- Victorian OHS Regulations 2017 Refer to Part 4.5 Crystalline Silica and Reg 168 atmospheric monitoring and Reg 169 health monitoring https://content.legislation.vic.gov.au/sites/default/files/2024-11/17-22sra016-authorised.pdf
- Safe Work Australia - legal duties https://www.safeworkaustralia.gov.au/law-and-regulation/duties-under-whs-laws
- WHS Regulations - Refer Reg 50 for airborne monitoring, Reg 368-378 health monitoring, Part 8A Reg 529A-529CE https://www.safeworkaustralia.gov.au/doc/model-whs-regulations
- Duties for PCBUs refer page 14 https://www.safeworkaustralia.gov.au/sites/default/files/2025-08/modelcop_managing-risks-respirable-crystalline-silica_aug2025.pdf
- Free health monitoring, QLD mining & quarry workers www.rshq.qld.gov.au/miners-health-matters/physical-health/respiratory-health/former-and-retired-workers

WHS regulators in Australian jurisdictions

- ACT: https://www.worksafe.act.gov.au/laws-and-compliance/acts-and-regulations
- NSW: https://www.safework.nsw.gov.au/legal-obligations
- NT: https://worksafe.nt.gov.au/laws-and-compliance/workplace-safety-laws
- QLD: https://www.worksafe.qld.gov.au/laws-and-compliance/work-health-and-safety-laws
- QLD: www.business.qld.gov.au/industries/mining-energy-water/resources/safety-health/mining/legislation-standards
- SA: https://www.safework.sa.gov.au/resources/legislation
- TAS: https://worksafe.tas.gov.au/topics/laws-and-compliance/acts-and-regulations
- VIC: https://www.worksafe.vic.gov.au/laws-and-regulationst
- WA: https://www.worksafe.wa.gov.au/work-health-and-safety-laws

Workers assessed under an occupational health monitoring program

Relevant Population

The information in this section is applicable to workers undertaking high-risk silica work.

Under statutory requirements (WHS Regulations - Reg 368 and Reg 529CE, Victorian OHS Regulations - Reg 169 refer Resources section above for more detail) workers must be provided with occupational health monitoring where there is a significant risk to a worker's health arising from ongoing work involving exposure to RCS (refer Glossary for definition of high-risk silica work). Medical practitioners with expertise in occupational health monitoring should be conducting and/or supervising these assessments (Fig. 2). A list of required skills, qualifications and experience is provided by Safe Work Australia (refer Resources section below). Failure to understand and meet the statutory requirements of the supervising doctor of a health monitoring program has legal and professional consequences.

In Queensland, the Mining and Quarrying Safety and Health Regulations apply to workers in the mining and quarry sectors - supervisory and examining medical practitioners need to be approved and registered with Resources Safety and Health Queensland.

Workers with occupational lung diseases, such as silicosis, are usually asymptomatic in the early stages. Occupational lung diseases may be difficult to differentiate from non-work-related conditions. There are several conditions with an evidence base demonstrating causation, or increased risk, associated with RCS exposure:

- Silicosis
- Thoracic lymphadenopathy
- COPD
- Diffuse interstitial pulmonary fibrosis
- Sarcoidosis
- Lung cancer
- Pulmonary tuberculosis
- Rheumatoid arthritis (e.g., Caplan's syndrome)
- Systemic lupus erythematosus (Lupus)
- Systemic sclerosis (Scleroderma)
- Chronic renal disease
- Antineutrophilic cytoplasmic antibody (ANCA) -associated vasculitis

Collecting baseline data is important when undertaking occupational health monitoring. Baseline data collection is required when a person has never had exposure, or for someone who has had exposure but no previous health monitoring.

General assessment

Note that workers with early silicosis usually have **no** symptoms.

The general assessment should cover:

- demographics
- medical history e.g., background of respiratory or autoimmune diseases
- smoking and vaping history, and other relevant environmental exposures
- history of exposure to tuberculosis or migration from a country where tuberculosis is endemic
- presence of respiratory symptoms e.g., wheeze, shortness of breath, chronic cough
- presence of symptoms consistent with an autoimmune condition e.g., hot, red swollen joints, early morning joint stiffness (lasting > 30 minutes), skin rashes (especially if photosensitive)
- family history of lung disease e.g., alpha-1 antitrypsin deficiency.

Smoking further increases the risk of silicosis and the carcinogenic potential of RCS dust therefore all patients who smoke should be strongly encouraged to quit. Patients should also be strongly encouraged to avoid any other toxic inhalational exposures, such as vaping. For information on smoking cessation support, see the 'RACGP supporting smoking cessation: a guide for health professionals' (refer to the Resources section below).

Occupational exposure history

It is important to take a complete occupational history, identifying jobs and tasks where individuals may have been at risk of silica exposure. All possible exposures throughout a worker's life should be considered as there may be many years between exposure and development of silica-related disease. Although there are well established high-risk silica industries, it is important to be aware of the potential for new occupations and tasks that may expose workers to RCS.

Enquire whether the worker has previously undergone occupational health monitoring and what the outcomes were. All employers who are required to provide access to occupational health monitoring are also mandated to provide results of RCS air monitoring to the individual affected, and workers in the same work group (7). Details regarding the RCS air monitoring data are captured in the worker's occupational history. The PCBU/employer is also required to provide details of the work that triggered the requirement for health monitoring, and how long the worker has been carrying out the work.

There may be other occupational exposures that are identified during the consultation, such as hazardous chemicals, asbestos, or other sources of dust. It is outside the scope of this document to address these exposures. However, advice (e.g., educational short courses that can be accessed via the Lung Foundation Australia website) can be obtained from exploring links that are listed in the Resources section below.

If there is concern about poor RCS control measures in a workplace, medical practitioners can contact the regulator in their state and report the PCBU. This can be done anonymously so as not to compromise the privacy of the worker (refer to Resources section for contact details).

An example of an occupational history template is available in Appendix B.

Lung function testing

Spirometry is a physiological assessment of lung function, interpreted in the context of clinical findings, including symptoms and occupational exposures. It is used to establish a pre-employment baseline and to track changes in lung function over time. Monitoring lung function longitudinally can detect significant declines earlier - often before clinically significant or symptomatic disease develops. Longitudinal monitoring must always be conducted with the same testing protocols and using GLI reference values (16) (refer to Appendix C).

There is software available to assist with monitoring of longitudinal decline, for example, Lung Tracker https://gli-calculator.ersnet.org/lung_tracker/.

All individuals working in a high-risk RCS exposure job must have lung function testing performed by a spirometry provider that meets the latest TSANZ spirometry standards (16). Medical practitioners interpreting spirometry as a part of an occupational health monitoring program are expected to understand and refer to the TSANZ spirometry standards, specifically SPC01 (see Resources section).

Spirometry should be undertaken annually and compared with previous results.

Unless there is an established explanation, the recommended action thresholds for spirometry results, as appropriate to the person's clinical findings and occupational history, are presented in Figure 2.

Chest Imaging

Chest high resolution CT (HRCT) is the preferred radiological modality for identifying silicosis. This lowers the risk of a potentially false negative result from chest x-ray for detection of early stages of disease (20-22). The HRCT scan should be performed using the standards developed by the Royal Australasian & New Zealand College of Radiology (RANZCR) (23).

Referrals for HRCTs should:

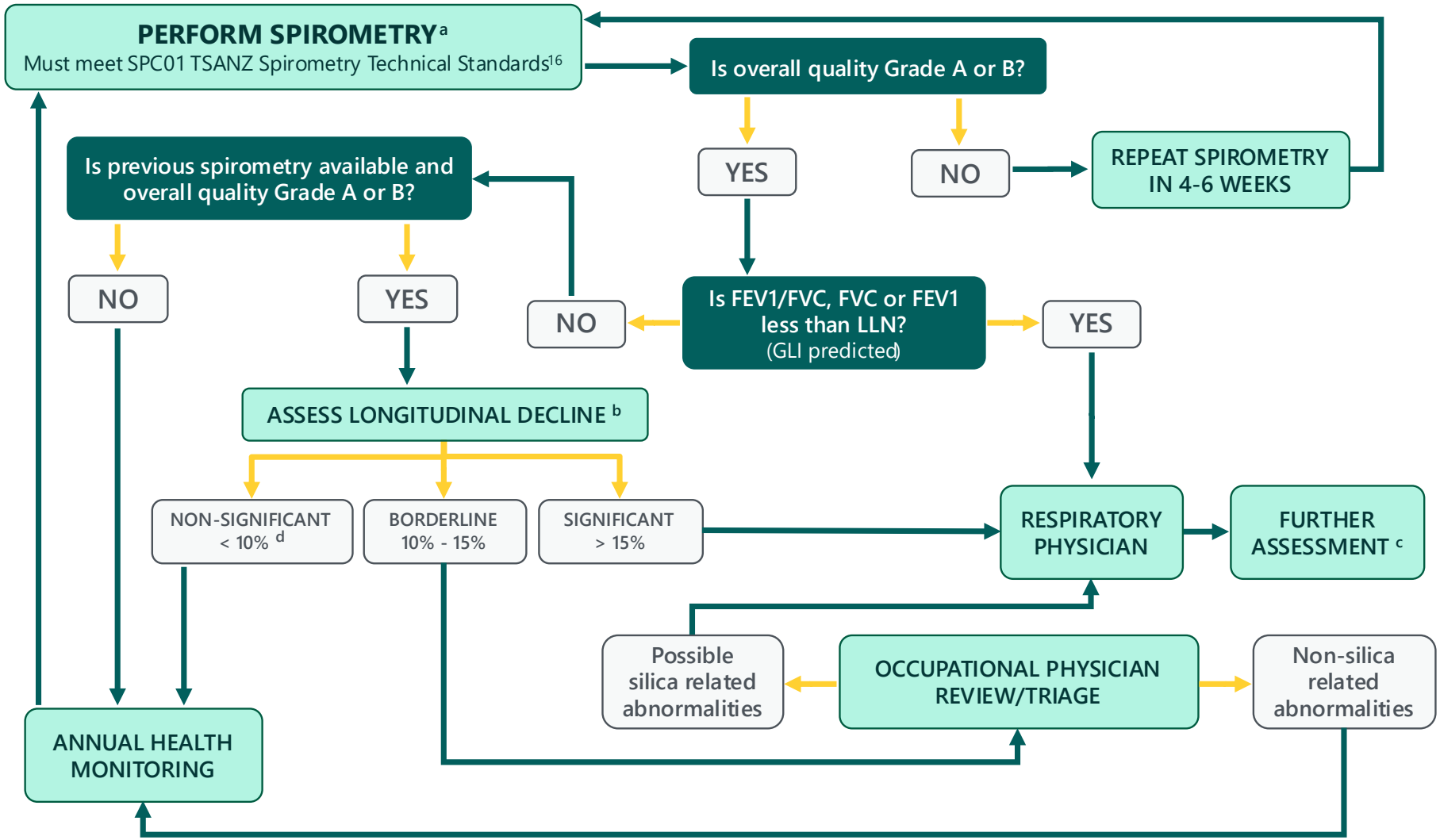
- **include relevant occupational and exposure history**
- **be addressed to the occupational lung reporting team**
- **include the statement on the request form 'Do not report this image unless you have experience in occupational lung disease'.**

(See Appendix D for an example of an HRCT scan referral).

