



HEALTH MONITORING FOR NEW SOUTH WALES TUNNEL CONSTRUCTION WORKERS INDUSTRY CONSIDERATIONS

*Air Quality Working Group
Information Package - Part 12 of 12*

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1 PURPOSE

The Australian Tunnelling Society (ATS) recognises the importance of health and safety in our industry in addition to valuing the strong experience and contribution of our members to support key stakeholders in our ever-growing sector. The ATS support collaboration with industry stakeholders as an essential part to both raise awareness of the important issue of silica dust control, but also to enable effective strategies to be developed that will ultimately be practical and a positive step forward.

The Air Quality Working Group (AQWG) was formed in 2017 as a collaborative platform to enable industry to work together to develop and implement health strategies in conjunction with regulatory efforts to improve occupational health outcomes, with an initial focus on respirable crystalline silica (“silica dust”).

The AQWG membership collectively produced reference material for purposes of communicating information that currently does not exist in the tunnel construction industry’s body of knowledge. There are 12 parts to the information package, and each part must be considered in the context of the other. This document represents Part 12 of 12 total parts as listed in **Table 1**. Documented material is considered to benefit the wider tunnelling industry and therefore is freely available on the ATS website.

Table 1 – Complete list of material produced by the AQWG

Part	Document Title	Document Reference
Part 1	NSW Air Quality Working Group Background & Methodology – Silica Dust Exposure and the Tunnelling Industry	Doc No. AQWG_0_0.07
Part 2	Good Practice to Control Silica Dust Exposure During NSW Tunnel Construction	Doc No. AQWG_1_0.08
Part 3	Silica Dust Awareness Package	Doc No. AQWG_2_0.21
Part 4	Silica Dust Awareness Package Speakers Notes	Doc No. AQWG_2a_0.04
Part 5	Design and Procurement - Industry Considerations	Doc No. AQWG_3_0.09
Part 6	Scrubber System - Case Study	Doc No. AQWG_4_0.09
Part 7	Ventilation During Tunnel Construction - Industry Considerations	Doc No. AQWG_5_0.08
Part 8	Portal Misting System - Case Study	Doc No. AQWG_6_0.05
Part 9	Roadheader Cabin Air Filtration - Case Study	Doc No. AQWG_7_0.06
Part 10	Respiratory Protective Equipment - Industry Considerations	Doc No. AQWG_8_0.07
Part 11	Monitoring RCS Exposure - Industry Considerations	Doc No. AQWG_9_0.07
Part 12	Health Monitoring for NSW Tunnel Construction Workers – Industry Considerations	Doc No. AQWG_10_0.14

This document was produced with the aim of standardising processes to enable consistency across the industry in how workers are selected to undertake health monitoring for respirable crystalline silica (RCS).

2 BACKGROUND

Currently, there is no central standardised health monitoring scheme for RCS for tunnel construction workers. Rather, each Person Conducting a Business or Undertaking (PCBU) is individually responsible for managing health surveillance where there is a significant risk to the worker's health. Such programs operate independently on each tunnel project with each PCBU able to utilise the services of a medical health provider of their choice.

Due to the project-based nature of tunnelling, the current system does not require, nor enable, the health status of tunnel workers to be tracked over time. Therefore it is challenging to understand the extent of occupational illness and disease in this sector, and it therefore not possible to analyse trends in disease that may, in turn, inform future policy or specific action.

In 2017, members of the ATS Air Quality Working Group requested that the issue of a consistent approach to health monitoring for tunnel workers be investigated. Several PCBUs expressed a number of challenges with the current health surveillance system including:

- An inconsistent approach to determining which groups of workers are required to undergo health monitoring for RCS; and
- The level of understanding of some private medical providers with regards to the elements required to complete health monitoring for RCS in contrast to a '*fit for duty*' medical.

It must be noted that health monitoring is not an alternative to eliminating or controlling exposures to crystalline silica

3 EXAMPLE OF LEGAL REQUIREMENTS AND CURRENT GUIDANCE

There are many legal requirements and associated guidance material available on the topic of health monitoring. This section presents examples for quick reference in the context of this document. It is not an exhaustive list and readers should not rely on the information presented in this document alone, and should refer to the original source documents for further information.

