European Commission

Guidance for National Labour Inspectors on addressing risks from worker exposure to respirable crystalline silica (RCS) on construction sites

Senior Labour Inspectors' Committee (SLIC)
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Employment, Social Affairs and Inclusion

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PART 1

1.1 Background to SLIC Long Latency Interest Group

The Senior Labour Inspectors' Committee (SLIC) recognised the need to redress the balance between **Occupational Safety** and **Health** and agreed in spring 2014 to support work on respirable crystalline silica (RCS) via its Working Group on Chemicals (SLIC CHEMEX WG). RCS is widely encountered in workplaces in EU countries, across a number of industry sectors, and is known to have serious health risks, mostly developing over many years.

National Labour Inspectorates (NLIs) were asked to express interest in this work, which has a focus on the levers available to NLIs and a primary objective of sharing good practices. Representatives of 7 NLIs (See Appendix 1) formed the RCS sub-Working Group (RCS sub-WG) in September 2014, reporting to SLIC CHEMEX WG. SLIC Plenary approved this guidance in May 2016 and the development of complementary inspector training materials.

To confirm the controls advised, the sub-WG considered some key research studies on the occupational exposures associated with the tasks covered, and assembled relevant data in a 'RCS Reference Table Exposures in Construction'. This may be of interest to occupational hygienists and is available via the SLIC Secretariat.

Comments, or suggestions, on the guidance should be directed to CHEMEX WG, via national KSS focal points.

1.2 Purpose and structure of the guidance

This guidance document developed for NLIs aims to increase inspector confidence to address and regulate RCS risks, thereby enhancing the effectiveness of NLI interventions on **construction sites**. Construction workers' health is just as important as their safety and the key ambition of the SLIC CHEMEX WG is to provide guidance which will support NLIs in tackling RCS health risks as they would safety risks (e.g. from working at heights), on Europe's construction sites.

Construction activities are the focus of this guidance:

- due to their widespread presence across Member States (MS),
- because of their high risks both in terms of potential for exposure (personal) and the large number of workers potentially exposed (societal), and
- because this sector is not a participant in the European Social Dialogue Agreement (NEPSI) on Workers' Health Protection through the Good Handling and Use of Crystalline Silica and Products containing it. http://www.nepsi.eu/agreement

This guidance is divided into two parts:

Part 1 provides background information on RCS, health risks, the regulatory framework and control measures.

Part 2 provides NLIs with a number of RCS task sheets. These have been developed for NLIs to provide basic guidance on various site activities, prioritised for their RCS exposures.

In the Task Sheets, possible 'Actions' are recommended for NLIs where they may encounter a potential high, medium or low RCS health risk, depending on the extent and level of controls implemented by the employer at the time of inspection.

Important Note: National arrangements
The NLI will always have discretion on the level of action considered appropriate to the site circumstances, as it is fully recognised that methods of enforcement vary from one country to another, sometimes going beyond EU Directive minimum requirements described in this guidance. The choice of enforcement regime depends on the legal/cultural background of each country. The information in this guidance will still be relevant when RCS is included in Annex I and Annex III of the Carcinogens and Mutagens Directive (CMD).

1.3 What is RCS?

- Silicon (Si) is the second most common element in the Earth's crust (oxygen is the most common). The compound silica, also known as silicon dioxide (SiO_2), is formed from silicon and oxygen atoms.
- Silica occurs in 3 forms: crystalline, microcrystalline (or cryptocrystalline) and amorphous (non-crystalline).
- Crystalline silica exists in 7 different forms (polymorphs), depending upon the temperature of formation. The main 3 polymorphs are quartz, cristobalite, and tridymite. Quartz is the second most common mineral in the world.
- Crystalline silica is found widely in stone, rocks, sands and clays.
- Construction products often contain crystalline silica (see Table 1 below) and in many situations it is difficult to eliminate or substitute.

Table 1 – Crystalline Silica concentrations in common materials	
1. Silica containing composites, e.g. manufactured stone	Up to/ or > 90%
2. Sandstone, gritstone, quartzite, flint	More than 70%
3. Concrete, mortar	25% to 70%
4. Shale	40% to 60%
5. China stone	Up to 50%
6. Tile	30% to 45%
7. Slate	Up to 40%
8. Granite	Up to 30%
9. Brick	Up to 30%
10. Ironstone	Up to 15%
11. Basalt, dolerite	Up to 5%
Source *Material 1* - https://www.osha.gov/Publications/OSHA3768.pdf *Materials 2-10* - http://www.hse.gov.uk/pubns/guidance/cnseries.htm *Silica advice sheet for managers – CN0*	

1.4 Why should NLIs address RCS?

- RCS is one of the substances with the highest respiratory health risk to construction workers, together with asbestos.
- The cutting, breaking, crushing, drilling, grinding, or abrasive blasting of silica-containing materials produces airborne dust containing a range of sizes of crystalline silica particles, some of which can be inhaled.

- Inhaling RCS can lead to serious health effects such as silicosis, Chronic Obstructive Pulmonary Disease (COPD) and lung cancer.
- Inhalable crystalline silica approximates to the fraction of airborne material that enters the nose and mouth during breathing and is therefore potentially available for deposition into the respiratory system. Larger particles are prevented from being inhaled into the lungs by filtering by the nose and coughing.
- The finest particles are those that are able to penetrate to the gas exchange region of the lungs where they cause damage. These particles are RCS and are invisible under normal lighting conditions.

Key information for Inspectors

- **Most dust-generating construction activities where crystalline silica-containing materials are present produce a mixture of visible and respirable particles, and the latter may not be visible under normal lighting.**
- Visible dust can be used as a general guide for improving dust suppression efforts. If you see visible dust being generated, emissions of RCS are probably too high.
- Measures that control tool-generated dust at the source usually reduce all types of particle emissions, including respirable particles.
- You cannot rely only on visible dust to assess the extent of the crystalline silica hazard. There may be airborne respirable dust present that is not visible to the naked eye.
- It can take up to 24 hours for RCS dust created by very high energy tools (e.g. cut-off saw) to settle, so it remains an invisible risk during that time.
- General Rule: If dust containing crystalline silica is visible in the air, it is almost always at a level more than any of the existing occupational exposure limits for RCS in the European Union and is potentially harmful to health.
- **Workers' respiratory health can be at risk if the dust they breathe in over a typical day's work, equals the amount of RCS shown next to the 2 cent coin below, and still is potentially at risk (albeit lower) following exposures to amounts smaller than this.**

(Source GDWW, B)

(Further information can be found in Section 1.15)

1.5 Health risks

Exposure to RCS can lead to:

- Silicosis
- COPD
- Lung cancer
- Other health effects

Silicosis and COPD

Silica exposure at work can cause both silicosis and COPD.

Both these breathing conditions cause shortness of breath and cough, and difficulty with breathing on exercise. For example, things that a worker used to be able to do, like climb stairs and play football with their children, may now cause them to be short of breath. Strenuous work tasks also may start to get harder to perform. However, early in the development of each of these two conditions, workers may have no breathing problems at all.

For example, a worker may be developing simple silicosis (usually after many years of exposure to RCS) whilst being exposed to silica at work, but feel well and have no breathing complaints. It is because of this that x-rays are used to identify this condition early. By the time breathing problems have developed, silicosis may be at a more advanced stage. Workers with silicosis may also eventually cough and develop weight loss, and may also develop tuberculosis. It is not really understood why there is a link with TB. It is assumed that the immune system is weakened by silicosis, and then workers are more likely to get TB.

The situation with COPD is slightly different. Whilst this also gets worse gradually over time, workers may again feel well and have no breathing complaints in the early part of their illness. Here, breathing tests show that the lungs are losing capacity. When COPD becomes more established, then breathing problems, cough, wheeze and lots of chest infections become more common.

