Real-time monitoring for silica dust

Real-time dust monitor

Background

Real-time monitoring is used as an indicator to help understand the levels of fine dusts and respirable crystalline silica ('silica dust') in the workplace.

It has been used across Sydney Metro projects to highlight areas where control measures are working well or where additional controls, such as ventilation, may need to be put in place.

Coupling real-time monitoring with the use of a camera, known as 'video exposure monitoring' is a useful way of visualising tasks and work areas where dust controls are effective.

Why is real-time monitoring helpful?

Across Sydney Metro sites, occupational hygienists perform personal exposure monitoring each month to assess exposure to silica dust to the workforce. This process typically takes two to four weeks between sampling and reporting the results. This lengthy time period can be challenging in a construction based environment where work tasks and environments may change on a regular basis.

Real-time monitoring is used in addition to personal exposure monitoring to provide an indicator of the levels of dust and silica within a shorter time frame.

At Sydney Metro, real-time monitoring has been used by occupational hygienists, health and safety professionals, and site based teams to assess and help control silica dust exposure.

How is it done?

A method to directly measure silica dust in real time is not yet readily available. Instead, a hand-held dust monitor is used which is configured and programmed to measure respirable dust.

The type of 'silica' being measured across Sydney Metro worksites is quartz. Knowing the amount of quartz in respirable dust is a key part of undertaking real-time monitoring for silica dust.

The amount of quartz in the air is applied as a correction factor (as a percentage) to the result to estimate the amount of silica dust in the air.

This case study provides data on the range of quartz concentrations found during common work activities across Sydney Metro and some common applications.

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Determining the correction factor

The amount of quartz used as the correction factor for real-time dust monitoring should be material and task specific.

For example, reviewing a Safety Data Sheet for concrete may show that it contains 30 per cent quartz. If work activities involved cutting into that product, then a minimum correction factor of 30 per cent would be used.

Some products such as sandstone and shale will not come with Safety Data Sheets. Information on their quartz content may come from geotechnical reports. Across Sydney Metro City & Southwest, sandstone has been reported to have an average of 70 per cent quartz with shale at an average of 30 per cent quartz.

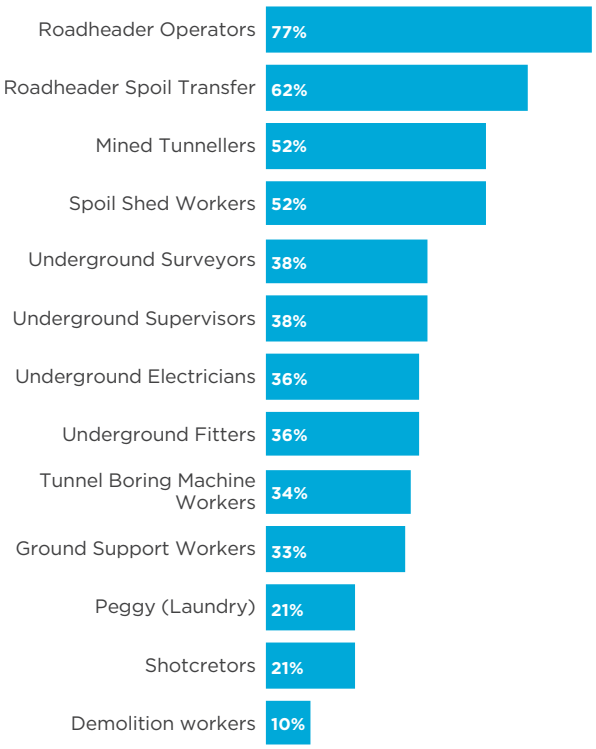
It is also important to understand the possible sources of silica dust exposure to the workforce. Workers may be exposed to more than one source of silica dust for example. In these cases, the highest proportion of quartz is typically used.

Previous exposure data collected by the occupational hygienist for the work activities conducted can also assist where this is available.

Figure 1 provides the measured proportion of quartz from over 900 respirable dust samples collected across Sydney Metro.

