



# **NEW SOUTH WALES AIR QUALITY WORKING GROUP – BACKGROUND AND METHODOLOGY**

## ***Air Quality Working Group Information Package - Part 1 of 12***

**December 2018**

## Silica Dust Exposure and the Tunnelling Industry

Statistics released by *Safe Work Australia* demonstrate that each year in Australia, on average 250 workers will die from an injury sustained at work, while over 2000 workers will die from an occupational disease (SWA, 2012) validating the real need to adequately focus on work-related health hazards. Such failures are frequently linked to the specific challenges associated with managing occupational health risks; particularly as such hazards can be invisible, silent and insidious in the long latency of their ill effects, with health problems only emerging many years later.

Such statistics prompted *Safe Work Australia* to review the performance of work health and safety among all Australian industries. The review identified the construction industry's inherent hazardous nature results in one of the highest incidence rates and highest number of workers' compensation claims when compared to all other industries. As such, in 2012 *Safe Work Australia* nominated construction as a priority industry for improved performance, with a particular focus on preventing high prevalence occupational diseases (SWA, 2015).

Within the context of the tunnelling industry, tunnel construction workers have an increased risk of developing occupational disease when compared to those in the general construction industry due to increased exposure to occupational health hazards. Such diseases include lung cancer, silicosis, chronic obstructive pulmonary disease, asthma and adverse respiratory symptoms that include general airflow limitations and lung function decline at a rate double to that experienced by heavy smokers (Ulvestad, 2000, 2001a, 2001b, 2014).

In an economic context, tunnel construction in Australia is considered to be exceptionally strong (Office of the Chief Economist, 2016) as significant building construction, along with major infrastructure projects continue to take place, particularly in metropolitan regions. This has led to the delivery of more kilometres of tunnels in Australia in the next seven-years than what has been constructed over the past two decades (Cole, 2017). Of note, almost two-thirds of such tunnel construction is planned to take place in Australia's largest city, Sydney.

Sydney, positioned in a basin, has been shaped by its inherent underlying geology, Hawkesbury sandstone. Geotechnically, tunnelling through sandstone offers enormous benefits as it is soft enough to prevent significant equipment wear and tear, however, is strong enough to hold the shape and form of the excavation. Such characteristics afford huge benefits when constructing tunnels; however such benefits are met with challenges through the generation of silica dust, an inherent health hazard associated with excavating rock containing high quartz concentrations.

Tunnelling through quartz containing rock generates dust known as respirable crystalline silica, commonly referred to as "silica dust" (Cole, 2017). Overexposure to silica dust causes incurable diseases such as silicosis and lung cancer (IARC, 1997). Previous studies have demonstrated tunnel construction workers had the highest silica dust exposures in the construction industry (WHSQ, 2013), therefore, the control of such should be prioritised to prevent ill-health in Australian tunnel construction workers.

## Industry collaboration & taking action

In 2016, *SafeWork NSW* published a *Work Health and Safety Roadmap*, which included a strategy to enable a continued decline in fatalities, serious injuries and illnesses with a specific focus on key priority areas (SafeWork NSW, 2017). In mid-2017, *SafeWork NSW* finalised a *Hazardous Chemicals and Materials Exposures Baseline Reduction Strategy* which resulted in focusing on two priority chemicals, one of which was crystalline silica (SafeWork NSW, 2017a). At that same time, a report investigating global best practice was published which identified engagement and collaboration as critical elements to a best practice approach for reducing illness and disease in Australian tunnel construction workers (Cole, 2017).

The Australian Tunnelling Society (ATS) membership includes contractors, designers, client representatives, asset operators, and members of academia in the tunnelling industry. The ATS was uniquely positioned to facilitate collaboration on this significant topic, recognising the importance of

cooperation with regulatory and industry stakeholders in being essential to raising awareness, in addition to enabling the development of effective practical strategies.

Consequently, the ATS executive commenced initial discussions on this issue in September, 2017 and initiated collaboration at the industry's first "*Silica in Tunnelling Workshop*". The workshop was held at the triennial ATS conference in October 2017 with the aim of bringing together key stakeholders representing major tunnel projects alongside the health and safety regulator, *SafeWork NSW* to understand if improving silica dust control could be achieved through a strengthened all-industry approach.