This is why a combination of an x-ray and breathing tests are often used to find these problems early in workers. Both tests are needed in combination.

It is important to appreciate that silicosis can develop at or below Occupational Exposure Limit Values (OELVs) set in some MS[1, 2]

Lung Cancer

Workers exposed to RCS (for instance as in Figure 1), are at an increased risk of developing lung cancer. In 2009 (Monograph 68) IARC stated that "crystalline silica inhaled in the form of quartz or cristobalite from occupational sources" is carcinogenic to humans (Group 1). Again, in the early stages of lung cancer RCS-exposed workers may not experience any symptoms and they may feel perfectly well. As the cancer progresses and grows larger, it will start to cause problems like cough, shortness of breath and chest pain. Lung cancer is normally identified first only when the worker complains of a symptom to a doctor, and they are then sent for an x-ray.

This IARC statement is consistent with the previous recommendation made /published by SCOEL in 2003, when it affirmed that "the main effect in humans of respirable silica dust is silicosis, there is sufficient information to conclude that the relative risk of lung

cancer is increased in persons with silicosis … therefore preventing the onset of silicosis will also reduce the cancer risk …". At present the carcinogenic role of silica in the absence of silicosis is debated.[3]

Other health risks

Workers exposed to RCS are also at an increased risk of tuberculosis, kidney disease, cardiovascular diseases[4] and diseases of the immune system such as scleroderma, rheumatoid arthritis and systemic lupus erythematosus; although these are quite uncommon.

Figure 1: Worker at risk of high RCS exposure. Arrow points to worker (Source HSA, IE)

1.6 Legal framework

The Framework Directive 89/391/EEC introduces measures to encourage improvements in the safety and health of workers at work. It requires the employer to evaluate all the risks to the safety and health of workers and implement measures which assure an improvement in the level of protection afforded to them. The employer shall, amongst other things:

- take into consideration the worker's capabilities as regards health and safety when he entrusts tasks to workers;
- consult workers on the introduction of new technologies;
- designate worker(s) to carry out activities related to the protection and prevention of occupational risks;
- take the necessary measures for first aid, fire-fighting, evacuation of workers and action required in the event of serious and imminent danger;
- keep a list of occupational accidents and draw up, for the responsible authorities, reports on occupational accidents suffered by their workers;

- inform and consult workers and allow them to take part in discussions on all questions relating to safety and health at work;
- ensure that each worker receives adequate safety and health training; and
- provide health surveillance for workers according to national systems.

Risk elimination, as shown in the hierarchy of controls table below, is the first general principle for prevention, as provided for by the Framework Directive 89/391/EEC. Silica substitution should be encouraged when possible, but is difficult to consider in the construction industry due to its presence in numerous basic materials used.

Hierarchy of Controls
▪ **Elimination** e.g. design and use of appropriate work processes, systems so that the operation giving rise to the exposure is no longer necessary, such as using total enclosure or pre-cut materials. ▪ **Substitution** e.g. replacement of high quartz content material A with low (or no) quartz content material B which is less hazardous. ▪ **Engineering Controls** e.g. installation of local exhaust ventilation unit, water suppression. ▪ **Administrative Controls** e.g. restricting access to a controlled work area; provision of training, instruction and information. ▪ **PPE** e.g. use of half-mask respirator, as a last resort.

Hazardous chemical agents such as RCS are subject to the requirements under Council Directive 98/24/EC (CAD) on the protection of the health and safety of workers from the risks related to chemical agents at work. CAD states that employers have a duty to determine whether any hazardous chemical agents are present in the workplace, to eliminate these and, where this is not possible, to assess the risks to which they may give rise.

RCS is classified in some Member States as a carcinogen and NLIs need to check their national position. As previously mentioned, crystalline silica inhaled in the form of quartz or cristobalite is classified by IARC as a 'Group 1 human carcinogen'. It is not currently included within the scope of the Carcinogens & Mutagens Directive 2004/37/EC (CMD), but the position is undergoing discussion (see Important Note on Page 4).

Under Article 3 of Directive 98/24/EC, the Commission can set OELVs, either as indicative or binding limit values. These represent the maximum time-weighted average concentration of an airborne contaminant to which a worker can be exposed, measured in relation to a specified reference period, normally eight hours.

There is currently no indicative or binding OELV for RCS at the EU level and national OELVs, where they exist, vary. The OELVs for crystalline silica in MS range from 0.05-0.15 mg/m^3 as respirable fractions. Most countries have 0.1 mg/m^3 as the OELV. A useful source of current OELVs for RCS in different Member States can be viewed via the GESTIS - Substance Database http://limitvalue.ifa.dguv.de/ Some recent research reports indicate that the OELV should be in the range of 0.025-0.05 mg/m^3 to better protect workers. With this in mind, additional control measures should always be considered.

Benchmark for control of exposures - as low as possible

Based on the OELVs presented above, the main focus of this guidance is on the control of exposure; keeping in mind the health risks and current discussions at EU level, exposure should always be kept as low as possible.

However, in keeping with a December 2012 opinion (Doc. 2011/12) agreed by the EU tripartite (government-employer-union) Advisory Committee on Safety and Health at Work (ACSHW), this guidance document, in particular in Part 2, **will refer to a benchmark of 0.1 mg/m³ over a 8 hr time weighted average**.
http://ec.europa.eu/social/main.jsp?langId=en&catId=148&newsId=2536&furtherNews=yes (Further information can be found in 1.15 Useful Website links)

1.7 Risk assessment

The employer must be in possession of an assessment of the risk in accordance with Article 9 of Directive 89/391/EEC. This assessment shall be kept up-to-date, particularly if there have been significant changes or if the results of health surveillance show it to be necessary.

The employer is obliged to consider the hazardous properties of any chemicals, the information on health and safety provided by the supplier, the level, type and duration of any exposure, the circumstances of the work, any OELVs, and the effect of preventive measures. (While RCS is a process-derived substance and therefore no safety data sheet (SDS) is available, information concerning the quartz content of building materials used should be available from the supplier). Furthermore, conclusions have to be drawn from any monitoring or health surveillance data.

During inspection activities, inspectors should establish the degree to which the employer has met their responsibilities to make a risk assessment, and put in place the measures necessary for the safety and health of workers. It is recommended that the employer does this through an action plan for the elimination or control of risks.

In relation to RCS, the employer shall have:

- commissioned, organised and coordinated the assessment
- appointed competent people to make the assessment
    - the person carrying out the risk assessment can be:
      - the employer themselves
      - workers designated by the employer
      - external assessors and service providers if there is a lack of competent personnel in the workplace
    - people can demonstrate their competence by showing that they have the following abilities:
      - an understanding of the general approach to risk assessment
      - the capacity to apply this understanding to the workplace
      - the ability to identify situations where they would be unable to adequately assess the risk without help, and be able to advise on the need for further assistance
- consulted workers' representatives on arrangements for the appointment of those who will make the assessment

- provided the necessary information, training, resources and support to assessors who are the employer's own workers
- ensured adequate coordination between assessors (where relevant)
- involved management and encouraged the participation of the workforce
- determined the arrangements to be made for reviewing and revising the risk assessment
- ensured that the risk assessment is documented in a suitable form according to national law and practice
- ensured that the preventive and protective measures take account of the results of the assessment
- monitored the protective and preventive measures to ensure that their effectiveness is maintained
- informed workers and/or their representatives of the results of the assessment and of the measures introduced (making the records available to them).