NSW Work Health and Safety Regulation (2017)

Regulation 368, 369, 370, 371, 372, 373, 374, 375, 376, 378

- A PCBU must ensure that health monitoring is provided to a worker carrying out ongoing work generating hazardous chemicals and a) there is a significant risk to the worker's health because of exposure to a hazardous chemical in Schedule 14; or b) because of ongoing work generating hazardous chemicals there is a significant risk that the worker will be exposed and valid techniques are available to detect the effect on the worker's health.
- A PCBU required to provide health monitoring must give information about the health monitoring requirements.
- The PCBU must consult with the worker provided with health monitoring regarding the selection of the registered medical practitioner
- Duty to ensure that appropriate health monitoring is provided, and is supervised by a registered medical practitioner with experience in health monitoring.
- Duty to pay the costs of health monitoring
- Duty to provide information to the registered medical practitioner.
- Duty to obtain health monitoring report and provide such report to the worker.
- Duty to give health monitoring report to the Regulator if the report contains any advice that test results indicate that the worker may have contracted a disease, injury, or illness as a result of carrying out the work generating hazardous chemicals that triggered the requirement for health monitoring; or any recommendation that the PCBU take remedial measures, including whether the worker can continue to carry out the work that triggered the requirement for health monitoring.
- Duty to give the health monitoring report to relevant PCBUs.
- Health monitoring records to be kept confidential.

Schedule 14: Requirements for health monitoring – Crystalline Silica

- Demographic, medical and occupational history
- Records of personal exposure
- Standardised respiratory questionnaire to be completed
- Standardised respiratory function test, for example, FEV1, FVC and FEV1/FVC
- Chest X-ray full size posteroanterior (PA) view

SafeWork Australia Guide on Health Monitoring for Exposure to Hazardous Chemicals (2013)

Guide for Persons Conducting a Business or Undertaking:

- The PCBU must ensure that health monitoring is provided to a worker if the worker is carrying out ongoing work using, handling, generating or storing hazardous chemicals and there is a *significant risk to the worker's health* because of exposure to a scheduled chemical
- The PCBU who engages the worker must pay all expenses for health monitoring
- A *significant risk* means people in the workplace are likely to be exposed at a level that could adversely affect their health. e.g. if exposure is high, the substance to be used is highly toxic; and/or it is reasonably foreseeable leaks or spills of a hazardous chemical might occur.
- If you are required to provide health monitoring...you must provide information about the health monitoring requirements before the worker starts that work.

- Health monitoring must be carried out by or be done under the supervision of a registered medical practitioner with experience in health monitoring.
- Once you have the health monitoring report from the registered medical practitioner, you should consider the results and recommendations and advice contained in it. As soon as practicable, you must provide a copy of the health monitoring report to: the worker; all other PCBUs who have a duty to provide health monitoring for the worker; the regulator if the report contains any of the following: advice that the test results indicate the worker may have contracted a disease; injury or illness as a result of carrying out work with the chemical; recommendation that remedial measures be taken including whether the worker can continue to carry out work with the hazardous chemical that triggered the requirement for health monitoring.
- Health monitoring reports and results must be kept as confidential records and must not be disclosed to another person without the worker's written consent, except where the records are required to be given under the WHS Regulations to any of the following: the regulator; another PCBU who has a duty to provide health monitoring for the worker; a person who must keep the record confidential under a duty of professional confidentiality.
- Health monitoring records for all workers must be kept for at least 30 years after the record is made, even if the worker no longer works at your workplace.

SafeWork Australia Guide on Hazardous Chemicals Requiring Health Monitoring (2013)

Safe Work Australia:

- Baseline Health Monitoring before starting work in a crystalline silica process will include: collection of demographic data; work history; medical history; physical examination; investigation.
- A medical examination should be conducted annually and will include work history; medical history; physical examination; lung function investigation.
- The Australian Institute of Occupational Hygienists (AIOH) recommends "where there is a continued likelihood of 50 per cent of the exposure standard being exceeded, exposure monitoring and health surveillance should apply.
- A final medical examination, upon leaving work, will be conducted and include: medical history; physical examination; investigation.

SafeWork NSW Technical Fact Sheet on Crystalline Silica (2017)

Health monitoring – WHS Regulation

- In relation to health monitoring, PCBU duties include:
- *informing workers of the requirements for health monitoring*
- *using a registered medical practitioner with experience in health monitoring*
- *providing details to the medical practitioner*
- *obtaining a copy of the health monitoring report*
- *providing a copy of the health monitoring report to SafeWork NSW if the worker has developed a disease or injury and/or the report contains any recommendations on remedial measures at the workplace*
- *keeping records of health monitoring for 30 years.*
- Workers exposed to respirable crystalline silica at levels or a frequency not resulting in a significant risk to health, are not required to undergo health monitoring.
- Workers relying on personal protective equipment (PPE) such as respirators for controlling their exposure below the exposure standard must be included in health monitoring.

