Controlling exposures to prevent occupational lung disease in the construction industry

Do you breathe freely?

Mike Slater
Past President BOHS
Managing Health Risks in the Construction Industry

Mike Slater
Diamond Environmental Ltd.
BOHS Past President 2014/15
How many construction workers died last year as a result of an accident at work?

a) 35
b) 135
c) 350
d) 3500
How many construction workers died last year as a result of an accident at work?

a) 35
b) 135
c) 350
d) 3500
How many construction workers died last year due to ill-health caused by their work?

a) 50  
b) 150  
c) 500  
d) 5000
Deaths from Occupational Cancer

- Construction, 3700
- Other industries, 4300

Deaths from Occupational Cancer
How many construction workers died last year due to ill-health caused by their work?

a) 50  
b) 150  
c) 500  
d) 5000 ?
Approx 13,000 died from work related disease

99% health

148 workers died in accidents at work

1% safety
“For too long we’ve whispered health and shouted safety”

Steve Hails
Thames Tideway
(formerly Crossrail)
How effective is water suppression?

a) 10%
b) 25%
c) 75%
d) 99%
Laboratory tests showed water suppression reduced dust levels by up to **99%**

On-tool shrouds reduced respirable crystalline silica concentrations by ... 99%

An Evaluation of On-Tool Shrouds for Controlling Respirable Crystalline Silica in Restoration Stone Work
Controlling Exposures to Prevent occupational lung disease in the construction industry

Do you breathe freely?
Raise awareness

Provide tools and resources
Roadshows
Health in Construction Leadership Group
occupational health risk management in construction

A guide to the key issues of occupational health provision

Document prepared by:
Construction Industry Advisory Committee (CONARC)
Health Risk Working Group

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• Fitness for work
• Health screening
• Early detection of ill health
• Treat symptoms
Manage the **risk** not the symptoms
WELLBEING

RISK PREVENTION & CONTROL

HEALTH SURVEILLANCE
Protecting people from workplace health risks

Managing health of workers

Promoting healthy lifestyle choices
Occupational health provision on the Olympic Park and athletes’ village

Final report

Prepared by the Institute for Employment Studies for, and jointly funded by, the Health and Safety Executive and the Olympic Delivery Authority 2012
Building the Business Case

- Financial
- Employee relations
- Social responsibility
- Reputation
Manage health like safety
Is worker health protection given the same emphasis as safety in your organisation?

a) No  
b) To some extent  
c) Yes, expectations are generally met  
d) Yes and there are examples of innovation and "best practice"
Manage the **risk** not the symptoms
In managing health in your organisation is priority given to risk prevention?

a) No
b) To some extent
c) Yes, expectations are generally met
d) Yes and there are examples of innovation and “best practice”
Protecting people from workplace health risks

Managing health of workers

Promoting healthy lifestyle choices
The HI Management Standard

A self-assessment tool for managing workplace health risks in construction
HI Standard Self-Assessment Tool

The Health in Industry Management Standard
### Bold questions

1. **Care about Appearance**
   Constructors should ensure sites appear professional and well managed
   - Does the external appearance of the site present a positive image of the industry?
   - Does the site appear well presented, clean, and tidy?
   - Does the appearance of all facilities, stored materials, vehicles and plant make a positive impression?
   - Does the appearance of the workforce project a positive impression?

2. **Prompts**
   - First impressions, signage, enclosures, entrance, obstructions, mud, debris, litter, graffiti
   - Tidiness, organisation
   - Screening of facilities, remote compounds, organisation, layout and tidiness, supply chain
   - On-site dress code, off-site appearance, smoking
   - Inspection, public rubbish, materials, dust prevention
   - Site waste, viewing points, vandalism, waste bins
   - Supervision, procedures, checklist
   - Workforce awareness, involvement
   - Guidance, discreet areas, ashtrays
   - Communication, guidance, branding, signage, websites, social media, corporate branding

### Non-bold questions

1. What actions are taken to keep the perimeter and surrounding areas clean, tidy and free of litter, mud and dust?
2. What procedures are in place to ensure that the work area is clean and tidy?
3. How are waste and storage areas clean, managed and maintained?
4. How does the site encourage the workforce to contribute to cleanliness and good housekeeping?
5. How is all smoking managed to avoid a negative impact on the public?
6. How are company values, corporate identity and a positive industry image promoted?
The HI Management Standard
How to use the self-assessment tool

Instructions
1. Work through each of the six leading indicators, considering how your organisation is currently performing in each area, giving a score for each question area. Note down evidence to support the scores you have given, to assist when referring back to this and sharing with others.
2. For each section, add up the score and enter the total. Finally, enter these totals into the overall assessment table below.
3. Identify those areas where the score is lowest and use this as a basis for completing the action plan sheet at the back of the document.
4. You can use this tool to assess performance company-wide or for individual sites and projects.