Further to the employer's risk assessment actions above, during inspection activities the inspector should consider, based on site observations and this guidance document, the following factors in determining if the employer has adequately addressed the RCS risk on site:

Elimination or substitution	Has the employer considered elimination or substitution e.g. process, use of pre-cut materials, or substituting with materials with no crystalline silica content, changing to low quartz materials?
Task	What work is creating the dust and how much energy is involved? The higher the energy the greater the risk. Can the task be done in another way that reduces the risk?
Location	Where is the work taking place? The more enclosed a space the higher the exposures will be **unless a suitable means of extraction is used;** this has an impact on the controls required e.g. RPE
Duration	How long is the task taking? Generally, the longer the task the higher the exposure.
Frequency	How frequently is the task done? Are people likely to be regularly exposed doing other similar tasks?
People	Who is being exposed? Is it just the worker doing the task or are others being exposed?
Controls	Are effective controls in place and in line with the **hierarchy of controls?**
Monitoring of Controls	Is there a system in place to monitor controls e.g. supervision, personal air sampling?
Other OSH issues	Does application of appropriate controls introduce other OSH issues e.g. ladder work with on-tool extraction may increase the risk of falls?

Exposure assessment

According to Article 6 of CAD the employer should clearly demonstrate that adequate prevention and protection have been achieved. In practice they should have assessed

the level of exposure to RCS, in particular in relation to any OELV for RCS. To do this the employer can have measurements taken or make use of other means of evaluation, like models that predict the occupational exposure. Unless the employer clearly demonstrates this, the inspector may make arrangements for personal air sampling and analysis to be carried out in order to determine if exposure to RCS after controls have been implemented is below any relevant OELV.

Where air monitoring is considered necessary, the European Standard EN 689 gives guidance for the assessment of exposure to chemical agents in workplace atmospheres. It describes a strategy to compare workers' exposure by inhalation with relevant limit values for chemical agents in the workplace and a measurement strategy in air is also considered.

1.8 Elimination and substitution

Elimination is the process of removing the hazard from the workplace. As mentioned previously, risk elimination is the first principle in the hierarchy of controls but is difficult or impossible to achieve in the construction industry due to the presence of quartz in numerous basic materials used. However, the work should be organised in such a way that the risk is eliminated for those workers not directly involved in the work e.g. restricting access to work areas where high-risk tasks resulting in RCS exposures are carried out. This can be achieved through good organisational measures and ensuring adequate controls are in place at the source of exposure.

Risk elimination or reduction measures would include, for example, using the right size of building materials so less cutting preparation is needed or a different method of work e.g. a direct fastening system.

Substitution should be encouraged when possible and examples of this in the construction industry may include using plastic kerbs rather than concrete kerbs and replacing high quartz content materials with lower quartz content materials. Substitution is especially important for sandblasters, where the abrasive blasting is difficult to control from an engineering perspective. The most severe silica exposures occur in abrasive blasting when silica-containing blasting material is used. Eliminating the silica-containing blasting material by replacing it with a non-silica-based alternative can reduce RCS exposures. There are many possible substitutes for silica in abrasive blasting, including those listed below.

▪ Aluminum Oxide ▪ Aluminum Shot ▪ Ambient Polycarbonate ▪ Apricot Pits ▪ Calcium Car ▪ Corn Cobs ▪ Cryogenic Polycarbonate ▪ Emery Garnet	▪ Glass Beads ▪ Melamine Plastic ▪ Novaculite ▪ Olivine (Magnesium Iron Silicate) ▪ Polycarbonate ▪ Silicon Carbide ▪ Stainless Cast Shot ▪ Stainless Cut Wire	▪ Steel Grit ▪ Steel Shot ▪ Urea Plastic ▪ Walnut Shells ▪ Wheat Grain ▪ White Aluminum Oxide ▪ Zircon
Source: https://www.osha.gov/dsg/etools/silica/protect_against/protect_against.html (with the exceptions of Olivine and Calcium carbonate which are known to be widely used).		

The task sheets in Part 2 of this guidance provide other examples of risk-reduction measures which should be considered by the employer at the design stage of a job.

1.9 Engineering controls

The technical means of controlling exposure to RCS dust are well-known and significantly reduce the airborne concentration of crystalline silica dust. The control options include ***water suppression*** and local exhaust ventilation (LEV) such as **on-tool extraction**.

Water Suppression

Water suppression techniques enable damping down of dust clouds. Water is directed on to the tool cutting point via the covering shroud or hood. Water flow can be controlled, allowing management of the water volume supplied in line with manufacturer's instructions. In the absence of a prescribed rate in the manual, studies[5] show that a minimum water flow of about 0.5 litres/minute is required to optimise dust suppression e.g. an 8 litre container/bottle/tank would be used in about 16 minutes. Low flow rates will reduce dust suppression; very much higher flow rates do not improve dust suppression but increase the need to refill the container/tank/bottle more often. A water suppression system (See Figure 2) consists of:

- A water source e.g. tank with pump;
- A strong flexible hose;
- A tap/valve for adjusting the water flow;
- A connection to the tool.

Figure 2 photographs showing water suppression system: (source HSE, GB)

During a site inspection, appropriate action taken by the inspector should be considered, in line with their national legislation and regulatory framework, if the following is observed:

- Lack of correct pressure/low water flow rate;
- Blocked spray jets;
- Inadequate supply of water for all of the work;
- Damping areas only before work or pouring water from a container.

On-Tool Extraction

On-tool extraction removes dust as it is being produced. It is a type of LEV system that fits directly onto the tool. This 'system' consists of several individual parts – the tool, captor hood, extraction unit and tubing.

The **captor hood** is the most important part of the LEV system (See Figure 3). It is often manufactured as part of the power tool but it can also be retro-fitted to existing equipment. Poor design of, or damage to, the hood, will significantly affect the control of dust.

Figure 3 Grinder with on-tool extraction (Source HSE, GB)

The **extraction unit** is like an industrial vacuum. It is a portable unit and also an important part of the LEV system. The extraction unit removes the dust from the captor hood, filters it and then stores it for safe disposal. It is important that the extraction unit is to the correct specification for silica i.e. M (Medium) or H (High) class unit. The extraction units are marked with a special label (see Figure 4 below).

Figure 4 Label on M and H class extraction units (Source HSE, GB)

During a site inspection the inspector should consider appropriate interventions, in line with their national legislation and regulatory framework, if the following is observed:

- Poor physical condition of the components, particularly the hoses/tubing and connections e.g. any damage/presence of tape; heavy /excessive dust contamination on the equipment particularly the hood/shroud and tubing; connections are not secure;

- The equipment low-flow alarm is activated when the equipment is used (Note: Type M and H class equipment should be fitted with an audible alarm which triggers when there is a low air velocity (i.e. <20m/s) in the tubing);
- Significant visible dust generated (e.g. large dust clouds) when the tool is used. Some dust is expected but not large constant clouds! (Note: If this occurs for some equipment it may be due to poor positioning of the hood/shroud).

1.10 Administrative controls

Administrative controls include adopting safe work practices and providing appropriate training, instruction or information to reduce the potential for harm and/or adverse health effects to workers from exposure to RCS.

This would also include having appropriate supervision to ensure the correct dust control measures provided are being used correctly and that safe work practices are being followed. Safe work practices may involve the employer limiting the number of people near the work and/or rotating those doing the task and having good personal hygiene and housekeeping practices.

1.11 Personal protective equipment (PPE)

The use of PPE is the last line of defence in the hierarchy of control. When there is still a risk present, PPE is necessary. The use of PPE can be burdensome to workers and should be kept to a minimum; therefore the organisation of the work is critical.

Often respiratory protective equipment (RPE) is an essential part of silica dust control, in addition to engineering controls. Water suppression and LEV systems are not fully reliable and even when functioning effectively they do not eliminate all silica dust. The residual dust concentrations will be variable and unpredictable, so additional personal control will be necessary in many situations [i.e. RPE]. The task sheets presented in Part 2 of this guidance document outline the recommended controls for silica in various construction site activities.