4 PROCESS OVERVIEW FOR HEALTH MONITORING FOR CRYSTALLINE SILICA

4.1 When Health Monitoring for Respirable Crystalline Silica is Required

Health monitoring for RCS must be conducted where exposure presents a significant risk to the worker’s health due to exposure. A significant risk is defined as one where the people in the workplace are likely to be exposed at a level that could adversely affect their health (SWA (2013)). This includes any of the following items:

- If exposure is high
- If the substance used is highly toxic
- If it is reasonably foreseeable that leaks or spills of a hazardous chemical might occur.

As the need for health monitoring is based on risk, a site-specific risk assessment is recommended to determine which workers, or groups of workers, will require such health monitoring. This risk assessment is typically performed and documented by a Certified Occupational Hygienist (COH)[®] working in conjunction with construction managers, project managers, and other key members of the project team to understand the work to be performed, and to anticipate the resultant risk to health with an understanding of the planned control measures to be in place.

Examples of situations where health monitoring is typically conducted include:

- i. Where a risk assessment has been conducted by a competent person (e.g.: an occupational hygienist) before a work activity commences, and the risk of personal exposure to respirable crystalline silica has been assessed as “high”, regardless of whether the workers are required to utilise respiratory protection. Health monitoring would be provided prior to the worker commencing work activities.
- ii. Where personal exposure to respirable crystalline silica has been measured to be above 50 percent of the WES, regardless of whether the worker utilises respiratory protection. Health monitoring would be performed as soon as practicable after such results are obtained, if the worker has not previously undertaken such monitoring within the previous 12-months.

4.2 Documented Health Monitoring Program

PCBUs of the primary tunnelling contractor should arrange medical examination and health monitoring activities in accordance with a documented program to ensure that these activities are conducted in a systematic manner. **Table 2** provides an example of typical responsibilities of each party.

Table 2 – Responsibilities in a Health Monitoring Program

Responsibility of the PCBU	Responsibility of the Medical Provider
Document similar exposure groups (SEGs) and determine which SEGs are included in health monitoring	Supervise and authorise health monitoring activities
Consult with and provide information to workers regarding health monitoring	Follow recognised methods for the performance of health monitoring and diagnostic testing
Schedule identified workers for health monitoring	Follow recognised methods for the identification and reporting of persons with occupational illness
Review health monitoring results	Document methods to treat and manage persons with occupational illness
Follow recommended methods to manage persons with occupational illness	Sound ethical and clinical practice
Notify regulator of adverse test results	Confidentiality provisions
Confidentiality provisions	

4.3 Assignment of Worker Category

Based on industry experience, the health monitoring program is most efficiently managed through assigning workers into specific categories, or Similar Exposure Groups (SEGs). **Table 3** presents a high-level list of SEGs that support tunnel projects that are typically included in health monitoring. **Appendix 1** contains a comprehensive list of SEGs for further information.

Table 3 – Similar Exposure Groups (SEGs) included in Health Monitoring for Crystalline Silica

Tunnel Worker Similar Exposure Group (SEG)	Description
Plant Operators	Persons operating the following items of plant underground or as part of construction of shafts, cut and cover structures, or cross passages or on other locations where spoil/dust is present: <i>Roadheader (including open and closed cabin negative pressure filtered cabins), Profiler, Dozer, Articulated Dump Truck, Excavator, Brokk, Front End Loader, Mobile Concrete Pump, Skid Steer, Paver, Gantry Crane, Jumbo Drill, Rockbolter, Water truck, Sweeper truck, Surface Miner, Trencher, Pavement machine</i>
Field Workers Construction	Persons performing activities located underground or as part of construction of shafts, cut and cover structures cross passages, or on other locations where spoil/dust is present: <i>Concreting, Earthworks, Carpenters, General Labourer (including labour hire), Paving, Pipe Layer, Service Installer, Bricklayer, Plant Spotter, Rigger, Scaffolder, Steelfixer, Formworker, Liner, Surveyor, Mechanic/Fitter, Electrician, Shotcretor, Tunneller, Driller, Hosemen, Traffic Controllers</i>
Tunnel Boring Machine (TBM) Operations	Persons working to support TBM operations including: <i>TBM operators, grouters, ring builders, segment handlers, services extension, TSP/MSV operators</i>
Field Works Fit Out	Persons performing activities located underground as part of fit out or Commissioning after all excavation and pavement is completed: <i>Surveyor, Mechanic/Fitter, Electrician, Plumber, General Labourer</i>
Field Supervisors	Personnel supervising any activity in the tunnel/shaft/cut and cover during construction and fit out including: <i>Workgroup Supervisor, Shift boss, Tunnel Foreman, Pavement Foreman, Fit out Foreman, Electrical leading hand, Mechanical Leading hand.</i>
Support Workers	Site Engineers, Junior Engineers, Project Engineers, Senior Project Engineers, Construction Superintendent, General Superintendent

4.4 Identification of Medical Provider

There are many options available for PCBU's to choose from to provide a health monitoring for their workers. In NSW, some private medical providers provide health monitoring for RCS, and the Workers Compensation (Dust Diseases) Authority (also known as icare Dust Diseases Care) also provides a lung screening service. icare Dust Diseases Care provides health monitoring through its Lung Screen mobile service (commonly referred to as the "lung bus"), or through attending the clinic in the Sydney CBD.