Assessment
Score the answer to each question as follows, with a maximum of three points per question:

0 NO
1 Yes but there is limited evidence of implementation
2 Yes there is good evidence and expectations are generally met
3 Yes expectations are met and there are examples of best practice

Overall Assessment
Company/Project/Site Name: ____________

<table>
<thead>
<tr>
<th>Leading Indicator</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0-5</td>
</tr>
<tr>
<td>Leadership &amp; Commitment</td>
<td></td>
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<tr>
<td>Planning &amp; Prevention</td>
<td></td>
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<tr>
<td>Risk Assessment</td>
<td></td>
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<tr>
<td>Control</td>
<td></td>
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<tr>
<td>Competency, Training &amp; Behaviours</td>
<td></td>
</tr>
<tr>
<td>Programme Management</td>
<td></td>
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</tbody>
</table>
Leading Indicator: Leadership and Commitment

Demonstrate that worker health protection is valued.

- Manage workplace health risks as an integral element of delivering the business, so it is part of the business strategy not just an add-on
- Put in place a programme and procedures that address all potential ill health and disease risks
- Designate named management responsibility and accountability for Worker Health Protection at company, project and site level
- Develop a culture of prevention through good practice, advocacy, positive intervention, supervision and contractor management

<table>
<thead>
<tr>
<th>Company/Project/Site Name:</th>
<th>Question</th>
<th>Evidence</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Is worker health protection given the same recognition as safety?</td>
<td>WHP included in company EHS policy. WHP included alongside Safety in Health &amp; Safety meetings / reporting / targets etc.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Have you got a plan that outlines how you ensure worker health is protected?</td>
<td>Company EHS policy includes WHP. Any plans or documents (e.g. procedures) which show how you assess risks to hazardous agents and how exposure is prevented or controlled.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Has a senior manager been given responsibility for WHP?</td>
<td>Individual at senior management level in the organisation formally recognised as responsible for WHP and making sure plans are implemented.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Do people throughout the organisation know they have responsibility for WHP?</td>
<td>Responsibility for WHP identified at the start of new projects, at project and Site Level (and it is written down). WHP built into line management objectives.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Is the management of WHP promoted &amp; encouraged in the organisation?</td>
<td>Promotion of WHP via in-house publications e.g. leaflets, site posters. Company targets set for WHP and reported.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Are site level supervisors engaged in the management of WHP?</td>
<td>Site level supervisors understand the main health risks on their site and checks they need to make to ensure controls are being used and working e.g. use of correct topping / processes, extraction systems, personal protective equipment.</td>
<td></td>
</tr>
</tbody>
</table>

Other Evidence or Best Practices

Score (points per question)

- 0: No
- 1: Yes but limited evidence / implementation
- 2: Yes good evidence and expectation generally met
- 3: Yes expectation met and examples of best practice

Total

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Assessment

Score the answer to each question as follows,

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>No</td>
</tr>
<tr>
<td>1</td>
<td>Yes but there is limited evidence of implementation</td>
</tr>
<tr>
<td>2</td>
<td>Yes there is good evidence and expectations are generally met</td>
</tr>
<tr>
<td>3</td>
<td>Yes expectations are met and there are examples of best practice</td>
</tr>
</tbody>
</table>
Leading Indicator:
Planning and Prevention

Eliminate and minimise risks to health early on: design and plan them out wherever possible.