Respirators (filtering devices) are available in a range of styles, either as tight-fitting face-pieces (masks) or loose-fitting face-pieces (hoods/helmets). Disposable and re-usable half-mask respirators (both tight-fitting devices) are generally used on construction sites (See Figure 5). Powered hoods/helmets and full-face respirators may also be worn occasionally. Air-line blasting helmets should be worn for abrasive grit blasting.

Figure 5 Re-usable half-mask respirators and FFP3 (Source HSE, GB)

EN standard 529 provides recommendations for the selection, use, care and maintenance of RPE and also includes information on protection factors. When selecting RPE the employer must ensure it is not only adequate but suitable for:

- The individual worker
- The task they are doing
- The environment in which they are working.

Where there is exposure to RCS, the RPE selected should be of a type which gives protection at least equivalent to that of an FFP3 respirator. However, the actual device selected will depend upon the nature of the task, the environment and the wearer (In some case a higher degree of protection may be required). In some MS a fit test is required for a tight-fitting mask, to check it matches the wearer's face and seals adequately. The fit test may be qualitative (based on the wearer's subjective assessment by sensing a test agent), or quantitative (measured using specialised equipment) (See Figure 6). Workers must be clean-shaven to get an effective seal to the face with a tight-fitting mask. Long hair or other facial features can interfere with the seal. The RPE equipment must be CE marked to ensure it has met the minimum legal requirements for its design.

Figure 6 Qualitative and Quantitative fit testing (Source HSE, GB)

Table 2 details the types of respirator, filter and fit test requirements (if required).

Respirator type	Filter Classification	Fit Test (if required by MS)
Disposable half mask	FFP3	Yes
Reusable half mask	P3	Yes
Full face mask	P3	Yes (Quantitative test only)
Powered full face mask	TM2P3	Yes (Quantitative test only)
Powered hood/helmet	TH2P3	No
Airline blasting helmets*	(no filter)	No

Table 2: Respirator types for protection against RCS

* The airline blasting helmet is a specialised/complex form of RPE and will require the provision of an air compressor and breathing air filter unit. This type of RPE for example, will normally be used on larger stone-cleaning projects. Use will require

specialised training. There are 4 types, with classification ranging from 1B-4B. Protection factors range from 10-40. For stone cleaning work a 4B classification is advised.

As noted above, fit testing is required in some MS for each type of tight-fitting mask used. Repeat fit tests will also be required where there are significant changes to the facial characteristics of the individual wearer, e.g. significant weight gain or loss, scarring or injury around the seal area of the RPE or dental changes; or the wearer complains of discomfort.

Disposable masks [filtering facepiece (FFP) respirators] should be replaced in accordance with manufacturer's instructions. Many of these disposable masks are 'single shift' products and so should not be used for more than a single day. Other masks have cleanable face seals, making them suitable for limited re-use if kept in a good condition. Products which are suitable for limited re-use will be marked "R", while those which are for single use only will be marked "NR".

Particle filters for half- or full-face masks should be renewed frequently, dependent on use, in accordance with manufacturer's instructions. As a guide, filters will require changing when:

- Damaged or visibly contaminated
- When the wearer experiences increased breathing resistance
- Where an expiry date marked on the filter has passed

Other factors are also important to obtaining protection from RPE. Wearers should be properly instructed, trained and supervised on the correct use and maintenance of the RPE. RPE can be compromised if other PPE is worn that may interfere with it. Most importantly, respirator fit should be checked every time the RPE is worn, to ensure that it is correctly fitted.

Options such as Helmets/Hoods which are not tight-fitting (and do not require a fit test) are available for workers who have beards or are unable to obtain an adequate fit with other mask types. Models incorporating head and eye protection can also be selected. These should have a TH2 classification. (See Table 2 and Fig 7).

Figure 7 Powered helmet (Source HSE, GB)

During a site inspection for RPE, the inspector should consider appropriate interventions, in line with their national legislation and regulatory framework, if the following is observed:

- RPE is not CE marked;
- RPE gives inadequate protection against the anticipated exposures e.g. P1 filter being used;
- RPE is not suitable for the work/environment;
- RPE does not fit the wearer – e.g. no/inadequate face-fit testing in countries where this is a requirement;
- Worker has stubble or a beard or is wearing other PPE that affects the face-seal on a tight-fitting mask;
- RPE is not properly worn – loose/twisted straps;
- RPE is not stored, maintained or cleaned properly; and
- Worker is not properly trained.

1.12 Health surveillance

Health surveillance is a system of on-going health checks of workers liable to be exposed to substances hazardous to health, such as RCS. **The approach to health surveillance varies in MS and further referral to national legislation on this matter is advised**. The information below is for guidance only and based on some MS approaches.

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The risk assessment, undertaken by the employer (taking into account any exposure monitoring), should demonstrate when and where there is a need to introduce health surveillance for employees.

For example, a health surveillance programme for workers should be established:

- when there is still a risk to health from RCS exposure, even after the implementation of all reasonable precautions;
- where there is reliance on RPE/PPE as a control measure;
- in situations where workers are carrying out most of the tasks referred to in this guidance, as RPE is also required as a control measure, in most cases.

It must be remembered that Health Surveillance cannot replace the controls put in place to prevent exposure to RCS, but is additional and complementary to it and provides a means of monitoring their adequacy.

The objectives of health surveillance in those exposed to RCS are to:

- detect ill-health effects at an early stage; provide an opinion on fitness to work with RCS;
- provide data to help employers evaluate health risks so they can introduce better controls to improve worker protection;
- highlight lapses in workplace control measures, therefore providing invaluable feedback to the risk assessment; and
- give an opportunity for workers to discuss any health concerns relating to RCS exposure.

Suitable health surveillance

A health surveillance programme for those exposed to RCS would include the following measures:

- Baseline assessment includes questionnaires, lung function tests and consideration of chest x-rays for comparison with future chest x-rays.
- The on-going health surveillance programme would include periodic chest x-rays as well as questionnaires and lung function tests. As chest x-rays carry some risks associated with the use of ionising radiation, their use always needs to be justified on health grounds, even though the actual dose of radiation required to carry out a single chest x-ray is very low. The competent person should advise on the frequency of chest x-rays.
- The competent person must explain the test results to the individual and report to the employer on the worker's fitness to work. Workers with early silicosis are often able to work normally, but they should be assigned to different tasks, with no exposure to silica dust.
- The competent person also needs to interpret any health trends in workers under health surveillance. This may drive a need to revise the risk assessment and implement improvements in control measures.

The UK HSE has published guidance on Health surveillance 'Health surveillance for those exposed to respirable crystalline silica (RCS) supplementary guidance for occupational health professionals (amended January 2016)'

http://www.hse.gov.uk/pubns/priced/healthsurveillance.pdf

Action on detection of an adverse health effect or silicosis

It is essential that, where health surveillance shows that a worker's health is being adversely affected, the employer should take action, including:

- reviewing the risk assessment and, if necessary, modifying risk control measures;
- arranging a medical examination of the worker concerned;
- transferring the worker to other work where there is no RCS exposure, on the advice of a competent advisor;
- medical assessment of all other workers who have been similarly exposed to RCS, on the advice of a competent advisor;
- arranging for a suitably-qualified person to explain results and any necessary actions to the worker(s) concerned.

During a site inspection where health surveillance is an issue, the inspector should consider an appropriate intervention, in line with their national legislation and regulatory framework, if the following is observed:

- No or inadequate health surveillance, where health surveillance would be appropriate.
- No or inadequate action taken by the employer following the report of an adverse health effect.