The registered medical practitioner/provider should be able to plan, implement and evaluate a health monitoring program in accordance with the *Health Monitoring for Exposure to Hazardous Chemicals – Guide for medical practitioners (SWA 2013)*.

4.5 Health Monitoring Verification

In some cases, a worker may have recently undertaken health monitoring while working for a PCBU and then takes up employment for new PCBU in less than a 12-month period. To prevent the need for another health monitoring examination within that 12-month period, the worker may be able to obtain a copy of their last health monitoring report to provide to the new PCBU.

It is noted that repeat examinations are required each 12-month period, therefore the PCBU may choose to request the worker to undertake a repeat examination for scheduling purposes.

4.6 Repeat Medical Examinations

Baseline health monitoring is to be performed prior to the worker commencing work that is assessed to present a significant risk to health.

After baseline health monitoring is performed, repeat examinations are required after 12-months of work, regardless of where the worker was located. For example, a worker may have only spent one-month of that 12-month period underground, and the rest of that time may have been spent in an office environment. A repeat health monitoring examination would still be required 12-months after the previous examination.

A final examination is required when the worker is no longer involved in the work that presents a significant risk to health.

4.7 Review of Results

Once the health monitoring report is received from the medical provider, the results, recommendations and advice contained in it must be considered by the PCBU. As soon as practicable, a copy of the health monitoring report must be provided to:

- the worker
- all other PCBUs who have a duty to provide health monitoring for the worker (eg: subcontractor)
- the regulator if the report contains any of the following:
 - advice that the test results indicate the worker may have contracted a disease, injury or illness as a result of carrying out work with crystalline silica.
 - recommendation that remedial measures be taken including whether the worker can continue to carry out work with the hazardous chemical that triggered the requirement for health monitoring.

The PCBU should ensure that a worker who has been diagnosed with a silica related disease is protected from further exposure to respirable crystalline silica. In consultation with the worker and the nominated medical practitioner, the PCBU should develop and resource a management plan for the worker, which may require modifications to a workplace, the use of powered air purifying respirators or the removal of the worker from certain roles or tasks.

Supervisors are to be notified of recommendations arising from health assessments and actions proposed by the PCBU. The relevant supervisor is responsible to implement the nominated recommendations in the areas under their control to ensure reasonable control of the hazard is achieved.

5. TUNNEL CONSTRUCTION WORKER HEALTH MONITORING REQUIREMENTS

Safe Work Australia have published Guidance on Crystalline Silica Health Monitoring which is available at: <https://www.safeworkaustralia.gov.au/doc/crystalline-silica-health-monitoring>

It includes information on Crystalline Silica Baseline Health Monitoring, Annual monitoring, the Exit Medical, Supplementary Information on Crystalline Silica and a standardised health monitoring report template. Readers should consult that information when developing their health monitoring programs.

While the Safe Work Australia document, and this document, primarily address respiratory illness and disease caused by exposure to dusts and silica, it is recognised that there are other medical and health monitoring requirements that are recommended for tunnel construction workers. Such elements are contained in **Appendix 2** for quick reference and represents industry's current inclusions for medical assessment and health monitoring for completeness.

6. RECORDS MANAGEMENT

All health monitoring information should be provided by the medical provider to the PCBU in electronic format. Workers are typically requested at the time of attendance with the appointed specialist to provide written consent to share health monitoring information with the PCBU.

Health monitoring reports and results must be kept as confidential records and must not be disclosed to another person without the workers written consent, except where the records are required to be given under the WHS Regulations to any of the following:

- The regulator
- Another PCBU who has a duty to provide health monitoring for the worker
- A person who keeps the record confidential under a duty of professional confidentiality.

Health monitoring records for all workers will be kept for at least 30 years after the record is made, even if the worker no longer works at the workplace.