The chest HRCT reporting should be undertaken by radiologists with experience in the interpretation of imaging for occupational lung disease i.e., familiar with the patterns of occupational lung disease and the common differential diagnoses (23). The ICOERD classification is the International Classification of High-Resolution Computed Tomography (HRCT) for Occupational and Environmental Respiratory Diseases (ICOERD); it may be appropriate to use ICOERD reporting in some situations.

The first chest HRCT should usually be requested for workers who have been working with RCS for three years. However, clinical judgement should be applied; if the occupational history is consistent with very high levels of RCS exposure, the first HRCT should be requested earlier.

Figure 2. Recommended Lung Function Testing Protocol



Explanatory notes for Figure 2
a TSANZ Standards Spirometry must be reported using the Global Lung Function Initiative (GLI)(17). The intrinsic advantage of using serial GLI percentage of predicted values (which incorporate adjustments for the person's age, height, sex at birth, and ethnicity) is well-established (18). Confirm spirometry has been performed and reported in accordance with SPC01 TSANZ Spirometry Technical Standards (16), including a documented overall quality grade of A or B and comments on test quality on the spirometry report. If no quality grade is provided, or the quality grade is C–F, do not interpret; arrange repeat spirometry in an appropriate service or refer.
b Longitudinal Decline Serial testing can detect deterioration before the individual develops clinically significant or symptomatic disease. A decline in FEV1 or FVC, expressed in GLI percent predicted, by >15% over any period, is an indication for further assessment (19). Redlich et al (18) discussed the uncertainties underpinning the 15% threshold and indicated that 'action levels' which 'trigger further evaluation, need to be established' when dealing with defined populations. Lower levels of decline, such as 10-15%, may indicate a problem (ACOEM 2020 statement). Results should be obtained from previous health monitoring providers/ Spirometry labs. The repeat spirometry should be compared to the baseline. Refer to Appendix C for longitudinal decline calculation example. Some workers may not have had any previous spirometry, so it will not be possible to determine their longitudinal decline.
c Further Assessment Further assessment, as determined by the respiratory physician, may include repeat pre- & post-bronchodilator spirometry (a significant response to bronchodilator is demonstrated by an increase in FEV1 or FVC by > 10% predicted GLI) (16). Consider complex lung function testing (including DLCO), and other investigations, depending on the clinical context for that individual. Complex lung function testing should ideally adhere to current ATS/ERS lung function testing standards, but this may not be practical in all cases (e.g., rural settings).
d Some workers may not have had any previous spirometry, so it will not be possible to determine their longitudinal decline.

Worker management

Safe Work Australia has published a Crystalline Silica Health Monitoring Guide for Medical Practitioners (24)[2] which provides further information on the role and responsibilities of a medical practitioner conducting occupational health monitoring.

Referral to a respiratory physician and/or occupational physician should be considered for workers with abnormal CT scan, spirometry findings, or concerning symptoms.

[2] At the time of publication, the SWA Guidelines recommends chest x-rays. However, the guidelines are scheduled for review in 2026.

Future monitoring

At this point in time there is limited evidence to guide frequency of follow-up assessments including HRCT imaging. In an individual where the baseline shows no abnormality, the frequency should be guided by the estimated level of silica exposure (based on duration and intensity) and any legislated health monitoring requirements.

As a general rule, **annual health monitoring** should include:

- Spirometry
- Review of symptoms
- Review of exposure to RCS (air monitoring results if available)
- Review of control measures

A chest HRCT should be performed for all workers with declining lung function or relevant symptoms. If no symptoms or no decline in lung function is present, a chest HRCT should be performed every 3-5 years for all workers who undertake high-risk silica work.

For an overview of the occupational health monitoring program guidance, refer to Figure 3.

Reporting and record keeping

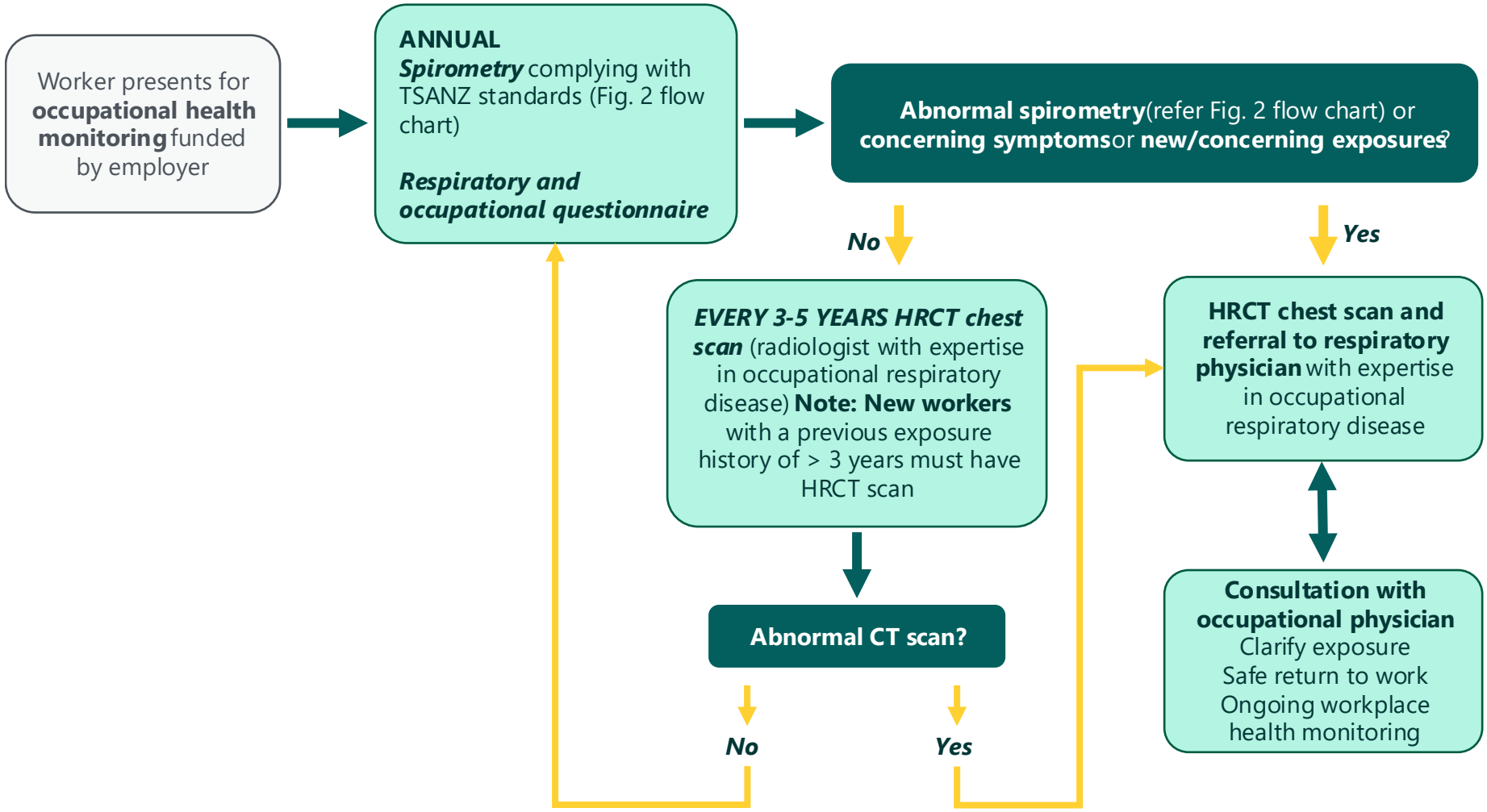
A standardised report (examples in Appendix E) of relevant results and recommendations should be provided to the worker and employer, ensuring the worker's privacy and that non-relevant medical or personal details are NOT included. Provision of reports should comply with health privacy principles (available on via the Office of the Australian Information Commissioner (https://www.oaic.gov.au/__data/assets/pdf_file/0020/251183/Guide-to-Health-Privacy-Collated-May-2025.pdf.) The standardised report should specify the type of assessment (such as HRCT or lung function test) and indicate the scheduled timing for the next evaluation. The report provided to the employer should contain a concise summary of the findings, including a clear indication (yes/no) regarding the presence of occupational lung disease, as well as a list of actionable recommendations for consideration. These recommendations must include the responsibility to review and update relevant control measures.

Workers may be concerned about the adverse impact health monitoring results may have on their current and future employment opportunities, so it is important to explain to them what information is contained in the report provided to the PCBU/employer. With informed consent, the medical practitioner supervising the occupational health monitoring has a professional obligation to provide the worker's GP with a detailed medical report including copies of the HRCT and lung function test reports. A copy of the medical report should also be sent to the worker. The results may also be entered into My Health Record if the patient provides informed consent.

In the Queensland mining and quarrying sectors, doctors must provide the health assessment records of coal miners directly to RSHQ.

Respiratory and occupational physicians are obliged to report diagnoses of silicosis and some other occupational lung disorders to the National Occupational Respiratory Disease Registry.

Figure 3. Overview of worker assessed under an occupational health monitoring program



Additional patient support

The detection of an abnormal finding can be very stressful for a worker, particularly in the period whilst they are awaiting diagnostic evaluation by the respiratory physician. Workers should be referred to a respiratory physician without delay, and all referrals triaged so that there is the least possible delay in obtaining a diagnosis.

Workers should be referred to psychological support services if appropriate; the Lung Foundation Australia provides access to the services of an occupational lung disease support nurse who can assist, and the ADDRI Silicosis Support Hub may also be beneficial (see Resources section below).

Period between abnormal finding and final diagnosis

It is important to remind and reinforce workers of safe work practices and optimal respiratory health. The consequences of continued exposure should also be repeatedly highlighted, and ideally the worker should be relocated to a work area where there is minimal risk of RCS dust exposure.

Examples of important topics for further education to be covered include:

- safe work practices (risk control practices in place that keep exposures below the WES e.g., ventilation systems)
- possible adverse health effects related to RCS exposure
- the importance of vaping and smoking cessation
- the importance of personal hygiene and cleanliness
    - washing face and hands before eating, drinking, smoking, vaping and chewing gum
    - not eating, drinking, vaping or smoking in the workshop
    - showering and changing into clean clothes and footwear before leaving the workplace. Dusty clothing should remain at work to be cleaned or put into airtight containers for transport to be cleaned
    - parking vehicles out of any dust plume
- correctly using PPE
    - any type of respirator may impose some physiological and psychological stress on the user. The Australian Standard requires persons who are routinely required to wear respirators to have an initial medical assessment prior to use to determine if they are able to wear RPE
    - fit checking and fit testing are required for effective respiratory protection (in compliance with the Australian/NZ standard AS/NZS ISO 16975.3:2023 Respiratory protective devices). Such testing is required for the particular respirator in use and should be conducted annually - if there is a significant change in face size (weight loss or weight gain), fit testing should be undertaken more frequently. For persons with reduced lung function, the use of negative-pressure RPE should be replaced with a powered air purifying respirator.