1.13 Good hygiene and housekeeping measures

Good personal hygiene and housekeeping practices support engineering and other risk controls by preventing re-suspension and spread of dust from surfaces or contaminated clothing. The key requirements are:

- Changing Facilities
  - These should be in line with national requirements. Suitable changing facilities should be provided when PPE is used or where outdoor clothing could become contaminated with substances hazardous to health e.g. RCS. Suitable storage for any PPE is also required.
- Uncontaminated areas for eating and drinking
  - Workers should not eat, drink or smoke in areas contaminated by hazardous substances.
- Washing Facilities
  - Washbasins which are large enough to wash face, hands and forearms.
  - Warm water, mild skin cleansers and soft paper towels for drying; avoid abrasive cleaners.
  - Pre-work creams to aid washing of dirt from skin and after work creams to replace skin oils.
  - Provision of showers where removal of heavy dust contamination is needed, e.g. demolition activities.
- Cleaning
  - Vacuum equipment with at least dust class M used for dry dust, or wet cleaning methods.
  - Workers should not clean up with a dry brush or using compressed air.

Inspector intervention is likely to be considered, in line with their national legislation and regulatory framework, in the following situation

- Where significant dust is present with a risk of re-suspension.

1.14 Information and training for workers

Training is an important measure in preventing worker exposure to chemical agents including RCS. Risk control methods, technical and prevention measures and work and housekeeping practices can only be effective if workers are carrying them out correctly. It is therefore essential that information, clear instructions and training are provided for workers on:

- The hazards of RCS, including the longer-term health effects and symptom recognition
- Good practice case studies e.g. case studies of affected workers with occupational lung diseases (e.g. Terry the stonemason http://www.hse.gov.uk/lung-disease/case-study-stoneworker-terry.htm)
- When and where silica-containing materials pose a concern (how to recognise typical work activities with possible exposure to RCS)

- How to eliminate or at least control the exposure:
    - Control methods used to control exposure to RCS and dust in general (e.g. water suppression, LEV systems like on-tool extraction, isolation of the process from operator or bystanders by means of distance, enclosure or other method as applicable; good work practices for proper use of machines)
    - Proper use and maintenance of dust-reducing systems (e.g. on-tool extraction)
    - Importance of good housekeeping practices and good personal hygiene measures when working with dust containing RCS (including the safe handling and disposal of collected waste materials)

- The appropriate use, care, maintenance, cleaning and disposal of protective equipment (especially RPE)
- Education should be offered concerning the health surveillance process itself, in order that workers understand why they are undergoing Health Surveillance, and what will happen to them if they are deemed to "fail". These educational interventions should be developed in consultation with workers and their representatives.

Not only workers, but also supervisors, project managers and those involved in the proposal and planning phases of construction should receive training on these topics.

Information and training should be provided in a manner appropriate to the outcome of the risk assessment. This may vary from oral communication to instruction and training for individual workers, supported by information in writing, depending on the nature and degree of the risk revealed by the assessment. In the construction sector, 'Toolbox meetings/talks' are a well-known approach to address certain topics in a concise and often visual way. To be effective, training should be refreshed on a regular basis.

Sometimes engineering controls and work practices cannot provide sufficient control of exposure to RCS and so workers must also wear RPE for protection. Workers should be instructed and trained on the proper use and care of RPE (including the importance of a 'proper' seal if tight-fitting) before using RPE themselves.

During inspections inspectors should check/verify how employers ensure that construction workers receive information, instruction and training. Appropriate inspector intervention should be considered, in line with their national legislation and regulatory framework, if the following is observed during a site inspection:

- Workers are not aware of the risk of being exposed to RCS;
- Workers have no clear instruction and/or training on the use of control measures provided to reduce exposure including work practices and good housekeeping rules;
- Workers are not properly trained on the proper use and care of RPE.

1.15 Further information and resources on RCS

References

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3. Sogl M, Taeger D, Pallapies D, Bruning T, Dufey F, Schnelzer M, Straif K, Walsh L and Kreuzer M. (2012) Quantitative relationship between silica exposure and lung cancer mortality in German uranium miners, 1946–2003. Br J Cancer 107, 1188–1194.

4. World Health Organisation. Chronic cor pulmonale, Report of an expert committee. WHO Tech. Rep. Ser. No. 213, Geneva, 1961.

5. Thorpe A and Ritchie AS. (1999) Measurements of the effectiveness of dust control on cut-off saws used in the construction industry'. Annals of Occupational Hygiene 43 (7) 433-456 ISSN 0003 4878.

International Agency for Research on Cancer (IARC) and World Health Organization (WHO), Silica and some silicates, Volume 68, IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Humans. WHO and IARC, Lyon, 1997. http://monographs.iarc.fr/ENG/Monographs/vol68/mono68.pdf

EN 60335-2-69:2012: Household and similar electrical appliances — Safety — Part 2-69: Particular requirements for wet and dry vacuum cleaners, including power brush for commercial use

EN 529: Respiratory Protective Devices Recommendations for selection, use, care and maintenance.

EN 689: Workplace atmospheres-Guidance for the assessment of exposure by inhalation to chemical agents for comparison with limit values and measurement strategy, 1995, CEN.

EN 481: Workplace atmospheres-Size fraction definitions for measurement of airborne particles, 1993, CEN.

EN 1232: Workplace atmospheres-Pumps for personal sampling of chemical agents-Requirements and test methods, 1997.

Useful website links

The Dutch labour inspectorate has produced a video on the 'dangers of silica dust'	http://www.inspectieszw.nl/publicaties/videos/the-dangers-of-silica-dust.aspx
HSE GB case study	http://www.hse.gov.uk/lung-disease/case-study-stoneworker-terry.htm
UK Health in Construction Leadership Group video	www.healthinconstruction.co.uk
Further information relating to Benchmark for control of exposures	http://europa.eu/rapid/press-release_MEMO-16-1655_en.htm https://osha.europa.eu/hu/themes/dangerous-substances/european-commissions-proposal-carcinogens https://roadmaponcarcinogens.eu/ http://www.efbww.org/pdfs/EFBWW%20policy%20paper%20on%20chemicals%20GB%20FINAL%20FINAL.pdf
NEPSI:	http://www.nepsi.eu/
HSE (GB)	http://www.hse.gov.uk/construction/healthrisks/cancer-and-construction/silica-dust.htm
OSH Wiki	https://oshwiki.eu/wiki/Main_Page
BOHS Breath freely	http://www.breathefreely.org.uk/
IOSH no time to lose	http://www.notimetolose.org.uk/
Construction Dust Partnership	http://www.citb.co.uk/health-safety-and-other-topics/health-safety/construction-dust-partnership/
Dust-Free Working	http://www.dustfreeworking.tno.nl/

Field Code Changed

1.16 Abbreviations used

CAD: Chemical Agents Directive

CE Conformité Européene

CIRCA BC: EU Commission collaborative platform, which offers an easy distribution and management of documents

CMD: Carcinogens and Mutagens Directive

COPD: Chronic Obstructive Pulmonary Disease

DLI, CY: Department of Labour Inspection (Cyprus)

DLI, NL: Dutch Labour Inspectorate (Netherlands)

FFP Filtering Facepiece - number indicates filter type

GDWW, B General Directorate Wellbeing at Work (Belgium)

HSA, IE: Health and Safety Authority (Ireland)

HSE, GB: Health and Safety Executive (Great Britain)

LEV: Local Exhaust Ventilation

MS: Member States

NEPSI: European Social Dialogue Agreement (NEPSI) on Workers' Health Protection through the Good Handling and Use of Crystalline Silica and Products containing it

NLIs: National Labour Inspectors/Inspectorates

OEL: Occupational Exposure Limit

OELV: Occupational Exposure Limit Value

PPE: Personal Protective Equipment

RCS: Respirable Crystalline Silica

RPE: Respiratory Protective Equipment

SLIC CHEMEX WG: Senior Labour Inspectors' Committee Working Group on Chemicals

SLIC: Senior Labour Inspectors' Committee

SWEA, S: Swedish Work Environment Authority (Sweden)

TWA: Time Weighted Average

PART 2

2.0 National labour inspector RCS task sheets

The RCS task sheets have been developed for NLIs, to provide basic guidance on various common work activities that give rise to RCS exposures.