7. REFERENCES

NSW Work Health and Safety Regulation 2017

Safe Work Australia, Health Monitoring for Exposure to Hazardous Chemicals 2013

Safe Work Australia, Hazardous Chemicals Requiring Health Monitoring 2013

SafeWork NSW Guide for applicants for health monitoring and notification of adverse health monitoring report

SafeWork NSW 2017, Crystalline Silica – Technical Fact Sheet

8. DEFINITIONS

Term	Definition
Certified Occupational Hygienist (COH)[®]	A person who holds Certification with the Australian Institute of Occupational Hygienists (AIOH) along with experience in the assessment and control of occupational health hazards relevant to the activities being performed.
Health Monitoring	Monitoring of a worker to identify changes in their health status due to exposure from certain hazardous chemicals.
Occupational Hygienist	A person who holds a professional grade of membership (e.g. Provisional, Full Member MAIOH or Fellow Member FAIOH) with the Australian Institute of Occupational Hygienists (AIOH), along with experience in the assessment and control of occupational health hazards, working under the governance of a Certified Occupational Hygienist (COH) [®] .
Similarly Exposed Group (SEG)	A group of workers having the same general exposure profile for the hazardous chemicals being assessed because of the similarity and frequency of the tasks they perform, the materials and processes with which they work and the similarity of the way they perform the tasks
Workplace Exposure Standard (WES)	The airborne concentration of a particular substance or mixture that must not be exceeded. In the context of respirable crystalline silica, this refers to the 8-hour time-weighted average (TWA) of 0.1 mg/m ³ .

9. DISCLAIMER

This document has been developed by volunteers of the ATS Air Quality Working Group and draws on the collective experience of those working across some of Australia's largest tunnelling projects. The publication comprises 12 parts, and each part should be considered in the context of the other parts.

The information contained herein is for general information and educational purposes only; it is not a comprehensive list of all factors to be considered and is not a substitute for legal or technical advice.

Accordingly, you should consult with appropriate professionals and make your own inquiries as to the suitability of the information for your specific purposes. This document should not be reproduced in whole or in part, in any manner or form, without the prior written permission of the ATS. Where details of suppliers are provided, it is noted that the ATS does not make recommendations on specific suppliers or organisations. Material is provided for information only and Clients and Contractors would be expected to make independent enquiries as to the suitability of such for their own use.

Appendix 1

Typical Similar Exposure Groups (SEGs)

This section provides a list of typical Similar Exposure Groups (SEGs) that are involved in the construction phase of tunnel projects.

For each SEG, an associated recommendation for inclusion in a Health Monitoring Program for RCS is noted. This has been developed from a review of previous tunnelling projects and using the experience from members of the New South Wales AQWG, where the majority of tunnel construction occurs in quartz containing rocks such as Hawkesbury Sandstone, Mittagong Formation and Shale. Notwithstanding this, significant exposures to RCS can occur from non-host rock sources such as cement dust and shotcreting. The tables presented below include all anticipated sources of RCS when making a recommendation for inclusion into a health monitoring program.

The recommendations may be used to assist with planning health monitoring for those organisations that may not have any historical exposure data or information to assess whether RCS presents a significant risk to health. It cannot be relied upon as a quantitative or definitive decision that such listed SEGs are at significant risk as this will depend on many factors that will be unique to each tunnel construction project. Competent persons such as Certified Occupational Hygienists (COH)[®] should be consulted in conjunction with project management teams to determine site specific requirements as part of a Risk Assessment prior to commencing work activities.

Generally, where there is uncertainty in determining if a significant risk to health exists, it is recommended that workers be enrolled in a health monitoring program.

Table A - Typical SEGs associated with Precast Facilities to support Tunnel Construction

SEG No.	SEG Name	Description	Recommendation for inclusion in Health Monitoring
SEGP1	Precast - Plant Operators and Supervisors	Plant operators and supervisors at a Precast Facility. Includes those plant operators who supply goods and materials to the facility.	
SEGP2	Precast – Gantry Crane Operators	Personnel operating gantry cranes at a Precast Facility.	
SEGP3	Precast – Maintenance Crew	Maintenance personal who service conveyors, components, and heavy machinery at a Precast Facility.	
SEGP4	Precast – General Labour	General labour that performs precast operations such as working on carousels and general clean up at a Precast Facility.	Yes
SEGP5	Precast – Concrete Testers	Those workers who perform concrete and materials testing at a Precast Facility (wet concrete works only).	
SEGP6	Precast – External Storage and Logistics	Workers involved in the logistics outside of the precast facility, including crane operations.	