- being clean-shaven is required if negative-pressure respirators or respiratory protective equipment that requires fit testing are used.

Period after diagnosis

Use of the Lung Foundation of Australia's silicosis management plan (see Resources section for a link) should be considered for patients who have been diagnosed with silicosis.

It is important to ensure that patients are provided with information about their diagnosis and prognosis in a format that is easy to understand. A goal of the silicosis management plan is to enable the individual and their primary support people to be involved in the decision-making.

When encountering an individual with established disease related to RCS, the default recommendation, regardless of the individual's clinical state, is avoidance of further exposure to RCS dust (25), and consideration of alternate roles that do not carry risk of exposure. Further exposure to crystalline silica dust may increase the risk of disease progression - a respiratory physician will provide advice about the management of fitness to work.

Advice concerning the risk of harm, should the worker continue to their place of work, can also be assisted by consultation with an occupational physician. Follow the links for the contact database for occupational physicians (https://www.racp.edu.au/about/college-structure/australasian-faculty-of-occupational-and-environmental-medicine/find-a-consultant).

Ensure workers are provided with information about submitting a workers' compensation insurance claim if relevant. The relevant Union may also provide advice and assistance including referral for legal advice (refer Resources section for links).

Example Case study for worker undergoing assessment by a medical practitioner with expertise in occupational health monitoring

Bob, a 41-year-old man, has been referred by his employer for occupational health monitoring due to the risk of respirable crystalline silica exposure at work. He works as a "patcher" for My Formwork.

He has been employed by the same company within the construction sector for 18 years, primarily constructing multi-level apartment complexes and office buildings. Over that time his roles with potential RCS exposure have included brick, concrete and stone cutting, road construction, and cement work. His current regular work tasks include jackhammering, grinding, and patching concrete (cleaning and preparing a damaged area of concrete and replacing with a repair material) for one to four hours a day each, as well as sweeping up concrete dust for up to an hour daily. He works a standard 40-hour week.

Prior to five years ago, Bob was rarely provided respiratory protection, but he now wears a half-face respirator for about half his workday. Bob shaves on workdays and the respirator was fit tested one year ago. He reports that current worksite dust control measures include natural ventilation, a dust extraction vacuum with a HEPA filter connected to the grinder, and facilities for showering and

changing clothes at the end of shifts. He is not aware if RCS levels have been assessed at his workplace.

Bob is a current smoker. He smokes 20 cigarettes a day and has done so for 23 years (23 pack-years). He has no other significant past medical history. His only relevant current symptom is cough with phlegm mostly in the mornings, present for the last six months. Spirometry demonstrated his FEV_1 and FVC to be within the normal range for his age and height (FEV_1 3.62 L, 89.6% of predicted, Z score -0.82; FVC 4.10 L, 81.6% of predicted, Z score -1.48; FEV_1/FVC ratio 88.3%, Z score 1.20). Previous spirometry results were not available for comparison.

Due to his occupational exposure history and symptoms, a HRCT chest was requested, to be reported by a radiologist with expertise in occupational respiratory diseases.

The CT report showed *"Subtle interstitial changes … with numerous very small ground-glass nodules in the upper lobes bilaterally. While these findings are non-specific and could be explained by smoking, in the context of silica dust exposure they are also suggestive of possible early simple silicosis. Mild paraseptal emphysema in the upper lobes and generalised bronchial wall thickening are also present."*

The medical practitioner has a follow up appointment with Bob and discusses the findings of the CT scan and provides smoking cessation advice. The medical practitioner provides Bob, his employer and the WHS regulator a brief report that an abnormal result has been identified and that Bob can continue his current work but requires further evaluation by a respiratory physician.

The medical practitioner requests the results of the most recent and historical workplace RCS monitoring from Bob's employer. He was referred to a respiratory physician with expertise in occupational respiratory diseases for further evaluation.

The respiratory physician obtains a further detailed occupational and clinical history. Physical examination is unremarkable. Complex lung function testing including assessment of gas transfer (DLCO) is normal. Autoimmune screening blood tests are negative.

The respiratory physician presents Bob's case at a multi-disciplinary meeting.

The consensus opinion is that the ground glass nodules are most likely due to smoking-related respiratory bronchiolitis-interstitial lung disease (RB-ILD) and chronic bronchitis; however, early silicosis cannot be excluded. Bob is counselled by the respiratory physician regarding smoking cessation and is referred to the Quitline. Bob agrees to stop smoking and commences nicotine replacement therapy. Advice is provided that Bob can remain in his current work role and that he should undergo a repeat HRCT chest and respiratory physician review in 6 months.

At review Bob indicates that he has not smoked for the last 5 months, and his cough has resolved. His work duties and dust control measures are unchanged. The repeat HRCT chest demonstrates resolution of the upper lobe ground glass nodules and bronchial wall thickening, with persistence of mild emphysema. Due to the resolution of the nodules in association with smoking cessation, the respiratory physician confirms that the previous radiological changes were consistent with resolved RB-ILD rather than early silicosis.

The respiratory physician provides correspondence to Bob, his General Practitioner, and the doctor providing occupational health monitoring, that due to his current work and previous workplace RCS exposure he should have ongoing annual occupational health monitoring review, including spirometry and a follow up HRCT chest in three years' time.

Resources

- Australian Dust Diseases Research Institute Silicosis hub https://silicosis.org.au/
- Lung Foundation Australia patient information booklet https://lungfoundation.com.au/support-resources/resource-hub/living-with-occupational-lung-disease/
- Lung Foundation Australia Silicosis Management Plan https://lungfoundation.com.au/support-resources/resource-hub/my-silicosis-management-plan/
- Managing occupational lung disease - short course https://lungfoundation.com.au/lung-diseases/occupational-lung-diseases/health-professionals/
- Mine dust health support service https://www.rshq.qld.gov.au/miners-health-matters/physical-health/respiratory-health/support
- National Occupational Respiratory Disease Registry https://www.cdc.gov.au/topics/nordr
- RACGP supporting smoking cessation: a guide for health professionals https://www.racgp.org.au/getattachment/be9bceb1-07bf-4848-8a7f-c0ce48001d2a/Supporting-smoking-cessation-A-guide-for-health-professionals.aspx
- RANZCR silicosis position statement (2019) https://www.ranzcr.com/search/silicosis-position-statement
- RSHQ (QLD) https://www.rshq.qld.gov.au/miners-health-matters
- Safe Work Australia list of requirements for medical practitioners carrying out health monitoring https://www.safeworkaustralia.gov.au/system/files/documents/2002/health_monitoring_guidance_-_registered_medical_practitioners.pdf
- Scleroderma Australia information and support https://www.sclerodermaaustralia.com.au/
- TSANZ Spirometry standards (SPC01) https://thoracic.org.au/resources/spirometry/

Unions

- Australian workers union: https://awu.net.au/national/campaigns/13261/silicosis-kills
- CFMEU: https://cfmmeu.org.au/
- Mining and Energy Union: https://meu.org.au/

State & Territories Regulator reporting hotlines

- WorkSafe ACT https://www.portal.worksafe.act.gov.au/worksafeBusinessPortal/s/report-a-complaint-overview
- SafeWork NSW https://speakup.safework.nsw.gov.au/forms/speak-up
- WorkSafe NT 1800 019 115
- WorkSafe QLD https://www.worksafe.qld.gov.au/services/raise-a-workplace-safety-concern
- RSHQ QLD (mining and quarry sectors) (07) 3199 8001
- SafeWork SA 1300 365 255
- WorkSafe Tasmania (03) 6166 4600
- WorkSafe Victoria 1800 136 089
- WorkSafe WA 1300 307 877

Individuals presenting to a medical practitioner and not currently participating in an occupational health monitoring program (workers/ex-workers)

Relevant Population

Individuals presenting to a medical practitioner (e.g., GP, rheumatologist, rural physician) may or may not have concerns or symptoms related to a history of occupational RCS exposure; they may either be

- previously employed in a high-risk silica industry (with or without previous participation in an occupational health monitoring program) or
- currently employed in high-risk silica work but not participating in occupational health monitoring.

In some jurisdictions, free health monitoring[3] may be available for ex-workers from certain industries, local regulators can be contacted to determine eligibility (see Resources section below).

Medical practitioners should routinely take an occupational history in order to determine whether patients have been exposed to hazards at work, including RCS. It is also important to bear in mind that patients may present with symptoms of other medical conditions, not only directly affecting their lungs, which could be associated with silica exposure (e.g., autoimmune diseases, tuberculosis).

Medical practitioners have an important role in identifying people exposed to RCS in the workplace, particularly those who previously worked in the stone benchtop industry or another high-risk industry. High-risk silica work environments include any job where there is dust created from a silica containing material such as sand, stone, concrete and pottery. Examples include:

- Abrasive blasting
- Concreting
- Construction / Demolition
- Dental technicians manufacturing dentures
- Excavation / Earth Moving
- Foundry casting
- Gas/oil well fracturing
- Mining / Quarrying
- Stone benchtop industry
- Stone masonry
- Tiling / Paving
- Tunnelling / Road Construction

[3] At the time of publication, in NSW all workers who were previously monitored, but no longer working in a high-risk silica work role, can register for free health monitoring through ICARE. In Qld, ex-miners and quarry workers can continue to receive free health monitoring from RSHQ after they leave the sector; in Vic ex-stone benchtop workers and stonemasons can access free health monitoring at the Alfred Occupational Respiratory Disease Clinic; in SA ex-quarry workers have access to free health monitoring via the Mining and Quarrying Occupational Health & Safety Committee.

Patients with occupational respiratory diseases, such as silicosis, are usually asymptomatic in the early stages. Occupational lung diseases may also be difficult to differentiate from non-work-related conditions.

There are several conditions with an evidence base demonstrating causation (increased risk), associated with RCS exposure. These include:

- Silicosis
- Thoracic lymphadenopathy
- COPD
- Diffuse interstitial pulmonary fibrosis
- Sarcoidosis
- Lung cancer
- Pulmonary tuberculosis
- Rheumatoid arthritis (e.g., Caplan's syndrome)
- Systemic lupus erythematosus (Lupus)
- Systemic sclerosis (Scleroderma)
- Chronic renal disease
- Antineutrophilic cytoplasmic antibody (ANCA) -associated vasculitis

General assessment

Enquire whether the patient has previously undergone occupational health monitoring and what the outcomes were (including results of air monitoring). Note that patients with early silicosis usually have **no** symptoms.