Possible 'Actions' are recommended for NLIs where they may encounter a potential high, medium or low RCS health risk, depending on the extent and level of controls implemented by the employer at the time of inspection. The information in this guidance will still be relevant when RCS is included in Annex I and Annex III of CMD.

Important Note: National arrangements

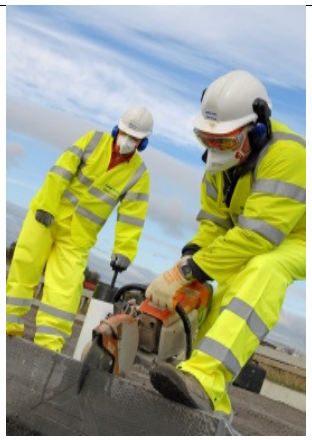
The NLI will always have discretion on the level of action considered appropriate to the site circumstances as it is fully recognised that methods of enforcement vary from one country to another, sometimes going beyond EU Directive minimum requirements described in this guidance. The choice of enforcement regime depends on the legal/cultural background of each country.

NLIs should also be alert for new or novel processes, which may give rise to significant RCS exposures. One such example is the installation of stamped concrete, often called textured or imprinted concrete, that replicates stones such as slate and flagstone, tile, brick and even wood. The installation process can generate significant levels of concrete dust. This work activity has not been included in a Task Sheet as CHEMEX WG is seeking further evidence on RCS exposures to determine whether a Task Sheet providing advice on control measures is appropriate.

Any comments on the Task Sheets or proposals for new ones should be directed to CHEMEX WG, via your national KSS focal points.

2.1 Cutting concrete kerbs, blocks and paving with a cut-off masonry saw

Poor practice – no dust suppression or RPE (HSE, GB)



Good practice – Water suppression and RPE (HSE, GB)

Good practice – Using a low energy solution such as a block splitter (HSA, IE)

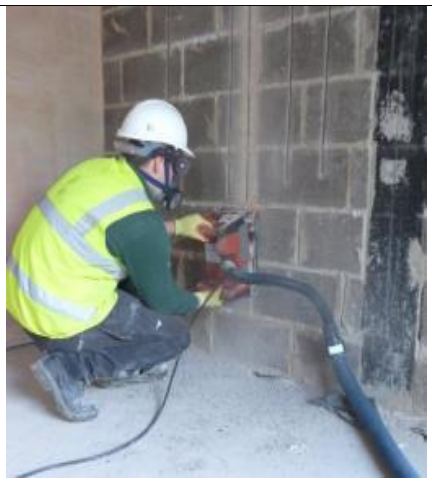
General comment	Using a hand-held masonry saw to cut bricks, concrete blocks and similar materials without dust controls can result in exposures to significant airborne concentrations of RCS. The task requires the control measures in this sheet to be properly applied, to reduce exposure below the benchmark OELV 0.1 mg/m^3.
Recommended controls for RCS dust	▪ Adequate supply of water for water suppression in line with manufacturer's instructions (in the absence of a prescribed rate in the manual, studies show a minimum of about 0.5 litres per minute is required to optimise dust suppression e.g. an 8 litre container would be used in about 16 minutes). [See also page 12 of part 1] ▪ Where possible a low energy cutter should be used ▪ Respiratory Protective Equipment (RPE) e.g. FFP3 disposable masks or half mask respirators with a P3 filter should be used

Possible Actions by National labour Inspector	**High Health Risk** - Consider **immediate action** when all controls missing/ineffective (e.g. stop work, use of Notices, use of administrative fines etc.)
	Medium Health Risk - Consider **action** in situations where one control is missing/ ineffective (e.g. use of Notices requiring action)
	Low Health Risk - No action required where all controls are present and effective

Designing Out Risks	▪ Limit the number of cuts during design/layout ▪ Get material cut off-site and delivered ▪ Use low quartz-containing material ▪ Use lower energy equipment like block splitters ▪ Set up dedicated areas away from other workers for cutting activity
Maintenance of control equipment & respiratory protective equipment (RPE)	▪ Make sure water jets are working ▪ Ensure adequate supply of water & correct flow rate ▪ Replace worn cutting disks to reduce cutting time ▪ Maintain hoses and bottles ▪ Inspect and maintain re-usable RPE, use disposable RPE just once ▪ Workers should be trained in the correct operation of the equipment and use of RPE

2.2 Chasing concrete and raking mortar

Poor Practice – Chasing concrete with no on-tool extraction or RPE (Safer Sites Website, GB)



Good practice – Chasing concrete with on-tool extraction (HSE, GB)

General comment	Chasing concrete and raking mortar can produce very high levels of silica-containing dust. Anyone breathing in this dust cloud will be affected. Those using or very close to the grinder etc. will be particularly at risk. Operating equipment for chasing concrete and raking mortar without dust controls can result in exposure to significant airborne concentrations of RCS. The task requires the control measures in this sheet to be properly applied, to reduce exposure below the benchmark OELV 0.1 mg/m^3.
Recommended controls for RCS dust	▪ On-tool extraction – use a specially-adapted grinder or chaser with on-tool extraction. Select an M or H class extraction unit. ▪ Respiratory Protective Equipment (RPE) e.g. FFP3 disposable masks or half mask respirators with a P3 filter should be used

Possible Actions by National labour Inspector	**High Health Risk** - Consider **immediate action** when all controls missing/ineffective (e.g. stop work, use of Notices, use of administrative fines etc.)
	Medium Health Risk - Consider **action** in situations where one control is missing/ ineffective (e.g. use of Notices requiring action)
	Low Health Risk - No action required where all controls are present and effective

Designing Out Risks	▪ Limiting the need for chasing at the design / lay-out stage ▪ Using a work method that limits / does not need chasing, e.g. use of cable conduits and cable trunking.
Maintenance of control equipment & respiratory protective equipment (RPE)	▪ Make sure the extraction flow rate is right for the work. ▪ Hose connections should be tight-fitting and secure without obvious leaks ▪ Maintain hoses ▪ Carry out thorough examination and testing on extraction system as required ▪ Inspect and maintain re-usable RPE, use disposable RPE just once ▪ Workers should be trained in the correct operation of the equipment and use of RPE

2.3 Cutting roof tiles with cut-off saw

Poor Practice – Cutting roof tiles without control measures (National Federation of Roofing Contractors Ltd, GB)

Good practice – Cutting roofing tiles with a tile cutter (National Federation of Roofing Contractors Ltd, GB)

General comment	Cutting roof tiles can produce very high levels of silica-containing dust. Operating equipment such as a cut off saw to cut roof tiles without dust controls can result in exposure to significant airborne concentrations of RCS. The task requires the control measures in this sheet to be properly applied, to reduce exposure below the benchmark OELV 0.1 mg/m^3.
Recommended controls for RCS dust	▪ Adequate supply of water for water suppression in line with manufacturer's instructions (in the absence of a prescribed rate in the manual, studies show a minimum of about 0.5 litres per minute is required to optimise dust suppression e.g. an 8 litre container would be used in about 16 minutes). [See also page 12 of part 1] ▪ Respiratory Protective Equipment (RPE) e.g. FFP3 disposable masks or half mask respirators with a P3 filter should be used

Possible Actions by National labour Inspector	**High Health Risk** - Consider **immediate action** when all controls missing/ineffective (e.g. stop work, use of Notices, use of administrative fines etc.)
	Medium Health Risk - Consider **action** in situations where one control is missing/ ineffective (e.g. use of Notices requiring action)
	Low Health Risk - No action required where all controls are present and effective