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Table B - Typical SEGs associated with Civil Construction to support Tunnel Construction

SEG No.	SEG Name	Description	Recommendation for inclusion in Health Monitoring
SEGC1	Temporary Works Construction	Personnel operating cranes, forklifts, installing temporary services such as stormwater, water, sewer, utilities services, and scaffolding.	
SEGC2	Ground Support	Personnel involved in the installation of bored cast-in piles and pile head breaking and ground anchoring. This includes all workers involved in form, reo, pour concrete works, including capping beams.	Yes
SEGC3	Cut and Cover (C&C) Heavy Plant Operators	This includes personnel who operate heavy plant such as excavators, hammers, ADT (Moxy's) and compactors inside a cut and cover structure (either full or partially covered).	Yes
SEGC4	C&C Ground Crew	This includes all personnel performing ground work inside a C&C structure, including labouring and general spotter duties.	Yes
SEGC5	Shotcrete Crew	This includes all personnel involved in shotcreting activities and waterproofing, when applied using spray methods.	Yes
SEGC6	Heavy Plant Operators – Above Ground	This includes personnel who operate heavy plant outside of an excavation such as truck and dogs transporting deliveries across or to and from site, or the watercart etc.	
SEGC7	Traffic control	Workers performing traffic control activities.	
SEGC8	Peggy	The Peggy provides general cleaning including washing and drying work clothes, and maintaining the showers and laundry.	Yes
SEGC9	Bullgang	The bullgang crew perform a range of above-ground activities to support operations.	
SEGC10	Supervisors / Surveyors / Engineers	Supervisors / surveyors and engineers who work with the crews on an intermittent and non-routine basis. This applies to above ground and C&C works.	Yes
SEGC11	Stores	Maintain store and lay down material, equipment. Control materials, equipment orders, deliveries used by workforce.	

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Table C – Typical SEGs associated with Shaft / Station Box Construction

SEG No.	SEG Name	Description	Recommendation for inclusion in Health Monitoring
SEGS1	Heavy Plant Operators – Shaft / Box Construction	Personnel who operate heavy plant such as excavators, hammers, ADT (Moxy's) inside a shaft or box construction.	Yes
SEGS2	Bolt, Mesh, Shotcrete Crew	Personnel involved in bolt/mesh/shotcreting activities and waterproofing, when applied using spray methods.	Yes
SEGS3	General Labour	Persons on-foot in the shaft / box during construction.	Yes
SEGS4	Heavy Plant Operators – Spoil Transfer	Plant operators involved in spoil removal to surface via ADT. Also includes operators who drive Concrete agitator tucks (Agi's) to deliver shotcrete.	Yes
SEGS5	Mechanical / Electrical Crew	Mechanics and electricians who work in a shaft/station box.	Yes
SEGS6	Supervisors and Surveyors	Supervisors and surveyors on-foot in the shaft / box during construction.	Yes

Table D – Typical SEGs associated with Mined Tunnel Construction

SEG No.	SEG Name	Description	Recommendation for inclusion in Health Monitoring
SEGT1	Road Header (RH) Operator – Open Cabin	Road header operators working within an open cabin road header.	Yes
SEGT2	Road Header (RH) Operator – Closed Cabin	Road header operators working within a closed and pressurised cabin road header.	Yes
SEGT3	Drill & Blast	All persons involved in drill and blast activities who enter the tunnel post-blast.	Yes
SEGT4	Bolt, Mesh, Shotcrete Crew	Personnel involved in bolt/mesh/shotcreting activities and waterproofing, when applied using spray methods.	Yes
SEGT5	Tunnellers	Tunnellers are required to complete a range of ancillary tasks in the tunnel including service relocation, relocation and extension of ventilation and extraction and high pressure water blasting. This SEG includes RH offside work and all ground personnel not performing any other specific activity listed in this table.	Yes
SEGT6	Underground Heavy Plant Ops	Plant operators that work underground. This SEG includes operators who drive the Concrete agitator tucks (Agi's) which deliver shotcrete to the tunnel face underground.	Yes
SEGT7	Spoil Shed Heavy Plant Ops	Heavy plant operators including telehandlers, FEL, watercart inside the spoil shed	Yes

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SEG No.	SEG Name	Description	Recommendation for inclusion in Health Monitoring
SEGT8	Spoil Shed Ground Crew	Ground crew performing refuelling, supervision, spotters, gantry crane operator, general labour inside spoil shed enclosures not otherwise classified in this table.	Yes
SEGT9	Mechanics	This crew comprises mechanics installing ventilation and systems and extending these services as the tunnel advances. It includes mobile equipment maintainers such as boilermakers and welders, and those that perform maintenance activities on heavy plant.	Yes
SEGT10	Supervisors / Surveyors / Engineers	Supervisors / surveyors and engineers who work with the crews on an intermittent and non-routine basis. This applies to works where a portion of the shift is spent underground.	Yes
SEGT11	Electricians	This crew comprises electricians installing lighting systems and extending these services as the tunnel advances. This crew installs HV & Comms pits; fire mains etc. This crew work both above and below ground.	Yes
SEGT12	Cross Passage Fit Out	This includes workers erecting blockwork and precast structures, drilling to install anchors; joint sealing; grouting; and connection of services.	Yes