- Medical history e.g., background history of respiratory or autoimmune diseases
- Potential non-occupational exposure history – ask 'How do you spend your free time? What are your hobbies? Do you have any pets (in particular, birds)?'
- Smoking and vaping history, and other relevant environmental exposures
- History of foreign travel/exposure to tuberculosis
- Presence of respiratory symptoms e.g., wheeze, shortness of breath, chronic cough
- Presence of symptoms consistent with an autoimmune condition e.g., hot, red swollen joints, early morning joint stiffness (lasting > 30 minutes), skin rashes (especially if photosensitive)
- Family history of lung disease (e.g. alpha-1 antitrypsin deficiency)

Occupational exposure history

Taking an occupational exposure history to identify RCS exposure can be challenging. It is important to consider hazardous exposures throughout a patient's life as there may be many years between exposure and development of disease (i.e., a long latency period). Although there are high-risk RCS exposure industries, there are frequently new occupations and workplace tasks which may expose workers to RCS.

If it is established that the patient has been exposed to RCS during their employment, it is possible that the employer should have been providing the worker with access to an occupational health monitoring program. Patients who are currently engaging in high-risk RCS work should be encouraged to speak to their employer and union about this. If the employer is not cooperative, the worker has the option to report this to the health and safety regulator in their State/Territory.

There may be other occupational exposures that are identified during the consultation, such as hazardous chemicals, asbestos, or other dust. It is outside the scope of this document to address these exposures; however, advice can be obtained from exploring links that are listed in the resources section below.

If there is concern about poor RCS control measures in a workplace, medical practitioners can contact the regulator in their state and report the PCBU anonymously so as not to compromise the privacy of the worker (refer to Resources section below for contact details).

An example of an occupational history template is available in Appendix B, which contains a comprehensive list of jobs involving high-risk silica work.

Workers who have been engaged in high-risk RCS work should have a HRCT chest scan and be referred to a respiratory physician who has expertise in occupational respiratory disease.

Chest imaging

Chest high resolution CT (HRCT) is currently the preferred radiological modality for identifying silicosis, as it lowers the risk of a potentially false negative result from chest x-ray for detection of early stages of disease (20, 21). The HRCT scan should be performed using the standards developed by the Royal Australasian & New Zealand College of Radiology (RANZCR) (23).

Referrals for HRCTs should:

- **include relevant occupational and exposure history**
- **be addressed to the occupational lung reporting team**
- **include the statement on the request form 'Do not report this image unless you have experience in occupational lung disease'.**

(See Appendix D for an example of an HRCT scan referral).

The HRCT chest reporting should be undertaken by radiologists with experience in the interpretation of imaging for occupational lung disease i.e. familiar with the patterns of occupational lung disease and the common differential diagnoses (23). The ICOERD classification is the International Classification of High-Resolution Computed Tomography (HRCT) for Occupational and Environmental Respiratory Diseases (ICOERD); it may be appropriate to use ICOERD reporting in some situations.

The need for an HRCT chest scan should be based on clinical judgement e.g., a patient who has never engaged in high-risk RCS work and has no symptoms will probably not need a chest HRCT at the time of initial assessment.

If a patient has had a chest HRCT scan within the last 3-5 years (that was reported by a radiologist with expertise in occupational respiratory disease), they will not need a CT scan unless they have new or changing symptoms.

Lung function testing

Patients who have been engaged in high-risk silica work should be referred to a respiratory physician, and will probably undergo complex lung function testing. It is therefore not necessary

to order spirometry for these patients. For patients who have symptoms without clear occupational exposures, spirometry should be undertaken - all spirometry must be conducted according to the TSANZ standard (16). Note that spirometry results can often be normal, even if silicosis is present, and will not necessarily be diagnostic of any particular occupational lung disease.

Patient management

Patients should be referred to a respiratory physician with expertise in occupational respiratory disease if they have any of the following:

- **relevant symptoms or physical examination findings that are otherwise unaccounted for (e.g., persistent cough, wheeze, or dyspnoea)**
- **a history of being employed in high-risk silica work**
- **abnormal HRCT findings**

The respiratory physician will discuss further diagnostic investigations with the worker and provide an ongoing management plan.

Because smoking increases the risk of silicosis and carcinogenic potential of RCS dust, all patients who smoke should be strongly encouraged to quit. Patients should be specifically warned of the hazards of continuing to smoke or vape. Patients should also be encouraged to avoid any other toxic inhalational exposures. For information on smoking and vaping cessation support, see the RACGP supporting smoking cessation: a guide for health professionals. Patients aged between 50-70 years who smoke may be eligible for free Lung Cancer Screening (refer to Resources section below).

If available, and with the person's informed consent, all baseline information and ongoing follow-up should be recorded on the individual's My Health Record (26).

Further exposure to RCS dust increases the risk of disease progression in silicosis and should be avoided, or at a very least, reduced. The respiratory physician will discuss the situation with the worker and provide some advice about the management of RCS dust reduction or removal. Advice concerning the risk of harm, should the worker continue to remain their place of work, can be assisted by consultation with an occupational physician. Follow the links for the contact database for occupational physicians (https://www.racp.edu.au/about/college-structure/australasian-faculty-of-occupational-and-environmental-medicine/find-a-consultant).

When encountering an individual with established disease related to RCS inhalation, the default recommendations, regardless of the individual's clinical state, are to avoid further exposure to RCS dust (25), with removal into low RCS exposure jobs or roles with no exposure. This advice should be balanced against the significant impact of ceasing or changing work, which has psychological, social and financial implications.

Patients should be provided with information about their diagnosis and prognosis in a format that is easy to understand (refer to Resources for a link to the silicosis management plan).

Refer to Figure 4 for a summary of the pathway for patients presenting to medical practitioners.

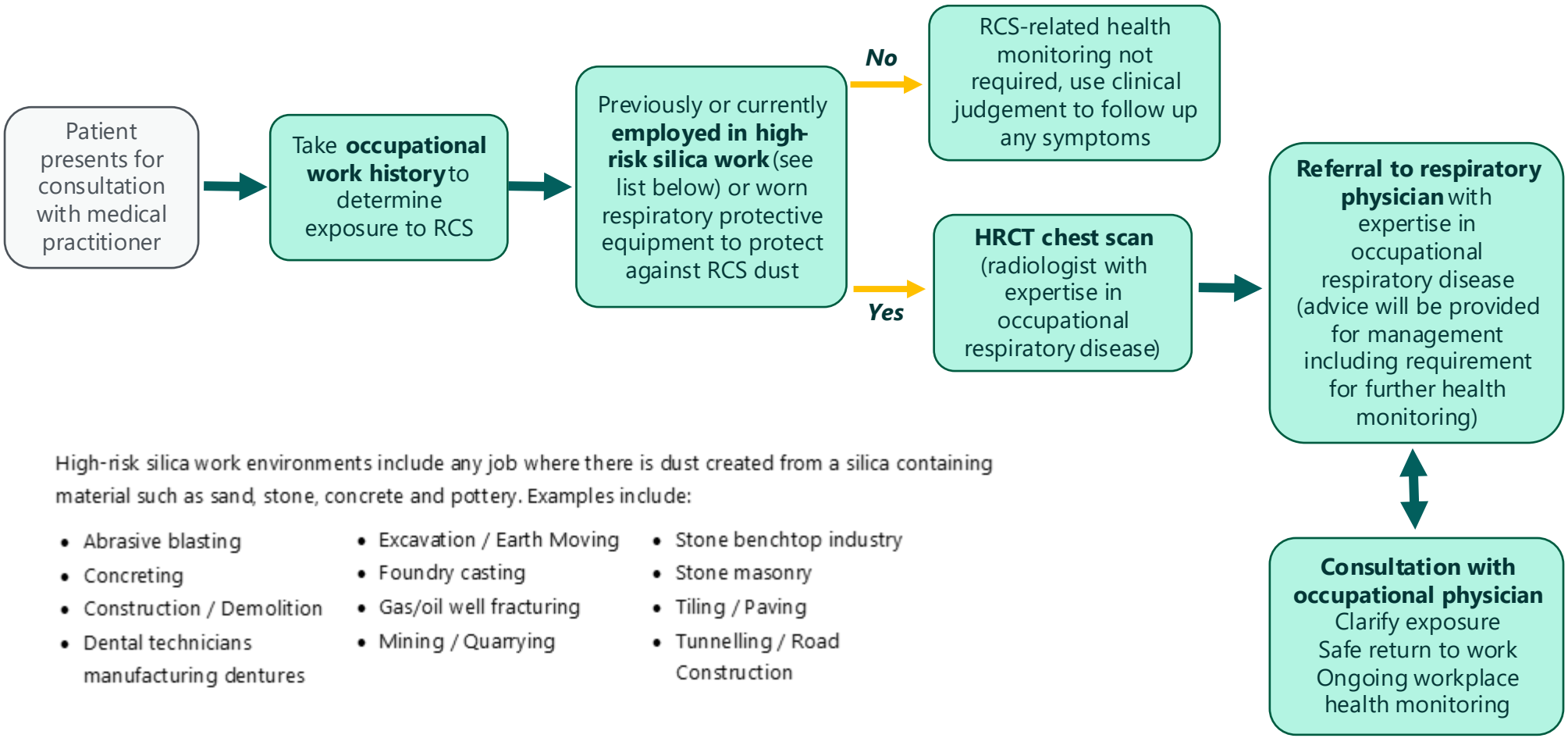
Additional patient support

Patients should be referred to psychological support services if appropriate. For patients who have a diagnosis of occupational lung disease, or a high-risk silica work exposure history, referral to the Lung Foundation Australia occupational lung disease support nurse services and ADDRI may also be beneficial. Ensure patients are provided with information about submitting a workers' compensation insurance claim. The relevant Union may also provide advice and assistance. Refer to Resources section below for links to available supports.

Educate and reinforce safe work behaviours. Examples of important topics for further education to be covered include:

- safe work practices (risk control practices in place that keep exposures below the WES e.g., ventilation systems)
- possible adverse health effects related to RCS exposure
- the importance of vaping and smoking cessation
- the importance of personal hygiene and cleanliness
    - washing face and hands before eating, drinking, smoking, vaping and chewing gum
    - not eating, drinking, vaping or smoking in the workshop
    - showering and changing into clean clothes and footwear before leaving the workplace. Dusty clothing should remain at work to be cleaned or put into airtight containers for transport to be cleaned
    - parking vehicles out of any dust plume
- correctly using PPE
    - any type of respirator may impose some physiological and psychological stress on the user. The Australian Standard requires persons who are routinely required to wear respirators to have an initial medical assessment prior to use to determine if they are able to wear RPE
    - fit checking and fit testing are required for effective respiratory protection (in compliance with the Australian/NZ standard AS/NZS ISO 16975.3:2023 Respiratory protective devices). Such testing is required for the particular respirator in use and should be conducted annually - if there is a significant change in face size (weight loss or weight gain), fit testing should be undertaken more frequently. For persons with reduced lung function, the use of negative-pressure RPE should be replaced with a powered air purifying respirator.
    - being clean-shaven is required if negative-pressure respirators or respiratory protective equipment that requires fit testing are used.