Designing Out Risks	▪ Minimising valleys/using dry valleys ▪ Limiting the number of cuts during design/layout ▪ Use lower quartz-containing material such as natural fibre tiles ▪ Using lower energy equipment like hand-operated tile cutters ▪ Cutting work should be carried out on the ground or on surrounding scaffolding. A dedicated cutting area(s) with scaffold protection should be established at the planning stage before work starts. This area should be the most central/suitable for the work.
Maintenance of control equipment & respiratory protective equipment (RPE)	▪ Make sure water jets are working ▪ Ensure adequate supply of water & correct flow rate ▪ Replace worn cutting disks to reduce cutting time ▪ Maintain hoses and bottles ▪ Inspect and maintain re-usable RPE, use disposable RPE just once ▪ Workers should be trained in the correct operation of the equipment and use of RPE

2.4 Scabbling or grinding concrete floors with hand-held tools

Poor Practice – Using a hand-held scabbler without on tool extraction (David Flynn Ltd, IE)

Good practice – Using a hand-held grinder with on-tool extraction (HSE, GB)

General comment	Scabbling or grinding concrete floors without dust controls can result in exposure to significant airborne concentrations of RCS. The task requires the control measures in this sheet to be properly applied, to reduce exposure below the benchmark OELV 0.1 mg/m^3.
Recommended controls for RCS dust	▪ On-tool extraction – use a specially adapted hand-held scabbler or grinder with on-tool extraction. Select an M or H class extraction unit. ▪ Respiratory Protective Equipment (RPE) e.g. FFP3 disposable masks or half mask respirators with a P3 filter should be used

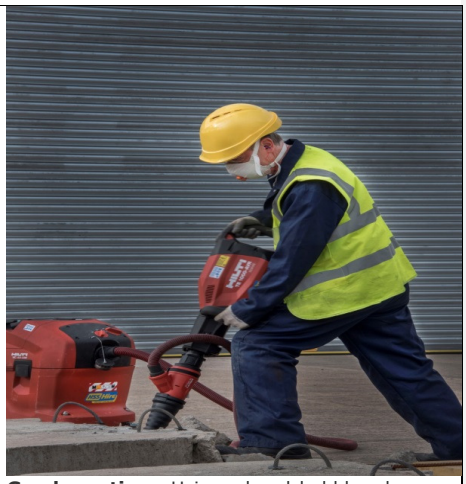
Possible Actions by National labour Inspector	**High Health Risk** - Consider **immediate action** when all controls missing/ineffective (e.g. stop work, use of Notices, use of administrative fines etc.)
	Medium Health Risk - Consider **action** in situations where one control is missing/ ineffective (e.g. use of Notices requiring action)
	Low Health Risk - No action required where all controls are present and effective

Designing Out Risks	▪ Specifying architectural finishes that do not need scabbling ▪ Using (ultra) high-pressure water jetting ▪ Using chemical retarders & pressure washing

Maintenance of control equipment & respiratory protective equipment (RPE)	▪ Make sure the extraction flow rate is right for the work ▪ Hose connections should be tight-fitting and secure without obvious leaks ▪ Maintain hoses ▪ Carry out thorough examination and testing on extraction system as required ▪ Inspect and maintain re-usable RPE, use disposable RPE just once ▪ Workers should be trained in the correct operation of the equipment and use of RPE

2.5 Hand-held breaker in enclosed space (without ventilation)

Poor Practice – Using a hand-held breaker without on-tool extraction (DLI, CY)



Good practice – Using a hand-held breaker with on-tool extraction (HSE, GB)

General comment	Operating equipment such as hand-held breakers without dust controls can result in exposure to significant airborne concentrations of RCS. The task requires the control measures in this sheet to be properly applied, to reduce exposure below the benchmark OELV 0.1 mg/m^3.
Recommended controls for RCS dust	▪ On-tool extraction –Select an M or H class extraction unit. ▪ Respiratory Protective Equipment (RPE) e.g. FFP3 disposable masks or half mask respirators with a P3 filter should be used

Possible Actions by National labour Inspector	**High Health Risk** - Consider **immediate action** when all controls missing/ineffective (e.g. stop work, use of Notices, use of administrative fines etc.)
	Medium Health Risk - Consider **action** in situations where one control is missing/ ineffective (e.g. use of Notices requiring action)
	Low Health Risk - No action required where all controls are present and effective

Designing Out Risks	▪ Limiting the amount of breaking at the design/planning stage ▪ Bursting, crushing, cutting, sawing or other techniques ▪ Remote controlled demolition ▪ Hydro demolition
Maintenance of control equipment & respiratory protective equipment (RPE)	▪ Make sure the extraction flow rate is right for the work ▪ Hose connections should be tight-fitting and secure without obvious leaks ▪ Maintain hoses ▪ Carry out thorough examination and testing on extraction system as required ▪ Inspect and maintain re-usable RPE, use disposable RPE just once ▪ Workers should be trained in the correct operation of the equipment and use of RPE

2.6 Drilling small diameter holes in concrete floors, walls and ceiling

Poor practice – Using Hand-held drill with no on-tool extraction (David Flynn Ltd, IE)

Good practice – Using a hand-held drill with integrated cassette (HSE, GB)

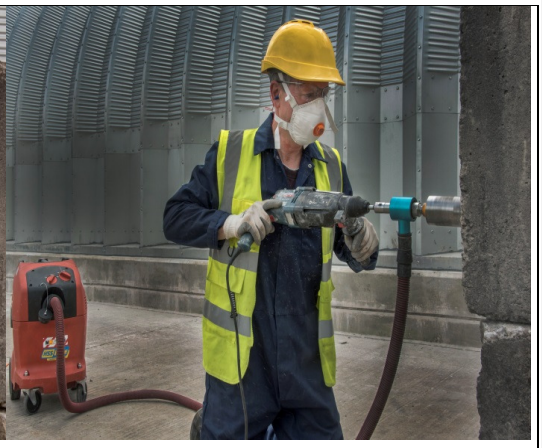
General comment	Operating equipment such as drills can result in exposure to significant airborne concentrations of RCS. The task requires the control measures in this sheet to be properly applied, to reduce exposure below the benchmark OELV 0.1 mg/m^3. Equipment such as drills without dust controls can produce high silica exposures.
Recommended controls for RCS dust	▪ On-tool extraction is optimal–Select an M or H class extraction unit, integrated cassette or generic dust caps. ▪ Where above controls are not available, consider Respiratory Protective Equipment (RPE) e.g. FFP3 disposable masks or half mask respirators with a P3 filter. ▪ RPE will also be needed in addition to on-tool extraction with longer-duration drilling work (greater than 15-30 minutes in one day)

Possible Actions by National labour Inspector	**High Health Risk –** Consider **immediate action (**e.g. stopping the work, use of Notices, use of administrative fines etc.) in more extreme conditions for long duration tasks when all controls are missing/ineffective, including RPE
	Medium Health Risk - Consider **action** in situations where control is missing/ ineffective for short-duration tasks or when both controls i.e. extraction and RPE are missing/ineffective for tasks of long duration i.e.>30 minutes (e.g. use of Notices requiring action)
	Low Health Risk - No action required where all controls are present and effective

Designing Out Risks	▪ Limiting the number of holes during design/planning ▪ Well-designed and maintained equipment significantly reduces dust and lasts longer between replacement and maintenance. Use sharp drill bits designed for concrete. They produce less dust than poorly-maintained bits.
Maintenance of control equipment & respiratory protective equipment (RPE)	▪ Make sure the extraction flow rate is right for the work. ▪ Hose connections should be tight-fitting and secure without obvious leaks ▪ Maintain hoses ▪ Carry out thorough examination and testing on extraction system as required ▪ Inspect and maintain re-usable RPE, use disposable RPE just once ▪ Workers should be trained in the correct operation of the equipment and use of RPE

2.7 Dry coring

Poor Practice – Using hand-held corer with no extraction or RPE (HSE, GB)



Good practice – Dust extraction on the core drill and RPE (HSE, GB)

General comment	Dry coring can only be used on 'softer' materials, e.g. bricks. For 'denser' materials, such as concrete and granite, wet coring must be used Operating equipment such as a coring drill without appropriate dust suppression can result in exposure to significant airborne concentrations of RCS. The task requires the control measures in this sheet to be properly applied, to reduce exposure below the benchmark OELV 0.1 mg/m^3.
Recommended controls for RCS dust	▪ On-tool extraction –Select an H or M class extraction unit. Flow should be at least so high that no dust is visible ▪ Respiratory Protective Equipment (RPE) e.g. FFP3 disposable masks or half mask respirators with a P3 filter should also be used for long duration work greater than 15-30 minutes in one day.