Table E – Typical SEGs associated with Back End Work (BEW) Operations

SEG No.	SEG Name	Description	Recommendation for inclusion in Health Monitoring
SEGB1	Road Profiler Operators and Offsiders	This includes personnel who operate a road profiler, which is an open-cabin machine. Operation typically involves approximately two workers, one who stands on top of the profiler, and one who is located adjacent to it during operation. Road profiling activities occur a far distance back from the ventilation extraction system.	Yes
SEGB2	Surface Miner Operators	This includes personnel who operate surface miners which typically have enclosed cabins.	Yes
SEGB3	BEW Excavation Heavy Plant Operators	This includes personnel that operate involving excavators performing hammering or mucking out activities that are not located adjacent to the ventilation extraction system. It includes Moxy's trucking out spoil from back end works; and draining trench excavation which involves saw cutting of the trench.	Yes
SEGB4	BEW Spotters	This includes all personnel performing spotting activities adjacent to heavy plant performing Back End Works such as spotters for Surface Miners who help direct the machine.	Yes

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SEG No.	SEG Name	Description	Recommendation for inclusion in Health Monitoring
SEGB5	FRP Crew	This includes all workers involved in form, reo, pour activities for cross passage construction, underground concrete paving, and drainage trenches. Typical significant exposures include diesel exhaust from concrete agitators, dermal exposure to hazardous substances, thermal heat stress, and manual handling.	Yes
SEGB6	BEW Painting	This includes persons involved in painting the tunnel roof, and includes use of elevated work platforms and application of paint through spray methods.	Yes
SEGB7	Pit & Pipe Installation	This includes personnel operating drills to install saddle clamps and brackets; placing pipes and pits to tunnel; and HDPE Welding activities.	Yes

Table F – Typical SEGs associated with Tunnel Boring Machine (TBM) Operations

SEG No.	SEG Name	Description	Recommendation for inclusion in Health Monitoring
SEGM1	TBM Operator	TBM Operator working for the majority of the time in the enclosed TBM operators cabin	Yes
SEGM2	Ring Builders	Includes ring builders and ring build assistants who install precast segmental lining.	Yes
SEGM3	TBM Back End	Includes grouters, segment handlers, services extension and operators of the TSP/MSV who work at the back-end of the TBM.	Yes
SEGM4	XP Tunneller	Workers performing labouring duties on-foot to support cross-passage construction.	Yes
SEGM5	XP Excavation	Personnel operating equipment to excavate a cross-passage (e.g. Brokk)	Yes
SEGM6	XP Transfer	Personnel operating ADT (Moxy's) to transfer spoil from cross-passage excavation	Yes
SEGM7	XP Formwork	Personnel installing formwork in preparation for concrete installation	Yes
SEGM8	XP Steelfixer	Personnel installing reo and steel fixes	Yes
SEGM9	XP Waterproofing	Personnel applying waterproof membrane.	Yes

Appendix 2

Other Health and Medical Requirements for consideration for Tunnel Construction Workers

Respiratory Protective Equipment (RPE) Assessment

Persons who are routinely required to wear respirators should have an initial medical assessment prior to use to determine if they are able to wear respirators¹. Respirators impose some physiological and psychological stress on the user, and as such the following considerations must be evaluated:

- Physiological considerations – regular wearing of non-powered air-purifying RPE and negative pressure demand air-supplied RPE imposes an extra burden on cardiac and respiratory systems. Thus, a worker with a history of disorders in these areas must be medically assessed by a medical practitioner or an occupational health physician, especially where heavy work or prolonged wearing of RPD is anticipated.
- Psychological considerations – helmet, hood and full face piece PRE, especially when combined with full body protection, may give risk to feeling of claustrophobia, isolation and anxiety in some people. Such people will find it difficult to perform their work satisfactorily under these conditions.

Respiratory Protective Equipment (RPE) Fit Testing

Some RPE relies on a positive seal against the wearers face to prevent inward leakage of airborne contaminants. Facial hair significantly influences the correct fit of RPE against the wearers face, resulting in less than adequate protection and leakage.

All personnel required to wear RPE that relies on a positive seal against the wearers face must:

- a) be clean-shaven such that the respirator will afford protection as intended; and
- b) participate in respirator fit testing in accordance with the requirements specified in AS/NZS1715:2009

Results of all fit tests will be recorded with records maintained with a person's health monitoring results.