Figure 4. Pathway for patient presenting to medical practitioner



High-risk silica work environments include any job where there is dust created from a silica containing material such as sand, stone, concrete and pottery. Examples include:

- Abrasive blasting
- Concreting
- Construction / Demolition
- Dental technicians manufacturing dentures
- Excavation / Earth Moving
- Foundry casting
- Gas/oil well fracturing
- Mining / Quarrying
- Stone benchtop industry
- Stone masonry
- Tiling / Paving
- Tunnelling / Road Construction

Example Case study for a patient presenting to a General Practitioner

Craig, a 44-year-old man, attends his general practitioner with a dry cough that has been present for three months.

Craig hasn't seen his GP for several years, and the last time was with regards to smoking cessation. He confirms that he successfully quit smoking 5 years ago and has a total smoking history of 20 pack years. He has no other significant past medical history.

Craig's cough is not associated with wheeze and there is no shortness of breath. He says his wife saw a post on social media about silicosis and she is worried about his work and made the appointment for him. His general health is good, his weight is stable, and he has no skin rashes or joint pains. He works 6 days a week and he spends his day off work at home with his young family.

His occupational history identifies that Craig is a qualified tiler and started his own business five years ago mostly tiling for bathroom renovations. He says that he has enjoyed the change of work. In his previous role he was employed by a builder, laying tiles on small and large construction projects. He worked for the building company from the age of 15 to age 39 years. In his new role he mostly works alone but sometimes has assistance from a contractor provided by a labour hire company.

Craig is asked further questions related to occupational dust exposure and respiratory protection used at work.

He usually cuts the tiles outside and uses a circular saw with a garden hose running over the blade. His other tasks include removal of old shower recesses, baths and vanities, and breaking these into small pieces with a crowbar so that they can fit into his trailer to take to the tip. He occasionally will also install the new bathroom vanity. The vanity benchtops are typically made of engineered stone, pre-ordered to size and manufactured entirely off-site. He says that sometimes he has to make small alterations to these benchtops for fitting. He makes the alterations with a handheld grinder and does some polishing with fine sandpaper afterwards. He says that he sprays water using a bottle onto the surface to keep the dust levels down.

He says that he is frequently covered with fine, white tile dust as the workday goes on and so are his work vehicle and equipment at the end of the day. He does not wear any form of respiratory protective equipment.

His respiratory and cardiac examinations are normal.

Craig's occupational history is consistent with a high-risk silica work.

Especially given his history of cough and smoking, further investigation with a HRCT chest reported by a radiologist with expertise in occupational lung disease is recommended. He is also referred to a respiratory physician for further assessment.

Craig's wife is particularly concerned about the possible outcome from further assessment.

Following the HRCT chest, Craig attends the appointment with the respiratory physician.

A further detailed occupational and clinical history is obtained from Craig.

The CT is reported to demonstrate enlarged mediastinal and hilar lymph nodes with specks of calcification. In the lung fields, multiple small nodules, less than 1 cm in diameter, are present, predominantly in the upper lobes with a peri lymphatic distribution. The physician indicates to Craig that based on his work history, and the CT results, chronic simple silicosis is probable but not confirmed at this stage.

The physician provides Craig and his wife information about silicosis. The physician tells Craig that he would like to order further blood tests, lung function tests and to discuss his case at a multi-disciplinary meeting.

Craig is booked for review in two weeks, after the meeting.

The consensus diagnosis at the multi-disciplinary meeting is of chronic simple silicosis. A lung biopsy is not recommended at this stage, as the radiological findings and occupational history are sufficient to make the diagnosis of silicosis with a high probability. At his review, the diagnosis of silicosis is explained to Craig and his wife. Blood tests and lung function results are within normal limits.

The physician explains to Craig that further exposure to RCS dust is likely to worsen his condition. Craig asks if wearing a mask would be an adequate control measure, but is told that a respirator unfortunately is very unlikely to provide sufficient protection.

Considering Craig is self-employed he is very concerned about the financial impact of his condition.

Craig is recommended to submit a workers' compensation insurance claim for his diagnosis of silicosis and obtain independent legal guidance regarding this process.

The potential impact on his mental health from the stress of the diagnosis is discussed.

Early follow-up with his GP to provide mental health support is recommended as well as a potential referral to a psychologist. Craig is also strongly encouraged to remain abstinent from smoking.

The physician encourages Craig to make changes to his work that will ensure he is not at risk of further exposure to silica dust.

Craig returns for review with the respiratory physician two months later. He and his wife have several further questions about silicosis. Craig has followed up with his GP and had an initial appointment with a psychologist. Craig has found thinking about a change to his work difficult and stressful but talking about these feelings has been helpful. He has been investigating undertaking a certificate in construction management, which would allow him to transition away from work with tiles directly. His respiratory physician tells Craig and his wife that although there is some uncertainty about the possibility of progression of his silicosis, his normal lung function test results and level of severity on the CT are encouraging signs.

The physician explains that ongoing monitoring of his condition is recommended and this will likely be for many years to come. Craig is also recommended to increase his exercise, since he is planning to do less physical work role in his future role. His next review appointment with the respiratory physician, including a repeat CT chest, is arranged for 6 months.

Resources

- Australian Dust Diseases Research Institute Silicosis hub https://silicosis.org.au/
- A list of consultant physicians in Occupational and Environmental Medicine can be accessed at https://www.racp.edu.au/about/college-structure/australasian-faculty-of-occupational-and-environmental-medicine/find-a-consultant
- RACGP supporting smoking cessation: a guide for health professionals https://www.racgp.org.au/getattachment/be9bceb1-07bf-4848-8a7f-c0ce48001d2a/Supporting-smoking-cessation-A-guide-for-health-professionals.aspx
- Lung Foundation Australia patient information booklet https://lungfoundation.com.au/support-resources/resource-hub/living-with-occupational-lung-disease/
- Lung Foundation Australia Silicosis Management Plan https://lungfoundation.com.au/support-resources/resource-hub/my-silicosis-management-plan/
- Lung Cancer Screening Program https://lungfoundation.com.au/protect-your-lungs/national-lung-cancer-screening-program/
- Managing occupational lung disease - short course https://lungfoundation.com.au/lung-diseases/occupational-lung-diseases/health-professionals/
- Mine dust health support service https://www.rshq.qld.gov.au/miners-health-matters/physical-health/respiratory-health/support
- RSHQ (QLD) https://www.rshq.qld.gov.au/miners-health-matters

Unions

- Australian workers union: https://awu.net.au/national/campaigns/13261/silicosis-kills
- CFMEU: https://cfmmeu.org.au/
- Mining and Energy Union: https://meu.org.au/

State & Territories Regulator reporting hotlines

- WorkSafe ACT https://www.portal.worksafe.act.gov.au/worksafeBusinessPortal/s/report-a-complaint-overview
- SafeWork NSW https://speakup.safework.nsw.gov.au/forms/speak-up
- WorkSafe NT 1800 019 115
- WorkSafe QLD https://www.worksafe.qld.gov.au/services/raise-a-workplace-safety-concern
- RSHQ QLD (mining and quarry sectors) (07) 3199 8001
- SafeWork SA 1300 365 255
- WorkSafe Tasmania (03) 6166 4600
- WorkSafe Victoria 1800 136 089
- WorkSafe WA 1300 307 877

WHS regulators in Australian jurisdictions

- ACT: https://www.worksafe.act.gov.au/laws-and-compliance/acts-and-regulations
- NSW: https://www.safework.nsw.gov.au/legal-obligations

- NT: https://worksafe.nt.gov.au/laws-and-compliance/workplace-safety-laws
- QLD: https://www.worksafe.qld.gov.au/laws-and-compliance/work-health-and-safety-laws
- QLD: www.business.qld.gov.au/industries/mining-energy-water/resources/safety-health/mining/legislation-standards
- SA: https://www.safework.sa.gov.au/resources/legislation
- TAS: https://worksafe.tas.gov.au/topics/laws-and-compliance/acts-and-regulations
- VIC: https://www.worksafe.vic.gov.au/laws-and-regulationst
- WA: https://www.worksafe.wa.gov.au/work-health-and-safety-laws

Assessment by Specialists: Respiratory physician with expertise in occupational respiratory disease and/or Occupational physician

General principles

The clinical management of workers diagnosed with silica-related disease is outside the scope of this guidance. Treatment of presenting symptoms and signs should not be deferred until a confirmed diagnosis is made hence, respiratory physicians typically lead this aspect of the assessment.

Patients referred for assessment of respiratory symptoms associated with silica exposure are often complex. The assessment needs to take into account the occupational history to understand intensity and duration of exposure to silica and risk of disease.

During the diagnostic work-up, clinicians should be aware that uncertainty regarding the work-relatedness of the individual's condition may be a potentially significant psychosocial stressor. A timely, patient-centred assessment should be undertaken, supported by ongoing, clear communication. Psychological support should be offered or arranged where clinically indicated.

In addition to silicosis, people exposed to RCS dust have a higher-than-average population risk of developing emphysema, lung cancer, pleural thickening, interstitial pulmonary fibrosis, tuberculosis reactivation and chronic bronchitis. They also have a higher risk of developing rheumatological, immunological and connective tissue disorders. Referral along an appropriate treatment pathway will depend on the lung function and blood test results, imaging findings, and symptomatology.

It is essential to take a detailed occupational history to understand the extent of silica exposure that an individual may have experienced. It is recommended to utilise an occupational history template, such as in Appendix B.

There may be other occupational exposures that are identified during the consultation, such as hazardous chemicals, asbestos, or other sources of dust. It is outside the scope of this document to address these exposures; however, advice can be obtained from exploring links that are listed in the resources section below.

Assessment generally would include:

- Evaluation of current and previous lung function tests
- Review of chest imaging - it is strongly recommended that imaging is reviewed by a radiologist with expertise in occupational lung diseases.

Referral to a multidisciplinary team (which may include a respiratory physician, occupational physician, radiologist, pathologist and occupational hygienist), is an opportunity to gain expert advice to assist with diagnosis and management of workplace-related conditions. The Asbestos and Dust Diseases Research Institute accept referrals of NSW patients, to a free monthly virtual MDT meeting which provides structured case reviews and expert input for doctors treating patients with suspected or confirmed occupational lung diseases (refer Resources section for more information).