- Remove high risk processes/substances/activities completely from the start
- Substitute with less hazardous processes/substances/activities where elimination isn’t feasible
- Plan hazardous work activities so they minimise impact on other working groups
- Involve specialist expertise to advise during the planning/design process

Company/Project/Site Name:

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<th>Question</th>
<th>Evidence</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are high risk processes / substances / activities reviewed and removed at the design stage?</td>
<td>Worker health protection included in planning stage. High risk activities are identified so that they can be avoided completely e.g. off site pre-fabrication of high noise processes or one that generates lots of hazardous dust or fumes.</td>
<td></td>
</tr>
<tr>
<td>Are substances / processes substituted for less hazardous ones at the planning stage?</td>
<td>Substances and processes reviewed at the planning stage so lower risk alternatives can be chosen e.g. selection of chemicals which do not cause serious breathing problems e.g. asthma, selection of processes and tools which have lower vibration.</td>
<td></td>
</tr>
<tr>
<td>Are high risk activities / processes identified and listed?</td>
<td>List generated of high risk activities or chemicals. List is communicated and shared so everyone makes an effort to avoid their use. List could even be included in contractual agreements.</td>
<td></td>
</tr>
<tr>
<td>Is work planned / scheduled so that other workers are not exposed to hazardous agents when they are not directly involved with the activity?</td>
<td>Where there may be a high risk of exposure from an activity e.g. noise and dust from concrete cutting, work is planned so other people do not have to work in this area at the same time.</td>
<td></td>
</tr>
<tr>
<td>Are there regular meetings / reviews of work schedules to maintain segregation of high risk activities?</td>
<td>Daily, weekly or monthly work reviews of high risk site activities to identify where they may be delayed / oversown. Other working groups may need to be rescheduled to avoid working alongside these high risk activities or additional WHP controls may be needed to protect them.</td>
<td></td>
</tr>
<tr>
<td>Is there a suitable level of knowledge of WHP included at the planning &amp; design stages?</td>
<td>Specialists are available to help identify hazardous agents and WHP options at the planning stage.</td>
<td></td>
</tr>
</tbody>
</table>

Other Evidence or Best Practices

Score (points per question):
0  No
1  Yes but limited evidence / implementation
2  Yes good evidence and expectation generally met
3  Yes expectation met and examples of best practice

Total
Leading Indicator:  
Risk Assessment

Assess the actual risks to health from workplace activities and substances (don’t just list the hazards).

- Take a systematic, task-based approach to the identification and assessment of health risks
- Anticipate all potential chemical, biological and physical hazards arising from products used and processes that are carried out
- Consider routine, non-routine, maintenance and emergency tasks
- Measure exposure risks quantitatively (i.e. via workplace monitoring), where required

### Company/Project/Site Name:

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<tbody>
<tr>
<td>Are the health hazards and risks assessed by a competent person for all activities/ tasks which are conducted?</td>
<td>Not just a list of substances &amp; safety data sheets, but how and when people would be exposed, number of people &amp; controls for each task. Risk assessor has competence/knowledge, skills &amp; experience in WHS.</td>
<td></td>
</tr>
<tr>
<td>Are all health hazards identified and considered in the risk assessment?</td>
<td>Not just the list of chemicals used but also any hazardous agents generated by the activity e.g. biological/chemical/noise/vibration/UV etc.</td>
<td></td>
</tr>
<tr>
<td>Are the ill health risks also assessed for non-routine activities such as maintenance?</td>
<td>Planned and foreseeable maintenance activities are also assessed for WHS. Including maintenance of control equipment e.g. emptying LEV bins.</td>
<td></td>
</tr>
<tr>
<td>Are the health risk assessments reviewed when there are changes to the task or new information available?</td>
<td>Exposure monitoring &amp; health surveillance data is reviewed and health risk assessments updated accordingly. Risk re-assessed where different tools or chemicals may be introduced.</td>
<td></td>
</tr>
<tr>
<td>Is there a process in place to assess the risks to emergency situations and unplanned activities?</td>
<td>Foreseeable exposures are covered e.g. spillages of hazards chemicals. Have a process for quickly assessing risk for unplanned activities e.g. dynamic risk assessment.</td>
<td></td>
</tr>
<tr>
<td>Is exposure monitoring conducted by a competent person where risk of exposure is not clear?</td>
<td>Use of specialists e.g. occupational hygienists to measure actual exposure where risk is not clear e.g. noise/dust/mists/vibration etc.</td>
<td></td>
</tr>
</tbody>
</table>

### Score (points per question):

- **1** Yes but limited evidence / implementation
- **2** Yes good evidence and expectation generally met
- **3** Yes expectation met and examples of best practice

### Total:

[Table of scores]
Recognise, evaluate, control
Steps to carrying out a practical COSHH assessment on a construction site
Leading Indicator: Control

Companies should adopt the most effective and appropriate exposure controls to prevent ill health and disease.