The workshop was attended by 20 tunnel construction stakeholders from both client and contractor organisations, representing NorthConnex, WestConnex M4 East, WestConnex New M5 and Sydney Metro City & Southwest, along with representatives from the health and safety regulator, *SafeWork NSW*.

## The Silica in Tunnelling Workshop

The Silica in Tunnelling workshop was held on the 31<sup>st</sup> of October, 2017. To set the context at the workshop, *SafeWork NSW* actively participated and presented the background for developing the chemical reduction strategy, along with its key components including awareness, research, interactions and legislation (*SafeWork NSW, 2017a*).

Fundamentally the *SafeWork NSW's* chemicals reduction strategy aims to:

- Raise awareness of the risks associated with silica dust exposure and the importance of controlling such exposure;
- Understand the extent and magnitude of silica dust exposure in the tunnelling industry;
- Work collaboratively with industry to reduce exposures in accordance with the control hierarchy so far as is reasonably practicable; and
- Review documents including the NSW Code of Practice – Tunnels under Construction.

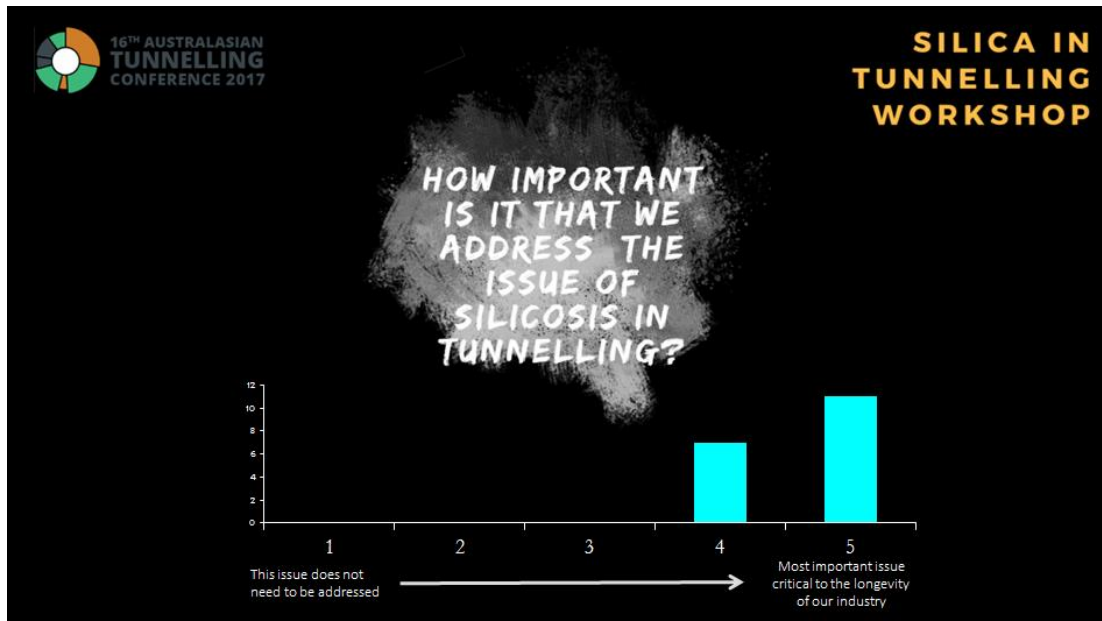
In the months prior to the workshop, *SafeWork NSW* had conducted preliminary inspections at major tunnelling projects to identify effective work practices along with improvement opportunities. Inspection activities included obtaining occupational exposure data records, the results of which were summarised and presented to the workshop participants. Such data demonstrated occupational silica dust exposure ranged between 50% of the workplace exposure standard (WES) to over ten times the WES. Information on the use of respiratory protection was not presented.

*SafeWork NSW* went on to present positive observations made during the inspections, including ventilation use close to the working face, dust suppression systems fitted to the rear of roadheaders in mined tunnels, enclosed cabins on equipment fitted with positive pressure systems, personal exposure measurements to assess silica dust exposure and compliance with the use of respiratory protection in some areas.