Static monitoring in place on Central Station measuring respirable dust and respirable crystalline silica

Figure 1: Proportion of quartz



Percentage of quartz measured in respirable dust samples collected across Sydney Metro[1]

Example of use – Central Station

Monitoring results collected for respirable dust and respirable crystalline silica were reviewed to determine the percentage of quartz reported in the samples.

This percentage was used as the 'correction factor' to adjust the real-time dust monitor used on the project so that it read approximately what silica dust levels were in the work area – rather than just respirable dust only.

The correction factor was reviewed each month as new data is reported.

This case study provides a summary of key information from work presented at the Australian Institute of Occupational Hygienists Annual Conference and Exhibition 2018[2] and 2019[3]

1 95 per cent Upper Confidence Limit

2 Cole & Fletcher, "*A program approach to managing occupational health and hygiene on Australia's largest public transport project, the Sydney Metro*" Australian Institute of Occupational Hygienists 36th Annual Conference & Exhibition, Melbourne

3 Cole & Fisher "*Measured proportion of quartz in respirable dust samples in the infrastructure sector*" Australian Institute of Occupational Hygienists 37th Annual Conference & Exhibition, Perth

Video exposure monitoring

Real-time dust monitoring can be combined with the use of a helmet-mounted camera to create video exposure monitoring. When used in this way, it provides a good tool to identify key points of exposure within a short timeframe.

The system is modelled on technology developed by the United States National Institute of Occupational Safety and Health (NIOSH) and consists of a small, helmet-mounted video camera and real-time dust monitor, worn by the worker for a short period of their shift.

At the end of the monitoring period, the video and exposure data are merged using a NIOSH developed software package, EVADE (Enhanced Video Analysis of Dust Exposure). The combined output can then be viewed and edited so that key work processes and tasks contributing to exposure can be easily identified.

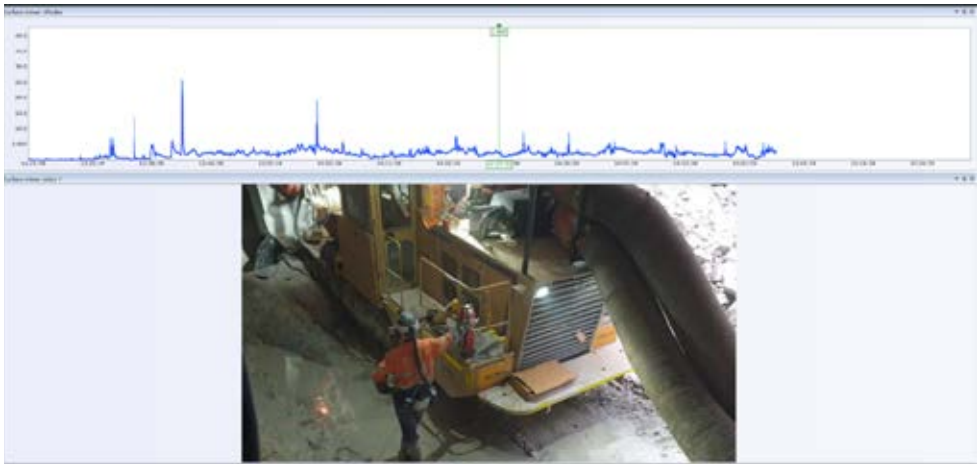
Example of use – Central Station

While personal exposure monitoring was used to understand a worker's total exposure over a shift, video exposure monitoring was used to understand where the dust exposure may have been occurring on the Central Station Main Works project.

As one example, video exposure monitoring was used to help understand the source of exposures for a worker located near an operating surface miner.

Video exposure monitoring helped verify the effectiveness of cabin enclosures and ventilation by reviewing the 'peaks' and level of dust recorded while workers were operating heavy plant and working near ventilation systems.

Hard hat mounted video camera



Screenshot of the output of video exposure monitoring

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Laing O'Rourke, Principal Contractor

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