- Implement a hierarchy of control and a preference for engineering solutions
- Use straightforward and effective measures using the principles of good practice
- Consider personal protective equipment (PPE) only as a last resort
- Ensure controls are proportionate to the health risk

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<tr>
<td>Where risks to ill health cannot be eliminated are engineering controls used rather than relying on personal protective equipment?</td>
<td>Engineering controls in use e.g. Osborne extraction for dusts / fumes, remote control of vibration equipment, vehicle exhaust extraction / filtration. PPE only used where other controls not reasonable.</td>
<td></td>
</tr>
<tr>
<td>Do controls protect all the routes in which a hazard may affect health?</td>
<td>Controls take into account all potential impacts on health e.g. may need controls for breathing in a chemical as well as preventing exposure to the skin.</td>
<td></td>
</tr>
<tr>
<td>Are sensible and practical controls used?</td>
<td>Use of Industry / HSE guidance documents on WHS controls which are “tried and tested” and provide a suitable level of protection for the particular process.</td>
<td></td>
</tr>
<tr>
<td>Are technical specialists used to help to select and design engineering controls?</td>
<td>Use of technical specialists to specify controls where standard controls are not available e.g. occupational hygienists, acoustic experts.</td>
<td></td>
</tr>
<tr>
<td>Is control information shared within the company as well as with other working groups / organisations to help ensure best controls are used?</td>
<td>Benchmarking with other companies / contractors / industry associations on the most effective controls &amp; working with suppliers of equipment.</td>
<td></td>
</tr>
<tr>
<td>Where PPE is required is it selected by a competent person?</td>
<td>Competence to assess which type of PPE will provide enough protection e.g. assigned protection factors, filter selection, noise attenuation, PPE compatibility requirements.</td>
<td></td>
</tr>
</tbody>
</table>

Other Evidence or Best Practices

Score (points per question)
0 = no
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3 = yes, expectation met and examples of best practice

Total
# Leading Indicator: Competency, Training & Behaviours

Ensure that every worker is on board, competent in, and takes ownership of, their own health risk management at work.

- Information, instruction and training for the whole workforce about the health risks they face and the precautions to take.
- Systems and rules that are enforced to ensure control measures are used.
- Regular monitoring and review of competency and behaviours.
- Requirement (and support) for subcontractors to work to the same high standard and within the same good practice framework.

## Company/Project/Site Name:

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<tbody>
<tr>
<td>Does everyone have training on WHS?</td>
<td>Includes all relevant health hazards (chemical / dust / noise / vibration / UV etc.), controls and how they are used. Includes management &amp; workers.</td>
<td></td>
</tr>
<tr>
<td>Is there a process to ensure that workers understand all the WHS requirements on the site before they start work?</td>
<td>Site induction to ensure that employees know the specific risks and controls on site and risks from other workers.</td>
<td></td>
</tr>
<tr>
<td>Are WHS risks / controls clearly communicated and in a suitable format so employees are clear on what they must and must not do?</td>
<td>Provision of simple, clear hazard information and instructions on what must and must not be done – provided in format relevant to complexity e.g. tool box talk or signage for simple requirements, class room for more complex risks.</td>
<td></td>
</tr>
<tr>
<td>Is there ongoing supervision to ensure that WHS requirements are being used?</td>
<td>Routine inspection / check by supervisors that correct processes, testing, controls and PPE are being used, and used correctly.</td>
<td></td>
</tr>
<tr>
<td>Is training provided for the correct use and fitting of PPE?</td>
<td>When and which types of PPE to be worn, limitations of PPE, user-pre-use tests and maintenance, face fit testing for respirators etc.</td>
<td></td>
</tr>
<tr>
<td>Are subcontractors required to work to the same standards?</td>
<td>Review of subcontractors to ensure they are following WHS requirements and working to the same standards. Could be via site inspections.</td>
<td></td>
</tr>
</tbody>
</table>

## Other Evidence or Best Practices

<table>
<thead>
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# Leading Indicator: Programme Management

Manage Worker Health Protection all the time: over the whole site, before and throughout every project and from the top to the bottom of the company.