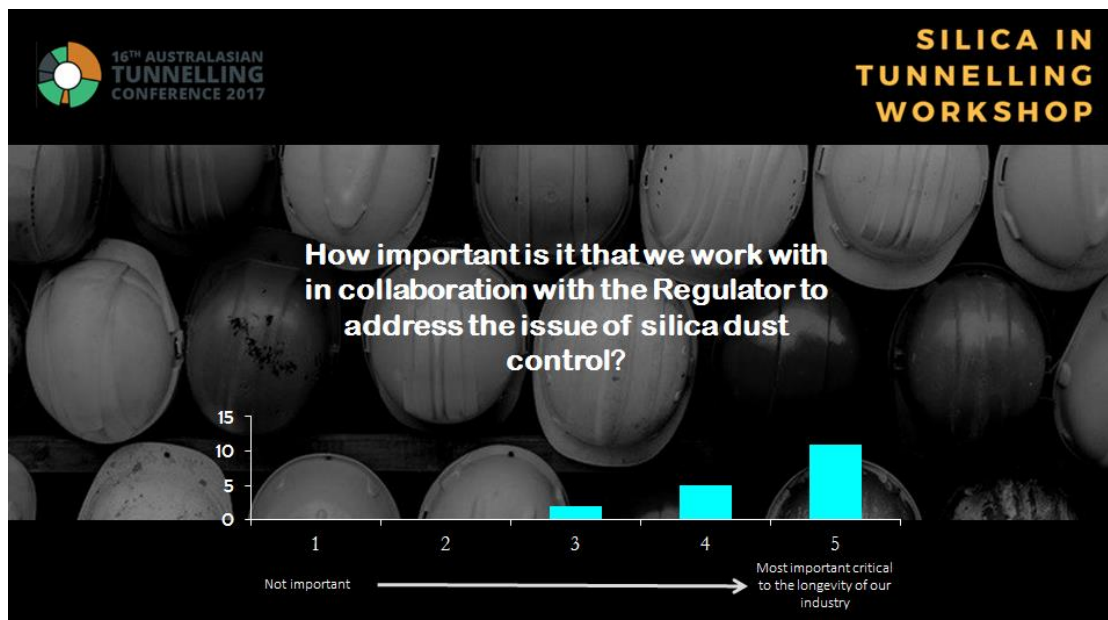
Following the communication of positive observations, *SafeWork NSW* elaborated a number of challenges observed to be experienced by industry. Such included less than adequate awareness of the consequences associated with silica dust overexposure, significant reliance on the use of respiratory protection and an understanding of what good practice looks like, particularly as control measures applied vary significantly from project to project.

The workshop progressed to a facilitated discussion, framed around the participants answering questions regarding the importance of addressing the issue of silicosis in tunnelling (refer to **Figure 1**) and working with the regulator to achieve such (refer to **Figure 2**). Workshop participants were then requested to communicate control practices that are working well in the industry, in addition to detailing the current challenges that could be addressed to improve performance outcomes, the results of which are detailed in **Table 1**.

Recognising the workshop was a one-off event and continued collaboration could facilitate improved awareness and industry performance, discussion was initiated to continue the workshop agenda. As such the notion of an Air Quality Working Group (AQWG) was advocated. Workshop participants were asked to confirm their interest in continuing their participation in a working group for the following 12-month period. Overwhelmingly, all participants nominated either themselves or another individual from their organisation, identified as likely to add value, in addition to being in a position to influence change on individual projects as improvement opportunities were developed.



