



Concrete Sprayer

HAZARDS AND RISKS

During tunnelling works, sprayed concrete lining (SCL) is applied to the surfaces of the tunnel to provide reinforcement of the excavated area, and is usually repeated a number of times to apply various layers (such as waterproofing), typically using a robotic spraying rig. This process can generate a large quantity of airborne dust which, if inhaled, exposes workers to respiratory health risks. The highest risk to a concrete sprayer's health is likely to be from breathing in dust, and in particular, silica dust.

Construction dust

Construction dust is a general term and includes dust from soil and building materials. Breathing in any dust over time can cause serious lung diseases such as chronic obstructive pulmonary disease (COPD) which is an umbrella term for a number of conditions including chronic bronchitis and emphysema.

Respirable crystalline silica (RCS)

Silica occurs as a component of concrete, and is often present in the consumable materials used during concrete spraying. Inhaling fine silica dust (RCS) over time can lead to serious, life-limiting and irreversible lung diseases such as silicosis, COPD, and lung cancer; these diseases can cause permanent disability and early death, and it is estimated that over 230 workers die every year from lung cancer caused by exposure to RCS.

CONTROL OPTIONS

Elimination/prevention

- Preventing exposure to silica is the most effective control measure of all. It may be possible that silica can be eliminated or greatly reduced by using non-silica or low silica materials for spraying.

Engineering controls

- As concrete spraying is often undertaken in tunnels, it can be difficult to implement local exhaust ventilation (LEV) controls.
- Use of de-duster units (air scrubbers positioned directly behind the work area) can reduce exposures.
- Dilution ventilation – forced provision of fresh air to the spraying face to dilute any dust generated – should also be considered in any enclosed environments.

Safe working methods

- Access to areas where spraying is undertaken must be strictly controlled (using physical barriers) and signage used to highlight the necessary controls.
- In most cases it is possible to control exposure to RCS by using a wet mixture that reduces the amount of airborne dust generated; this "wet" method, where additional water is mixed with the concrete before being sprayed, has generally replaced the older industry methods of concrete application.

PPE

- Engineering control techniques may not always be suitable for the task, so respiratory protective equipment (RPE) may be necessary.
- Due to the elevated levels of inhalable dust typically generated, sprayer operatives working alongside the spraying rig will require the use of battery powered respirators with P2 filters (with an APF protection rating of 40).
- Workers in the general vicinity will also need RPE; based on typical dust levels experienced in these areas RPE with an APF protection rating of 20 will usually be sufficient, disposable dust masks (P3 rated) will meet this requirement.

MANAGING THE RISK

Training & communication, supervision, maintenance & testing of controls and air monitoring* are all vital aspects of managing the risk, in addition to health surveillance which can be a requirement in certain circumstances.

See our introductory *Respiratory Health Hazards in Construction Fact Sheet Series: Overview* for more information about what things to consider and implement.

Air monitoring*

Air monitoring is a specialist activity. It may be needed as part of a risk assessment, as a periodic check on control effectiveness and to assess compliance with relevant WES, or where there has been a failure in a control (for example if a worker reports respiratory symptoms). A qualified Occupational Hygienist can ensure it is carried out in a way that provides meaningful and helpful results.

See reverse for Workplace Exposure Standards (WES)

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WORKPLACE EXPOSURE STANDARDS (WES) & EXPOSURE LEVELS

Agent or substance	Control/Exposure Limit	Exposure Levels
Silica - RCS	Respirable: 0.05 mg/m ³ (8 hr TWA)	<p>Exposure to RCS is dependent on the silica content of the material being worked, which varies; the silica content of concrete is typically quite high, at anything from 25-75%. Even with basic controls in place, likely exposure to total inhalable dust may be above the WEL (sometime two or three times the limit), and this may also be true for RCS during uncontrolled spraying. Directly underneath the spraying nozzle, exposure will likely be in the range of 10-30mg/m³ for total inhalable dust, and between 0.04-0.15mg/m³ for RCS. In more general areas, exposures can still be in the range of 8-16mg/m³ for total inhalable dust.</p> <p>Levels of exposure to all airborne dusts are affected by the frequency and duration of the work being undertaken and are likely to be higher in poorly ventilated spaces/areas.</p>

Further HSE information

- HSE: Silica dust: www.hse.gov.uk/construction/healthrisks/cancer-and-construction/silica-dust.htm
- British Tunnelling Society: Sprayed Concrete Linings (SCL)
www.britishtunnelling.org.uk/?sitecontentid=C22FDFDF-EEEE-45E8-A492-DAF60036B076