- Maintain and evaluate the effectiveness of controls on an ongoing basis
- Establish an exposure monitoring programme
- Ensure early reporting and investigation of any potential workplace ill health or disease, through health surveillance
- Set and then monitor measurable targets which relate to the occupational ill health prevention programme

## Company/Project/Site Name:

<table>
<thead>
<tr>
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<th>Evidence</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Are routine checks in place to ensure controls are working properly?</td>
<td>e.g. daily pre-use checks for extraction systems as well as annual thorough examination &amp; testing, pre-use checks for PPE / RPE – filter change etc.</td>
<td></td>
</tr>
<tr>
<td>Is there a programme of preventative maintenance to ensure controls do not ‘break down’?</td>
<td>e.g. planned maintenance to ensure extraction works correctly / filters changed, collection bins emptied, damaged ductwork repaired, maintenance of tubing so that does not deteriorate (increase noise and vibration) etc.</td>
<td></td>
</tr>
<tr>
<td>Has a need for ongoing exposure measurements been identified?</td>
<td>Routine exposure monitoring conducted to show that exposure assessments are still valid e.g. measurement of dust / fumes / noise / vibration.</td>
<td></td>
</tr>
<tr>
<td>Is health surveillance required? Has this need been assessed?</td>
<td>Health surveillance targeted on exposure risk assessments where there is a valid surveillance method and there is a significant risk of exposure.</td>
<td></td>
</tr>
<tr>
<td>Are any abnormal health surveillance or exposure monitoring results investigated to identify any unsatisfactory controls?</td>
<td>Health surveillance &amp; exposure measurement data reviewed to identify adverse trends. Investigation to identify if controls need to be improved.</td>
<td></td>
</tr>
<tr>
<td>Have targets been set to help monitor how well the WHIP programme is working?</td>
<td>% risk assessment completed, % maintenance completed on controls, pre-use checks completed, % of high risk activities, training on health hazards completed, results of exposure monitoring. A health surveillance, use of controls and PPE.</td>
<td></td>
</tr>
</tbody>
</table>

## Other Evidence or Best Practices

<table>
<thead>
<tr>
<th>Score (points per question)</th>
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<tbody>
<tr>
<td>0</td>
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</tr>
<tr>
<td>Yes data limited evidence / implementation</td>
<td></td>
</tr>
<tr>
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<td>Yes expectation met and examples of best practice</td>
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</table>

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<table>
<thead>
<tr>
<th>Company/Project/Site Name:</th>
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<tbody>
<tr>
<td>Leadership and Commitment</td>
</tr>
<tr>
<td>Action:</td>
</tr>
<tr>
<td>Person responsible:</td>
</tr>
<tr>
<td>Review date:</td>
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<tr>
<td>Comments:</td>
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<tr>
<td>Planning and Prevention</td>
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<tr>
<td>Action:</td>
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<td>Person responsible:</td>
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<td>Review date:</td>
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<td>Comments:</td>
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<tr>
<td>Risk Assessment</td>
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<td>Action:</td>
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<td>Person responsible:</td>
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<td>Review date:</td>
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<td>Comments:</td>
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<td>Control</td>
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<td>Action:</td>
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<td>Person responsible:</td>
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http://www.breathefreely.org.uk/the-hi-standard.html
Web based information hub

www.breathefreely.org.uk
# Bricklayer

## Hazards and Risks

Bricklayers can be frequently exposed to high levels of dust through many regular tasks. Mixing cement and mortar, emptying or disposing of cement bags, cutting, sawing, and drilling through brick and concrete, and cleaning/voiding in brickwork can all generate airborne dust. This is easily inhaled. Close-up work, such as brick marking and cutting, can also mean the worker is breathing very near to a dust source.

### Dust & respirable crystalline silica (RCS)

Construction dust is a general term for dust typically found on a construction site, the risk to health depends on the actual composition of the dust as well as the level of exposure to it. The highest risk to a bricklayer’s health is likely to be from breathing in silica dust. Silica occurs in many types of stone, including concrete and brick. Inhalation of respirable crystalline silica (RCS) over time can lead to serious lung diseases, including fibrosis, silicosis, chronic obstructive pulmonary disease (COPD), and lung cancer. These diseases cause permanent disability and early death. Over 500 construction workers die every year from exposure to silica dust. Breathing in any dust can lead to long-term irritation, asthma, and other acute and chronic respiratory conditions.

### Exposure levels

Exposure to RCS varies according to the silica content of the material being worked. Concrete typically has a high proportion (silica content of between 25-75%), as does brick which contains around 30-50% silica. Dry cutting/sawing without dust extraction is likely to produce the highest levels of airborne brick/dust dust. Wet cutting has been shown to reduce exposure levels by up to 71%. Exposure levels are also affected by the frequency and duration of the work.