**Figure 1 – Question 1 posed at the Silica in Tunnelling Workshop**



**Figure 2 – Question 2 posed at the Silica in Tunnelling Workshop**

Table 1 – Summary of responses received from workshop participants

Things that are working well in the tunnelling industry	Challenges to be overcome
<p>1. Culture                      A genuine desire to care for the workforce that deliver tunnelling projects; putting health and safety first; good levels of consultation with the workforce; an acceptance of the need to continually improve; taking a proactive approach.</p>	<p>1. Leadership                      Silica dust control can sometimes not be considered a priority by project leaders; open reporting could be better encouraged.</p>
<p>2. Experience                      Vast experience in the industry; embedding occupational hygienists into project teams; skills and experience in developing world class ventilation solutions.</p>	<p>2. Broad awareness                      Silica has not been elevated to the same level of importance as other safety risks; there still can be a perception that if you cannot see dust, then it is not a problem; awareness through the supply chain can be low.</p>
<p>3. Information Sharing                      Lessons learned within Contractor’s organisations; collaborative discussions of control measures with the workforce; international best practices being openly shared.</p>	<p>3. Data Availability                      There are no reliable disease statistics available to inform risk; no centralised reporting of illness or exposure; challenges with benchmarking each project; unsure if we can compare “apples” with “apples” per-say.</p>
<p>4. Technology                      Good use of technology (e.g. enclosed cabins, atomisers), capturing data; control technologies are becoming more affordable.</p>	<p>4. Reliance on PPE                      There is a high reliance on the use of respiratory protection; compliance relies on every person doing the right thing; onus is placed on the workforce to be clean shaven and wear respiratory protection correctly 100% of the time.</p>
<p>5. Awareness                      Workforce awareness is improving; better-quality plant being procured; embedding health into project inductions; good “pockets” of best practice.</p>	<p>5. Planning                      Greater control is needed at the design stage to increase the use of engineering controls; there can be inconsistent ventilation practices.</p>
<p>6. Monitoring                      Good at identifying areas of risk; consistent methods of monitoring in some areas; identification of similar exposed groups; gathering “real and accurate” data.</p>	<p>6. Contracts                      The construction methodology mandated by Clients impacts the level of risk to be managed; Clients should understand the risk of condensing work programs that result in multiple work fronts and the resultant constraints.</p>

## The Air Quality Working Group

Following the Silica in Tunnelling Workshop, Terms of Reference were established in November 2017 (refer **Attachment 1**). The Terms of Reference stated that the aim of the AQWG was to be, “...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 silica dust”.

The agreed role and objectives of the AQWG were to:

- Provide a collaborative forum for information sharing and identification of significant issues
- Share findings through disseminating information from SafeWork NSW inspectors who visit tunnels under construction in NSW
- Share the results of de-identified silica exposure monitoring data
- Share good practices observed which may lead to the development of industry “standards”
- Obtain feedback on challenges faced by the industry
- Develop reference material for use in the Australian tunnel construction industry.

The AQWG functioned as a technical working group under the governance of the ATS between November 2017 and November 2018 and was chaired by independent occupational hygienist and Churchill fellow, Kate Cole.

Membership included those with tunnelling experience who were working on major tunnel construction projects in NSW between November 2017 and 2018. The aim of group membership included representation of those occupying senior leadership positions, those directly accountable for project delivery, in addition to technical representatives such as engineers and occupational hygienists. *SafeWork NSW* were invited to provide representation, as was the attendance of representatives from Comcare and icare at later meetings.

The role of the individual members included:

- Attending regular meetings (once every 2-months) and actively participating
- A genuine interest in the initiatives and the outcomes being pursued by the Working Group
- Being an advocate for the program’s outcomes
- Being committed to, and actively involved in, pursuing the Working Group’s outcomes
- Representing the interests of all tunnel construction workers

It should be noted that during the AQWG functioning, further major tunnelling project contracts were awarded and as such, the membership of the AQWG was extended to include representatives from the Western Harbour Tunnel, WestConnex M4-M5 Link and Sydney Metro Central Station.

During the operation of the AQWG, members actively participated and worked together to share their knowledge, information and experience. The ATS communicated the AQWG progress to members via the ATS website, along with supporting *Safe Work Australia* by participating the *Virtual Seminar Series on Silica Dust* (SWA, 2018).

## Meetings

Between November 2017 and November 2018 the AQWG convened six times. Meetings were hosted and took place at a different tunnel construction project in Sydney, NSW.

The initial agenda of the AQWG meetings focused on sharing information to further define the challenges associated with controlling silica dust that were identified in the *Silica in Tunnelling Workshop*. Defining such challenges facilitated strong collective themes to develop, including:

- standardised, yet practical awareness material that could be effectively delivered during toolbox talks and tunnel inductions;

- identifying business processes associated with the tunnel construction life-cycle such that the risk of silica dust exposure was considered by client organisations during project planning and design;
- standardising a consistent approach for the performance of health monitoring of tunnel workers, including improving the methods applied to determine which workers are required to participate in crystalline silica health assessment activities;
- standardising a consistent approach for the performance of personal exposure monitoring, including the methods applied to sampling personal silica dust exposure concentrations;
- providing information on the effective use of respiratory protection and the limitations of such; and
- providing case studies of practical engineering controls that had been applied at tunnel construction projects to reduce silica dust exposure.