Other investigations

For all patients exposed to RCS in high-risk silica work, the following tests should be considered:

- full blood count
- biochemistry analysis including electrolytes, liver function tests and creatinine
- autoimmune screen including ENA and ANA, myositis antibodies, anti-CCP antibodies, rheumatoid factor, anti-dsDNA and ANCA
- c-reactive protein (CRP)
- interferon-gamma release assays are also indicated in diagnosing mycobacterium tuberculosis infection for individuals born overseas or those who are clinically deemed to be at-risk of developing latent or active tuberculosis. This possibility should be considered in any worker with long-term exposure to RCS dust due to work with engineered stone.

Patient management

When consulting on an individual with established silica-related disease, avoidance of further exposure to RCS dust is recommended (25). Remembering the latency between exposure and disease manifestation, the current workplace may not be the primary source of the harm.

Premature restrictions on the worker's employment can create significant secondary harm, so when there is doubt, patient-centred considerations are essential. The advice should be balanced against the significant impact of ceasing or changing work – psychologically, socially and financially. Aspects to consider in patient management include:

- Considering the range of 'reasonable accommodations' the employer is required by law to explore. This requires consideration of alternate roles that do not carry with them the same risk of exposure - classically the expertise of the occupational physician. Workplace insurance schemes, and worker compensation legal frameworks, across all jurisdictions, have programs to support this activity.
- Formally assessing a worker's fitness to work may be necessary, taking into account risk of further silica exposure in current or alternative roles. Again, fitness to work determinations are usually the role of the occupational physician.
- Monitoring for change of the disease over time as an indicator of disease and potential requirement for early referral for consideration of lung transplantation.
- General respiratory management including respiratory rehabilitation, smoking and vaping cessation, vaccinations against respiratory infections and early treatment. Early referral to

pulmonary rehabilitation, when available, is a valuable avenue to educate and support the worker.

- Mental health - noting the impact of a work-related disease may have a significant impact on mental health, should be addressed early. Referral to an appropriate mental health professional can mitigate the risk of deterioration.
- Economic impact, especially if an individual needs to change employment, can be substantial. The patient may require assistance in accessing workers' compensation and legal support.

If the patient is deemed fit to remain in their current role, strict attention is required to ensure adherence to optimal hazard control measures at their workplace such as appropriate engineering controls, use of respiratory protective equipment and validation of acceptable workplace RCS dust levels. An occupational physician or occupational hygienist consultation may be needed.

Patient confidentiality is essential and any communication with the current or potential employer needs to be only with the explicit informed consent of the patient.

Without informed consent and the appropriate level of communication with the employer, reasonable accommodations cannot be explored and defined.

Clinically urgent issues (e.g., suspected malignancy or TB) need to be managed in the usual way for a clinical consultation.

Patients should be provided with information about their diagnosis and prognosis in a format that is easy to understand. Advice on workers' compensation and legal support should also be provided; the relevant Union may also provide advice and assistance (refer Resources section below for links).

Management of patients with work-related respiratory conditions requires ongoing engagement with the GP as the primary care provider. Optimal communication between all medical professionals involved in the care of the patient is essential.

Reporting

All cases of silicosis diagnosed after May 2024 must be reported to the National Occupational Respiratory Disease Registry (https://www.health.gov.au/our-work/nordr). Reporting is mandatory for all Occupational and respiratory physicians if a diagnosis of silicosis is made. However, other occupational respiratory diseases can also be reported, with patient consent, and this is recommended in order to enable better understanding of the number of cases of such diseases and to prevent future cases

Resources

- Australian Dust Diseases Research Institute Silicosis hub https://silicosis.org.au/
- Lung Foundation Australia patient information booklet https://lungfoundation.com.au/support-resources/resource-hub/living-with-occupational-lung-disease/
- Lung Foundation Australia Silicosis Management Plan https://lungfoundation.com.au/support-resources/resource-hub/my-silicosis-management-plan/
- Managing occupational lung disease - short course https://lungfoundation.com.au/lung-diseases/occupational-lung-diseases/health-professionals/
- Multidisciplinary Team case review (monthly) https://addri.org.au/mdt-case-review-next-meeting-friday-14-november-2025/
- Occupational lung disease Multidisciplinary Team - short course https://lungfoundation.com.au/health-professionals/clinical-tools-and-training/
- RSHQ (QLD) https://www.rshq.qld.gov.au/miners-health-matters

Unions

- Australian workers union: https://awu.net.au/national/campaigns/13261/silicosis-kills
- CFMEU: https://cfmmeu.org.au/
- Mining and Energy Union: https://meu.org.au/

Appendix A: Occupational respiratory disease and silicosis

Occupational exposure to fumes, dusts, and vapours is a major cause of respiratory illness in Australia. Many occupational respiratory diseases are detected long after exposure, and affected individuals may experience long-term disability and reduced life expectancy (27). Examples include silicosis, silica-related chronic obstructive pulmonary disease (COPD) (which includes chronic bronchitis and emphysema), asbestos-related diseases, mining-related pneumoconiosis, chronic beryllium disease, byssinosis, work-related asthma, and hypersensitivity pneumonitis.

RCS exposure is also associated with lung cancer, autoimmune conditions such as scleroderma and rheumatoid arthritis, and chronic kidney disease.

The recent surge in engineered (artificial) stone-related silicosis has highlighted the need to better understand and prevent this life-threatening, irreversible pneumoconiosis. Silicosis develops after cumulative exposure to silica or silicate dusts and is characterised by a long latency period between first exposure and detectable disease (refer Table 1 for list of work activities involving RCS exposure). Latency is influenced by exposure intensity, cumulative dose, hazard type, and the sensitivity of detection tests. A longer disease latency makes it more complex to link previous relevant exposure to disease and affects the duration of health monitoring programs.

After disease is detected, a period may occur during which the individual appears well, but disease progression can still occur. Medical management during this period focuses on limiting further exposure and supporting biopsychosocial adjustment. For slowly progressing or inactive disease, preventing additional exposures remains critical; this is the domain of an occupational physician or respiratory physician with expertise in occupational respiratory disease. Important additional exposures include tobacco smoking, vaping, and other environmental exposures.

Health monitoring serves three main functions: identifying those individuals most likely to develop disease due to past exposure, reinforcing safe workplace practices, and detecting new outbreaks associated with novel exposures or processes.

Early diagnosis maximises the potential for effective intervention. Traditional measures including spirometry, ILO chest X-rays (CXR), and symptom assessment may fail to detect early disease, meaning some individuals are diagnosed only once silicosis is well established. Recent research in engineered stone benchtop workers showed that the sensitivity of CXR to detect silicosis compared with HRCT can be as low as 48% for ILO category 0 or 1 CXRs (28). Spirometry is also limited, with sensitivities for FEV1, FVC, and DLCO below LLN ranging from 14-19% (29). Understanding these limitations allows for implementation of enhanced strategies, such as an HRCT, for earlier and more accurate detection, along with psychological support and legislated health monitoring.

Table 1. Main activities in which employees may be exposed to silica (65)

Industry/activity	Specific operation/task	Source material
Abrasives	Silicon carbide production Abrasive products fabrication	Sand Tripoli, sandstone
Agricultural chemicals	Raw material crushing, handling	Phosphate ores and rock
Agriculture	Ploughing, harvesting, use of machinery	Soil
Asphalt and roofing felt	Filling and granule application	Sand and aggregate, diatomaceous earth
Automobile repair	Abrasive blasting	Sand
Boiler scaling	Coal-fired boilers	Ash and concretions
Cement	Raw materials processing	Clay, sand, limestone, diatomaceous earth
Ceramics, including bricks, tiles, sanitary ware, porcelain, pottery, refractories, vitreous enamels	Mixing, moulding, glaze or enamel spraying, finishing	Clay, shale, flint, sand, quartzite, diatomaceous earth
Concrete recycling	Crushing reclaimed concrete	Sand in crushed concrete
Construction	Abrasive blasting of structures, buildings Highway and tunnel construction Excavation and earth-moving Masonry, concrete work (including grinding), demolition	Sand, concrete Rock Soil and rock Concrete, mortar, plaster
Dental material	Sandblasting, polishing	Sand, abrasives
Engineered stone benchtop industry	Manufacturing, Fabrication, Installation	Quartz, cristobalite
Foundries (ferrous and non-ferrous)	Casting, shaking out Abrasive blasting, fettling Furnace installation and repair	Sand (quartz), cristobalite Sand Refractory material
Glass, including fibreglass	Raw material processing Refractory installation and repair	Sand, crushed quartz Refractory materials
Iron and steel mills	Refractory preparation and furnace repair	Refractory material
Jewellery	Cutting, grinding, polishing, buffing	Semiprecious gems or stones, abrasives
Metal products, including structural metal, machinery, transportation equipment	Abrasive blasting	Sand
Mining and related milling operations	Most occupations (underground, surface, mill) and mines (metal and non-metal, coal)	Ores and associated rock
Paint	Raw material handling	Fillers (Tripoli, diatomaceous earth, silica flour)
Quarrying and related milling operations	Crushing stone, sand and gravel processing, monumental stone cutting and abrasive blasting, slate work, diatomite calcination	Sandstone, granite, flint, sand, gravel, slate, diatomaceous earth
Rubber and plastics	Raw material handling	Fillers (Tripoli, diatomaceous earth)
Shipbuilding and repair	Abrasive blasting	Sand
Silicon and ferro-silicon	Raw materials handling	Sand
Soaps and cosmetics	Abrasive soaps, scouring powders	Silica flour

Epidemiology of silicosis

Estimating the prevalence of occupational respiratory disease is challenging due to the widespread use of RCS, delays between exposure and diagnosis, and incomplete understanding of exposure-disease relationships (30). Millions of workers worldwide are exposed to RCS (31), but the proportion who will develop silicosis remains uncertain. Between 2018 and 2022, 579 Australian workers from the stone benchtop industry were diagnosed with silicosis (32). Among 414 stone benchtop workers in Victoria who participated in a statewide screening program, 117 (28%) were diagnosed with silicosis (29). Similarly, in Queensland, 1,054 engineered stone workers were screened, identifying 38 cases of progressive massive fibrosis (PMF) and 234 other silicosis cases, suggesting a prevalence of 20-30% among screened workers (33). There have been more than 500 cases of silicosis in NSW since 2018, with more than 30 deaths (https://www.nsw.gov.au/departments-and-agencies/customer-service/publications-and-reports/silica-dashboard). Hundreds of stone benchtop workers have been exposed to unacceptably high levels of silica dust and are likely to develop silica-related diseases over time, while >300,000 workers from a wide range of industries are also exposed to occupational silica and are therefore at risk (4).

Silicosis and related diseases are associated with substantial morbidity and premature mortality. Between 1990 and 2021, the incidence of silicosis, number of attributable deaths, and disability-adjusted life years (DALYs) increased, such that in 2021, there were over 35,000 cases of silicosis, 10,000 deaths, and 250,000 DALYs associated with the disease globally (34). In this context, following recommendations from the National Dust Disease Taskforce, the Australian Department of Health and Aged Care launched a National Occupational Respiratory Disease Registry in May 2024 (35). All occupational physicians and respiratory physicians in Australia are now required to notify new diagnoses of silicosis to this registry through the online Physician Portal (36, 37), which will enable improved understanding of national silicosis epidemiology in the years to come and hopefully also enable better preventative practices.