## Control Options

### Elimination/prevention

- Use pre-cut bricks/blocks and ready-mixed concrete where possible.

### Engineering controls

- **Cutting:** Use pre-cut bricks/blocks and ready-mixed concrete where possible.
- **Sawing:** Use vacuum systems fitted with a HEPA filter wherever possible for cleaning.

### Safe working methods

- **Cutting:** Use wet saws for cutting.
- **Sawing:** Use wet saws for cutting.
- **Mixing cement:** Mix dry cement in a well-ventilated area.

## Managing the Risk

### Training & communication, supervision, monitoring & recording of controls and air monitoring

- Air monitoring is an essential activity. It should be needed as part of a COSHH assessment, as a periodic check on control effectiveness, and to assess compliance with relevant WELs or where there has been a failure in a control (for example if a worker reports respiratory symptoms). An occupational health officer can ensure it is carried out in a way that provides meaningful and helpful results.

### PPE

- Respiratory protective equipment (RPE) must be worn for brick cutting and cement mixing. The RPE should be a minimum of a P2 P2 certified disposable dust mask.

### Preferred control methods

- Use of pre-cut bricks and ready-mixed concrete.

See reverse for Workplace Exposure Limits (WELs)
Crossrail
Silica dust control in sprayed concrete lining

Building the business case for prevention

Crossrail’s Tunnel Boring Machines (TBMs) have constructed 42km of new tunnels for the trains to run through in 2018. In addition to this, 14km of the new separate tunnels (cross-passages and platform tunnels) have been constructed using the Sprayed Concrete Lining (SCL) technique. Managing the health risks to workers in Europe’s largest construction project clearly requires an overarching occupational health programme. In the context of SCL, this has meant implementing dust exposure control measures, which, with 90% of the SCL tunnelling complete, have already demonstrated benefits beyond the worker health protection for which they were designed, including cost savings, employee satisfaction, and timescale efficiencies linked to a joined-up approach throughout a complex and multi-project health risk management task.

SCL health risks

SCL is applied to the surfaces of tunnels to provide reinforcement of the excavated area, using robotic spraying rigs. This continuous process of excavating, mucking out, spraying concrete, allowing it to cure, breaking out and excavating further, generates a large quantity of hazardous airborne dust which, if inhaled, exposes workers to respiratory health risks. There is usually a particular risk of breathing in the silica dust (respirable crystalline silica, or RCS) during the breaking out of the concrete and excavation of the soil, as well as during spraying operations. Any workers – noise men, pump operators, backfillers, surveyors, inspectors, engineers – who are in the tunnel during the various tunneling stages are at risk.

Exposure control issues for Crossrail

The vast Crossrail project is split into many different sections of work, operated by different contractors, and this is true of the SCL tunneling operations. Each contractor is primarily responsible for selecting and implementing control measures for their SCL works, and the requirements vary depending on the scope and specifics of the different tunnels. Crossrail has the overarching responsibility to ensure the measures are implemented correctly and meet the requirements set out in 889164 (the tunneling standard) and the relevant health and safety legislation. There has to be a high level of cross-party cooperation and coordination between client, contractors, subcontractors and specialist consultants.

In some of these tunnel works, air monitoring showed that exposure to RCS during the sprayed application of the SCL was fairly low, but exposures were higher during the excavation phases. In other areas total inhaled dust presented a bigger exposure risk where levels could be in excess of five times the Workplace Exposure Limit (WEL) for sprayers. At the face of SCL works, other risks – for example the structural capability of newly sprayed SCL prior to curing, and noise – also have to be considered when thinking about dust control solutions.

The nature of tunneling means that engineering controls can be difficult to implement. An additional issue specific to this project was that the established ventilation set up was to provide fresh air to the tunnels – many of which were originally constructed as launch or receptor caverns for tunnel boring machines (TBMs) – and not specifically to control the dusts from the SCL operations. This meant that although the ventilation had been designed to 889164 requirements and had the detached effect of removing airborne contaminants, it couldn’t be assumed that it was doing so in the most effective way.

As with all large engineering and construction projects, the sheer number and range of workers requiring access and therefore protection was a consideration. Those at the sharp end – during excavation works and at the spraying face – would clearly be at most risk of dust exposure, but many other workers would also require access too.
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