### AQWG Information Package

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 1 of 12 total parts as listed in **Table 2**. Documented material is considered to benefit the wider tunnelling industry and therefore is freely available on the ATS website.

**Table 2 – 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

## Reflections and Limitations

By drawing on the collective experience of those working across some of Australia's largest tunnelling projects, the ATS provided a platform for collaboration to both raise awareness and share information to enable companies to improve dust control practices and to support key stakeholders in this ever-growing sector. This initiative is a key example of the value of organisations such as ATS in enabling the transfer of knowledge to support the wider industry.

Reference material was compiled by the AQWG in the context of the NSW tunnel construction industry by members of the ATS, representing the NSW local group. While the principles of silica dust control are applicable globally, it is appreciated that more extensive consultation with members representing other ATS local groups did not take place.

Numerous practical measures can be applied in the tunnel construction industry to reduce worker silica dust exposure. Performing a comprehensive review of all such measures did not form part of the scope or remit of the AQWG. Reference material was compiled by the AQWG for the purposes of communicating information that currently does not exist in the tunnel construction industry's body of knowledge. Regardless, and in all cases, persons and organisations referencing such are expected to make independent enquiries as to the suitability of the use of such information with particular regard to the nature and scope of the tunnel construction project for which it is intended to be applied. Particularly as the geology encountered during tunnel construction inherently introduces a set of risks unique to each project environment.

During 2018, at the same time of the AQWG operation, *Safe Work Australia* proceeded with undertaking a review of the Australian Workplace Exposure Standards (WES's) (SWA, 2018a), which subsequently prompted much discussion and robust debate between many industry stakeholders, external to the working group. It is important to note that engaging in activities associated with reviewing the respirable crystalline silica WES were not included in the scope of the AQWG. It was appreciated that there was a limitation on what the AQWG could practically achieve in the area of silica dust control, and that efforts from ATS members were better spent sharing their considerable knowledge and experience to develop information on control strategies to benefit the tunnelling industry.

The information package produced in this process represents practical approaches to reducing the risk that silica dust represents. A scientific study validating the implementation of measures included in the information papers compiled by the AQWG has not taken place.

## Opportunities for Future Work

Silica dust control presents a challenge across many areas of tunnel construction, not only in those geologies where high-quartz containing host rock will be disturbed. Given this challenge, the AQWG suggests that further scientific research is warranted into many of the health issues that exist to tunnel construction workers. There are also further opportunities to raise awareness and share information across projects in other tunnelling states in Australia such as Queensland, Victoria, and Western Australia.



## Bibliography

- Cole, K., 2017. Investigating best practice to prevent illness and disease in tunnel construction workers, Canberra, ACT: The Winston Churchill Memorial Trust.
- IARC, 1997. IARC Monographs on the Evaluation of Carcinogenic Risks to Humans. Volume 68 Silica, some silicates, coal dust and para-aramid fibrils, Lyon, France: World Health Organisation International Agency for Research on Cancer.
- Office of the Chief Economist 2016. Australian Industry Report, Chapter 2: Economic Considerations. Department of Industry, Innovation and Science. [Online] Available at: <https://www.industry.gov.au/Office-of-the-Chief-Economist/Publications/AustralianIndustryReport/assets/Australian-Industry-Report-2016-Chapter-2.pdf> [Accessed 2018 04 18]
- SafeWork NSW. 2017. Work Health and Safety Roadmap for NSW 2022, Gosford, NSW: s.n.
- SafeWork NSW. 2017a. 2017-2022 Hazardous Chemicals and Materials Baseline and Reduction Strategy, Gosford, NSW: SafeWork NSW.
- SWA, 2012. Australian Work Health and Safety Strategy 2012-2022, Canberra, ACT: Safe Work Australia.
- SWA, 2015. Work Health & Safety Perceptions Construction Industry, Canberra, ACT: Safe Work Australia.
- SWA, 2018. Safe Work Australia Virtual Seminar Series. [Online] Available at: <https://www.safeworkaustralia.gov.au/vss> [Accessed 2018 10 12].
- SWA, 2018a. WES Review 2018, WES Methodology: Recommending health-based workplace exposure standards and notations, Canberra ACT: Safe Work Australia.
- Ulvestad, B. e. a., 2000. Increased risk of obstructive pulmonary disease in tunnel workers. Thorax, pp. 277-282.
- Ulvestad B, B. B. E. W. K. J. L. M., 2001b. Cumulative exposure to dust causes accelerated decline in lung function in tunnel workers. Occupational and Environmental Medicine, 58(10), pp. 663-669.
- Ulvestad B, L. M. B. B. D. P. K. J. B. J., 2001a. Gas and dust exposure in underground construction is associated with signs of airway inflammation. European Respiratory Journal, Volume 17, pp. 416-421.
- Ulvestad B, B. L. M. B. B. T. Y. E. D., 2014. Short-term lung function decline in tunnel construction workers. Occupational & Environmental Medicine Vol. 72 No. 2.
- WHSQ 2013. Occupational dust and silica conditions in some Queensland construction and related industries. QLD: State of Queensland (Department of Justice and Attorney-General).