Pathophysiology of silicosis

Silicosis is an irreversible pneumoconiosis caused by cumulative exposure to crystalline silica (SiO_2) and silicate dusts (RCS). Silica and silicates are naturally occurring minerals in concrete, rocks, and soils. Current epidemiological evidence suggests that synthetic non-crystalline (amorphous) silica is associated with a much lower risk of adverse respiratory outcomes (38), and that forms of amorphous silica subjected to high temperatures (calcining) may be transformed into the crystalline form. However, in practice almost all forms of naturally formed rock will contain a mixture of RCS and amorphous silica and mixed dust exposures are common in most occupational exposures (39).

"Free" crystalline silica (also known as quartz, cristobalite, and tridymite) is unbound to other minerals. "Combined" forms, called silicates, include compounds such as asbestos, talc, and kaolinite (40). Engineered stone contains the highest silica percentages (>90%), while aggregates like mortar and concrete have variable levels (1). All have been implicated in pneumoconiosis.

RCS dust is generated during crushing, cutting, drilling, grinding, or polishing of silica-containing materials. Inhaled particles (<10 µm) reach distal airways and alveoli, while larger particles deposit in upper airways. Studies show sub-2 µm particles are consistently present in lung tissue (41), and ultrafine particles (<1 µm) may worsen lung function, CT findings, and inflammatory biomarkers (42). Freshly generated RCS dust is more toxic than aged dust (43), and surface area appears more important than mass in determining toxicity. Recent epidemiological evidence indicates that significant silicosis and other lung disease risks occur even at or below current workplace exposure limits (11, 12, 44), highlighting a need for ongoing review of permissible RCS thresholds.

Once in the lungs, alveolar macrophages engulf silica particles (43), activating pro-inflammatory and profibrotic pathways (42, 45). Inflammasome activation triggers IL-1 and IL-1β secretion, stimulating tumour necrosis factor, fibroblast growth factor, and TGF-β. Macrophages undergo necrosis and autophagy, releasing intracellular silica, which, if sufficient, causes early alveolar, parenchymal, and lymphatic changes which show as centrilobular ground-glass opacities on CT. Ongoing macrophage recruitment perpetuates inflammation and fibrosis. Factors that slow or halt disease progression are largely unknown, although emerging evidence suggests potential efficacy for drugs that target inflammasomes, cytokines, effector cells, fibrosis, autophagy, and oxidation (46).

Advances in laboratory techniques have improved understanding of macrophage function and lineage (47). Preliminary studies suggest potential biomarkers for early detection (48), but further research is needed for validation.

Classification of silicosis

The diagnosis of silicosis requires a history of sufficient exposure to RCS or silicate dusts, radiological appearances consistent with silicosis, and absence of another more likely diagnosis. Over the last 70 years, diagnostic criteria have evolved with improvements in radiography and surveillance programs. Historically, silicosis has been subclassified by time since first silica exposure (acute, accelerated, chronic).

Rapidly progressive pneumoconiosis (RPP) is defined as development of PMF or an increase in small opacity profusion of >1 ILO subcategory within <5 years (49). Queensland guidance for mine dust lung diseases uses equivalent thresholds, including increases in ICOERD scoring (50, 51). León-Jiménez et al (52) defined rapid progression similarly. However, the sensitivity of CXR is limited, particularly for early disease in engineered stone workers (28). As a result, HRCT and ICOERD scoring are likely to play an increasingly important role in future classification and monitoring guidelines.

Specific forms of silicosis

Acute silicosis

There is limited information regarding acute silicosis as this is a rare disease. Acute silicosis occurs after massive exposure, typically within 3 years, and presents with rapid onset or

worsening of dyspnoea, cough, fever, pleuritic pain, fatigue, and weight loss. Radiologically, a HRCT shows ground-glass opacities or air space consolidations, while bilateral perihilar consolidations may be seen on CXR. Early identification is critical, with urgent referral to a respiratory physician recommended, and differential diagnoses such as pneumonia, Acute Respiratory Distress Syndrome, heart failure, eosinophilic pneumonia, lipoid pneumonia, or other types of pulmonary alveolar proteinosis should be excluded (53, 54).

Chronic simple silicosis

Chronic simple silicosis generally develops after ≥10 years of exposure and may be asymptomatic or present with mild exertional dyspnoea. Radiographs show bilateral rounded discrete nodules (<1 cm) with upper-lobe and posterior predominance. Simple silicosis may progress to complicated forms with nodular aggregation and parenchymal distortion.

Complicated silicosis

Complicated silicosis involves parenchymal distortion or destruction, and may involve aggregation of nodules ≥1 cm (PMF), calcification, and emphysematous changes. Once simple silicosis becomes complicated, the rate of progression appears increased and may lead to respiratory failure, pulmonary hypertension, right-sided heart failure (cor pulmonale), or the need for lung transplantation. Disease evolution depends on exposure intensity, duration, and likely genetic susceptibility.

Accelerated silicosis

Accelerated silicosis usually develops with less than 10 years of exposure, or as a complication of the chronic forms, even if apparently stable for years. Breathlessness occurs more frequently than with other types of silicosis and there is a higher risk of emphysema or respiratory failure (43). This type of silicosis has been described after sandblasting, engineered stone work, and tunnelling into sandstone. Early recognition by serial assessment is essential to minimise parenchymal disruption or distortion due to fibrosis.

Exposure to RCS dust and silicosis

Epidemiological studies (25, 52) using ILO-standardised CXRs demonstrate a clear dose-response relationship between cumulative RCS dust exposure, silicosis severity, and risk of progression, but it is not linear and is modified by other factors (5). Progression can continue even after exposure ceases. Normal annual FEV1 decline in healthy adults is ~30 mL/year, but cumulative RCS exposure substantially increases risk of accelerated lung function decline and silicosis (55, 56). In Australia, the WES for RCS dust is 0.05 mg/m^3 TWA, but eight-hour averages can mask fluctuations above this level; TWAs are adjusted (lowered) for shifts longer than eight hours. Dust-generating processes are generally considered uncontrolled if short-term exposures exceed three times the TWA for >30 minutes per shift, or if a single measurement exceeds five times the TWA (57). Recent systematic reviews and cohort studies indicate that significant silicosis risk occurs at cumulative exposures even below 0.05 mg/m^3, and that thresholds as low as ~1 mg/m^3-years are associated with disease (11-13). These findings emphasise the need for rigorous

exposure control and minimisation, even when measured levels are below current regulatory limits.

Silicosis progression with continued exposure to RCS dust

Continued exposure to RCS dust after a silicosis diagnosis increases risk of disease progression. Gold miners with ongoing exposure had greater functional impairment and radiological severity than those who ceased exposure (58), and Hessel et al (59) also reported higher progression rates (94.6% vs 88.3%). Carneiro et al (58) found ongoing exposure raised the odds of significant nodular changes (ILO category 3, OR = 6.42, 95% CI: 1.20–34.27) and PMF/large opacities (OR = 3.85, 95% CI: 1.07–13.93). In a cohort of 141 granite workers, 37% progressed over 2-17 years, with progression linked to exposure duration, baseline disease severity, and presence of large opacities on initial CXR (60); similar findings have been observed in coal miners (61). These studies highlight that while continued exposure increases the 'risk of progression', it is important to remember that not all workers progress if they remain in the same industry with effective dust control measures. To minimise risk, further RCS exposure should be avoided, though cessation of employment should remain a patient-centred, shared decision until progression is evident.

Progression in the absence of further exposure to RCS dust

Silicosis may progress even without further exposure, however usually at a slower rate. Japanese tunnel workers (62) and Turkish denim sandblasters (63) showed disease progression over several years despite cessation of exposure. Some studies, however, report stable disease, possibly due to insensitive imaging (CXR vs HRCT), episodic progression, or short follow-up, with no clear predictors identified. León-Jiménez et al (52) found 56% of patients progressed ≥2 ILO subcategories over 4 years, yet 55% of ILO 1, 47% of ILO 2, and 29% of ILO 3 patients did not. Similarly, Mohebbi and Zubeyri (64) observed 34.8% of silica flour packers remained stable over 12-54 months. Due to the latency period between exposure and development of disease, new silicosis can also develop in previously exposed workers without prior disease (61).

Treatment of silicosis

Currently, there is no confirmed effective treatment for silicosis. Prevention of cumulative exposure that will trigger silicosis is therefore the highest priority. However, the outcome of treatment of chronic lung disease in general has improved by multi-disciplinary management including smoking and vaping cessation, vaccination, early treatment of infection, and pulmonary rehabilitation. Avoidance of excess weight gain is also of benefit. Lung transplantation is an effective treatment for selected patients, although a limited resource.

Prevention of silicosis

Prevention of silicosis is broadly divided into three categories: primary, secondary and tertiary prevention, as summarised in the table below.

Primary Intervention	**1** Prevent disease before it occurs	• Eliminate the risks to health and safety • Substitute the hazard • Isolate the hazard • Use engineering controls that minimises and controls dust generation • Use personal protective equipment
Secondary Intervention	**2** Diagnose the disease as early as possible and manage the high-risk worker	• Early referral to a respiratory or occupational physician • Monitor the health of high-risk workers • Encourage smoking cessation • Reinforce safe work practices • Promote respiratory health
Tertiary Intervention	**3** Maintain or improve the patient's quality of life, reduce symptoms and minimise the risks of complications	• Restrict further exposure to respirable crystalline silica dust inhalation • Monitor and reinforce the strategies that promote respiratory health

Appendix B: Assessment template

Occupational History Form that can be used in consultation with worker (NOT to be shared with PCBU/employer/regulator)

Are you currently working? ☐ Yes ☐ No

If no, when did you last work? _____

1. Current or Most Recent Job

Job title / Occupation	
Start date – End date	
Employment type	☐ Full-time ☐ Part-time ☐ Casual ☐ Contractor ☐ Self-employed
Typical work hours per week	
Company name & location	
What does the company make or do? and [if relevant] Materials used (e.g., stone, sand, concrete, metals)	
Main tasks or duties	
Is/was there dust at your workplace?	☐ Yes ☐ No
If applicable:	
Type of dust	☐ Stone ☐ Concrete ☐ Sand ☐ Other: _____
Respiratory protection worn?	☐ Always ☐ Sometimes ☐ Never
Type / Fit test	☐ P2/N95 ☐ Half-face ☐ Full-face ☐ Supplied air Fit-tested? ☐ Yes ☐ No ☐ Unsure
Workplace Controls	
Dust control or ventilation systems?	☐ Yes ☐ No ☐ Unsure
Water suppression or wet cutting	☐ Yes ☐ No
Local exhaust ventilation	☐ Yes ☐ No

Enclosed cabins	☐ Yes ☐ No
Change rooms / showers for use at end of shift	☐ Yes ☐ No
Dry sweeping or compressed air used	☐ Yes ☐ No
Regular air monitoring at work	☐ Yes ☐ No
At this job:	
• Could you see dust clouds?	☐ Yes ☐ No
• Did dust settle on clothes, tools, or skin?	☐ Yes ☐ No
• Could you taste or smell dust?	☐ Yes ☐ No
• Did dust colour the discharge from your nose or when you coughed?	☐ Yes ☐ No

REPEAT THE ABOVE QUESTIONS FOR PREVIOUS JOBS SINCE WORKER LEFT SCHOOL

2. Exposure screening

Have you ever worked with or near …?