Audiometric Assessment

Audiometric testing must be provided to workers who are frequently required to use personal hearing protection. Where audiometric testing and assessment of audiograms occur, they should be carried out within 3-months of the worker commencing work by competent persons in accordance with the procedures in AS/NZS 1269.4:2005 Occupational noise management – Auditory assessment. A repeat assessment is required at least every 2-years, however more frequent assessment may be needed if exposures are equal or greater than $L_{Aeq, 8hour}$ 100dB (A).

Thermo tolerance

Workers exposed to hot and humid environments and occupational activities must be evaluated specifically with regards to personal risk factors likely to affect their thermoregulation such as weight, physical fitness, age, medical disorders that influence tolerance of thermal loading, medications and historical thermal intolerance.

Typically this thermoregulation evaluation should be undertaken at the workers pre-employment medical.

Hand and nerve function

Workers exposed to hand arm vibration must be evaluated specifically with regards to personal risk factors likely to affect their health such as the presence of Raynaud's disease, disease caused by impairment of blood circulation to the hands, past injuries to the hand causing circulatory defects or deformity of bones and joints, disorders of the peripheral nervous system and disorders of the musculoskeletal system.

This medical assessment should be undertaken at the workers pre-employment medical.

If clinically indicated other assessments such as nerve conduction velocity, electromyography or vibrotactile perception at the fingertips may be performed.

Alcohol and Other Drugs (AOD) Screening

Alcohol

The testing method that must be applied is a hand held breath testing device conforming to the Australian Standard 3547:1997, Breath alcohol testing devices for personal use.

¹ Clause 6.1 of AS/NZS 1715 Selection, use and maintenance of respiratory protective equipment

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Drugs

The testing method that must be applied is urine testing, using a test kit that conforms to the Australian Standard 4308:2008, Procedures for specimen collection and the detection and quantitation of drugs of abuse in urine.

Alcohol Test Target Concentration Level

All employees to present for the pre-employment testing with a Target Concentration Level for alcohol of 0.000% Breath Alcohol Concentration (%BAC).

Drug Test Target Concentration Level

All employees to present for the pre-employment test with a Drug Target Concentration Level below the levels quoted in the following table.

Class	Test Target Concentration Level
Opiates	300 ug/L
Opiates – 6-Acetylmorphine	10 ug/L
Amphetamine (including Methylamphetamine, Methylenedioxyamphetamine and Methylenedioxyamphetamine)	150 ug/L
11-nor-delta-9-tetrahydrocannabinol-9-carboxylic acid (Cannabis)	15 ug/L
Cocaine	150 ug/L
Benzodiazepines	150 ug/L

Note: The Test Target Concentration Levels specified in the above table are drawn from “AS 4308:2008 Procedures for specimen collection and the detection and quantitation of drugs of abuse in urine”

- i. These targets represent the undiluted urine concentration.
- ii. Where the worker has completed a Medication Declaration and the results are consistent with the stated medication and dosage, the assessment report must confirm the consistency.
- iii. A Confirmed Positive Test result for drugs is recorded when the Confirmatory Test result from a NATA accredited Laboratory is known.

Drug and alcohol testing must be completed by a Registered Nurse or Testing Officer that is qualified to the AS/NZS 4308 standard.

Medical Questionnaire

The medical questionnaire must provide an accurate and comprehensive assessment of the medical history of the prospective employee, confirming their medical suitability for the role that they are due to fill. The questionnaire must cover an overview of previous work history and hazardous substance exposure

timeframes, a review of recent medical history and previous work-related injuries, the identification of any pre-existing conditions (with relevant details), an overview of lifestyle habits and confirmation that the medical information can be released to key individuals to allow an assessment of suitability to be completed.

Medical questionnaire assessment must be completed by a registered medical practitioner with the relevant experience or by an Occupational Physician.

Fitness Assessment

The fitness assessment must confirm that the prospective employee has the necessary physical capability to perform his/her identified role. The assessment must assess cardiovascular fitness levels.

Fitness assessments must be conducted by an Occupational Therapist, Physiotherapist or Exercise Physiologist.

Musculoskeletal Assessment

The musculoskeletal assessment must confirm that the prospective employee has adequate levels of spinal and limb mobility, upper and lower body strength, repetitive manual handling capacity to perform safely in their role.

Musculoskeletal assessments must be conducted by an Occupational Therapist, Physiotherapist or Exercise Physiologist.

Visual Acuity Assessment

The visual acuity assessment will be used predominantly for prospective employees that will be operating large items of mobile plant and equipment. The assessment must confirm that the individual has sufficient visual capability to operate all equipment safely. The assessment must confirm the necessity of any visual aids to achieve the required capability.

Visual Acuity assessments must be completed by a General Practitioner or Occupational Physician.