## Attachment 1 – Terms of Reference

### Background

The Australasian Tunnelling Society (ATS) recognises the importance of health and safety in our industry in addition to valuing the strong experience and contribution of its members to support key stakeholders in our ever-growing sector. The ATS recognise that collaboration with industry stakeholders is essential 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.

Understanding the recent focus on silica exposure in major infrastructure projects by many stakeholders, including SafeWork NSW, an initial *Silica in Tunnelling Workshop* was held at ATS 2017 in October 2017. That workshop involved key stakeholders from all operating tunnelling projects, both Contractors and Clients, along with the health and safety regulator, SafeWork NSW. Nominations were taken at that Workshop for membership of an Air Quality Working Group for the 12-month period to the end of 2018.

### Purpose

The Air Quality Working Group was formed 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 silica dust.

### Role and Objectives of the Working Group

The Air Quality Working Group will work to:

- Provide a collaborative forum for information sharing and identification of significant issues
- Share findings through disseminating information from SafeWork NSW inspectors who visit tunnels under construction in NSW
- Share the results of de-identified silica monitoring data
- Share good practices observed – which may lead to the development of industry “standards”
- Obtain feedback on challenges faced by the industry
- Consultation mechanism for development of Industry guidance material

### Management

The Air Quality Working Group shall be a technical working group under the Australasian Tunnelling Society.

The rights of the Committee shall include:

- Access to the ATS Executive such that decisions are made in a timely manner that enable the Working Group to discharge its duties; and
- Seek approval of expenditure associated with executing activities.

### Membership

Membership shall include those with tunnelling experience who work on current major tunnel construction projects in NSW. The Group aims to have a mix of those in senior leadership positions, those directly accountable for project delivery, in addition to technical representatives such as engineers and occupational hygienists.

Membership is capped at 25 participants, unless otherwise agreed by the Working Group. An interim Chair is nominated for the first 12-months. After-which, a rotating Chair is proposed to lead the Working Group for 12-month periods as voted by the Working Group.

## Role of individual group members

The role of the individual members includes:

- Attending regular meetings (once every 2-months) and actively participating
- A genuine interest in the initiatives and the outcomes being pursued by the Working Group
- Being an advocate for the program's outcomes
- Being committed to, and actively involved in, pursuing the Working Group's outcomes
- Representing the interests of all tunnel construction workers

The role of the Chair includes:

- Coordinate meetings;
- Document the outcome of meetings through preparation and distribution of minutes
- Develop meeting agendas for each meeting and distribute to committee members to enable adequate preparation time.
- At a minimum, the meeting agenda shall include a review of the progress status towards the achievement of improvement plan objectives, along with the status of action implementation.
- Preparation of summary reports to the ATS Executive.

## Frequency of Meetings

The Air Quality Working Group will meet every 2-months. The aim is to meet at rotating tunnelling projects each time.

## Proxies to meetings

Members of the Working Group may nominate a proxy to attend a meeting if the member is unable to attend. The nominated proxy will provide relevant comments/feedback about the attended meeting to Working Group member they are representing.