☐ Artificial stone (engineered stone)
☐ Concrete or cement
☐ Quarrying or mining
☐ Construction or demolition
☐ Sandblasting / abrasive blasting
☐ Foundry or metal casting
☐ Ceramics / pottery / tile work
☐ Tunnelling / roadworks
☐ Manufacturing dentures
☐ Other dusty work (please specify): _____

3. Health and Symptoms

Do you have any of the following?
☐ Cough ☐ Phlegm ☐ Wheeze ☐ Shortness of breath ☐ Chest tightness
☐ Fatigue ☐ Weight loss ☐ Joint pain ☐ Rashes ☐ Dry eyes/mouth ☐ Kidney issues

Do your symptoms:
• Worsen through/during the work week? ☐ Yes ☐ No
• Improve on weekends or holidays? ☐ Yes ☐ No
• Start after a particular job? ☐ Yes ☐ No
• Affect others at your workplace? ☐ Yes ☐ No

Appendix C: Spirometry Case Study

Age: 52 (30/07/1972)	**Height:** 186.5cm	**Occupation:** Underground Tunneller
Birth Sex: Male	**Weight**: 110.5kg	**Smoking History:** Never
Race: Caucasian	**Indication**: Health monitoring for respirable crystalline silica exposure	

A 52 year old male tunneller performs spirometry as part of a routine workplace health monitoring program. He is a current smoker with an estimated 15 pack year history (10 cigarettes per day for 30 years). He is currently asymptomatic and reports no prior history of asthma or COPD.

The best measured values from 3 acceptable and repeatable spirometry results are displayed below in Table 1, with a comparison of all available spirometry results displayed in Table 2. Test quality at each visit is documented as grade A or B and the Global Lung Function Initiative (GLI) reference values are used at each visit in accordance with TSANZ spirometry standards.

Table 1. Spirometry results

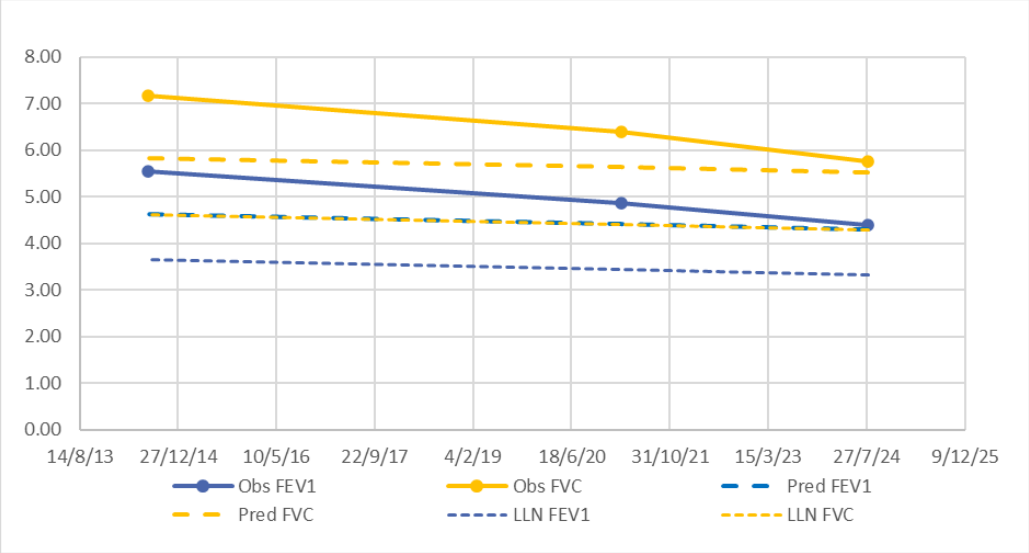
Visit Date: 3 Aug 2024	**Age**: 52	**Reference Values:** Quanjer 2012 (**GLI**)			
SPIROMETRY	**LLN**	**Predicted**	**Measured**	**% Pred**	**Z score**
FEV_1 (L)	3.34	4.30	**4.39**	102	0.155
FVC (L)	4.30	5.53	**5.75**	104	0.295
FEV_1/FVC	0.67	0.78	**0.80**		-0.294
Test Quality:	Nil bronchodilator prior to testing. Tests meet TSANZ spirometry standards. A grade FVC. A grade FEV_1.				
Interpretation:	Spirometry results are within normal limits. Comparison against previous results reveals a significant longitudinal decline of 16% in FEV_1 since 26/7/14*. Referral to respiratory physician is required for further assessment.				

* To calculate longitudinal decline: {baseline} FEV_1 % of GLI predicted - {current} FEV_1 % of GLI predicted

The longitudinal decline in FEV_1 for the above case study is calculated as: 118% - 102% = 16% decline

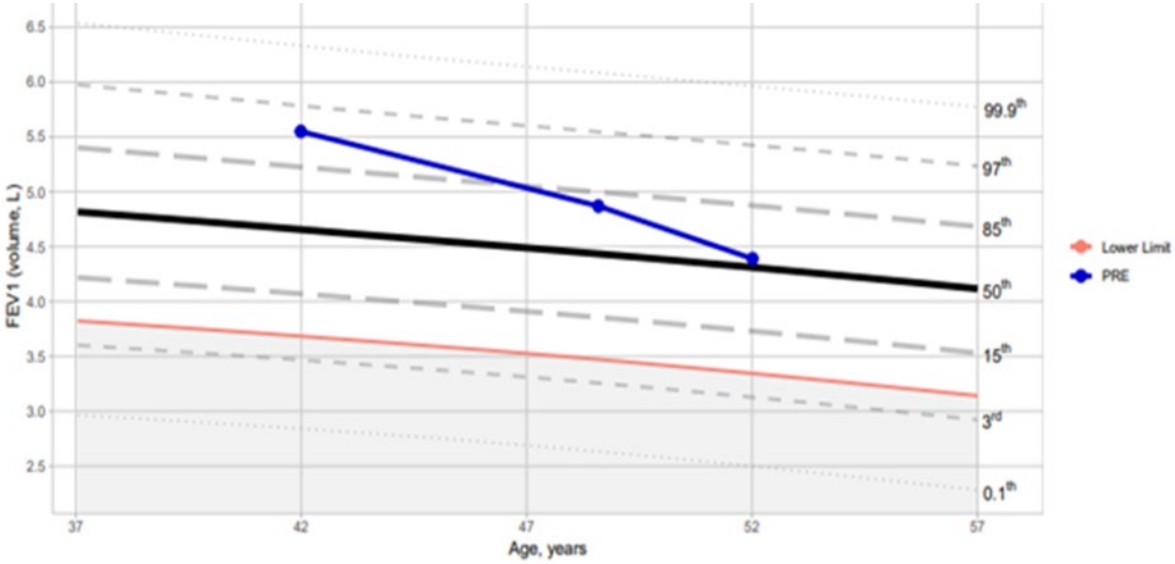
Table 2. Serial spirometry results

	3/8/24	01/03/21	26/7/14
FEV_1 (L) Measured	4.39	4.87	5.55
LLN	3.33	3.45	3.66
Predicted	4.29	4.41	4.62
% Predicted	102	110	120
Change since 2014	-17.7%	-8.1%	-
FVC (L) Measured	5.75	6.40	7.18
LLN	4.29	4.42	4.63
Predicted	5.52	5.64	5.84
% Predicted	104	113	123
Change since 2014	-18.9%	-9.3%	-
FEV_1/FVC Measured	0.76	0.76	0.77
LLN	67	68	69
Predicted	78	79	80
Test Quality Summary	A grade FVC. A grade FEV_1.	A grade FVC. B grade FEV_1.	A grade FVC. A grade FEV_1.
Interpretation Summary	Spirometry is within normal limits. Significant decline of 16% in FEV_1 compared with 2014.	Spirometry is within normal limits. No significant decline since 2014.	Spirometry is within normal limits.
Reference Values	GLI (2012)	GLI (2012)	GLI (2012)



This case study highlights:

- Longitudinal monitoring should be performed using the same testing protocols and GLI reference values. If historic data was generated using other reference values, the ERS GLI calculator https://gli-calculator.ersnet.org/ can support the conversion. Alternatively, enter the data into Lungtracker (https:/gli-calculator.ersnet.org/lung_tracker/) which will automatically generate a graphical output.



- Only A or B grade quality spirometry is suitable for calculating a longitudinal decline
- A significant decline in lung function can occur in individuals whose lung function remains within the normal range of the broader population. This is especially relevant for individuals with large lungs and baseline results exceed predicted values.
- The decline between 2014 and 2021 did not meet the 10% threshold to warrant referral to an occupational physician however, the trend was concerning. For workers in high-risk roles, this change can be used to reinforce the need for strict compliance with respiratory protective strategies, cessation of smoking, and annual spirometry.
- Longitudinal monitoring offers opportunity for early intervention, often before the onset of symptoms

Appendix D: CT scan referral

To: [radiology practice] Occupational Lung Disease team

Patient information

Surname: .....

First name: .....

DOB:

Examination required

High resolution CT Chest – non contrast – workplace dust exposure - *Do not report this image unless you have experience in occupational lung disease*

Clinical notes:

Past Radiology:.....

.....**«Report»**

Work/exposure history: .....

.....

Clinical history:.....

.....

Spirometry:.....

.....

Smoking/vaping history:.....

.....

Referring Doctor

.....	*Insert additional Dr name if required*
.....	.....

Report to

Please email report to:.....

C.c. to: Dr .....

Signature: **Date:**

Appendix E: Health monitoring report examples for PCBU/Employer

Safe Work Australia Health monitoring for Crystalline Silica
https://www.safeworkaustralia.gov.au/doc/health-monitoring-crystalline-silica

Resources Safety Health Queensland Health surveillance report for respiratory health surveillance of mineral mine and quarry workers

https://www.business.qld.gov.au/industries/mining-energy-water/resources/safety-health/mining/legislation-standards/recognised-standards

WorkSafe Victoria Hazardous health monitoring report

https://www.worksafe.vic.gov.au/resources/hazardous-substance-health-monitoring-report)

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