Possible Actions by National labour Inspector	**High Health Risk** - Consider **immediate action** when all controls missing/ineffective (e.g. stop work, use of Notices, use of administrative fines etc.)
	Medium Health Risk - Consider **action** in situations where one control is missing/ ineffective (e.g. use of Notices requiring action)
	Low Health Risk - No action required where all controls are present and effective

Designing Out Risks	▪ Limiting the number of holes during design/planning ▪ Well-designed and maintained equipment significantly reduces dust and lasts longer between replacement and maintenance. Use sharp drill bits. They produce less dust than poorly-maintained bits. ▪ Use compatible equipment
Maintenance of control equipment & respiratory protective equipment (RPE)	▪ Make sure the extraction flow rate is right for the work ▪ Hose connections should be tight-fitting and secure without obvious leaks ▪ Maintain hoses ▪ Carry out thorough examination and testing on extraction system as required ▪ Inspect and maintain re-usable RPE, use disposable RPE just once ▪ Workers should be trained in the correct operation of the equipment and use of RPE

2.8 Wet coring

Photographs not Available

Poor Practice – N/A as core drill will burn- out without water suppression	Good practice – Use of water suppression with the core drill (DLI, NL)

General comment	Wet coring is used for denser or 'harder' silica-containing materials such as concrete and granite. The use of water is necessary to cool the drill, which will burn without the cooling. A positive side effect is the suppression of silica dust. Too little water can harm both the worker and the drill. Operating equipment such as a core drill without appropriate dust suppression can result in exposure to significant airborne concentrations of RCS. The task requires the control measures in this sheet to be properly applied, to reduce exposure below the benchmark OELV 0.1 mg/m^3.
Recommended controls for RCS dust	▪ Adequate supply of water for water suppression in line with manufacturer's instructions (in the absence of a prescribed rate in the manual, studies show a minimum of about 0.5 litres per minute is required to optimise dust suppression e.g. an 8 litre container would be used in about 16 minutes). [Note see also page 12 of part 1] ▪ Respiratory Protective Equipment (RPE) e.g. FFP3 disposable masks or half mask respirators with a P3 filter should also be used in addition to water suppression when work takes place in an enclosed space without suitable ventilation

Possible Actions by National labour Inspector	**Medium Health Risk** - Consider **action** in situations where water suppression is missing/ineffective, or when both water suppression and RPE is missing/ineffective, when task is in an enclosed space for long periods i.e. >30 minutes. (e.g. use of Notices requiring action)
	Low Health Risk - No action required where all controls are present and effective

Designing Out Risks	▪ Limiting the number of holes during design/planning ▪ Well-designed and maintained equipment significantly reduces dust and lasts longer between replacement and maintenance. Use sharp drill bits. They produce less dust than poorly-maintained bits. ▪ Use compatible equipment
Maintenance of control equipment & respiratory protective equipment (RPE)	▪ Make sure the extraction flow rate is right for the work. ▪ Hose connections should be tight fitting and secure without obvious leaks ▪ Maintain hoses and water supply ▪ Inspect and maintain re-usable RPE, use disposable RPE just once ▪ Workers should be trained in the correct operation of the equipment as well as in the correct use of RPE

2.9 Abrasive pressure blasting

Poor Practice – Dry abrasive blasting without water suppression or on-tool extraction (HSE, GB)

Good practice – Wet abrasive blasting i.e. Water suppression with RPE (Note this hearing protection is incorrect! A hard hat and plugs or integrated helmet with hearing protection should be worn which is compatible with the RPE) (GDWW, B)

General comment	One of the main hazards in abrasive pressure blasting is exposure to dust, which in many cases can be harmful, for example, RCS dust. The amount of dust depends on the blasting equipment and blasting material used and material being blasted. RCS dust can be generated by: using abrasives containing crystalline silica (e.g. sand). Note: Quartz containing blasting media are prohibited in some MS or only allowed in certain circumstances. Studies show that blasting surfaces that contain crystalline silica (e.g. concrete, sandstone, bricks), especially dry abrasive pressure blasting, can result in exposure to significant airborne concentrations of RCS. The task requires the control measures in this sheet to be properly applied, to reduce exposure below the benchmark OELV 0.1 mg/m^3.
Recommended controls for RCS dust	▪ Use silica-free abrasive material ▪ Use wet or vacuum blasting methods that generate minimum RCS dust levels ▪ Temporary enclosure should be used for abrasive blasting in the open air for buildings and other fixed structures. Use barriers and curtain walls to isolate the blasting operation. Certain enclosed working places may also need general mechanical ventilation. ▪ Exclusion/restricted zones should be used to protect workers and other persons in the vicinity from exposure to RCS dust. Warning signs should be located so that they are clearly visible before anyone enters the area. ▪ Use appropriate Respiratory Protective Equipment (RPE). RPE will depend on the concentration of RCS, blasting equipment used and length of work. In the case of dry abrasive pressure blasting an effective blasting helmet (i.e. air-fed) must cover the wearer's head, neck and shoulder to protect the wearer from rebounding abrasive material. ▪ Perform clean-up using wet methods or HEPA-filtered vacuuming M or H class to minimize the accumulation of dust. See sheet 2.10

Possible Actions by National labour Inspector	**High Health Risk** - Consider **immediate action** in situations where all controls missing/ineffective; **or** when blaster is protected but other workers have no/ineffective RPE, while working in close proximity to the person blasting; **or** blasting with control at source but no effective RPE - where work is on high silica containing material or abrasive material. (e.g. stop work, use of Notices, use of administrative fines etc.)
	Medium Health Risk- Consider **action** in situations where blasting with effective RPE but no control at source where it is practical to do so and blasting with control at source but no effective RPE (e.g. use of Notices requiring action)
	Low Health Risk - No action required where all controls are present and effective

Designing Out Risks	▪ Use a less hazardous surface preparation method like 'steam cleaning' ▪ Use silica-free abrasive material
Maintenance of control equipment & RPE	▪ Inspect and maintain blasting equipment including hoses ▪ Inspect and maintain re-usable RPE like blasting helmets and air supply ▪ Workers should be trained in the correct operation of equipment

2.10 Removing small rubble, dust and debris

Poor Practice – Removal of rubble using dry sweeping (HSE, GB)

Good practice – Removal of dust using high-efficiency filter vacuum (HSE, GB)

General comment	Site housekeeping is important to avoid the resuspension of deposited dust by cleaning activities and subsequently by regular construction site activities. In particular dry sweeping and use of compressed air can result in high levels of RCS. These levels vary depending upon the location, duration and frequency. Very high levels can be created by prolonged periods of dry sweeping in enclosed spaces. Where practicable, accumulated dust should be removed using High efficiency filter vacuum methods or wet cleaning, to minimize the accumulation of dust. The task requires the control measures in this sheet to be properly applied, to reduce exposure below the benchmark OELV 0.1 mg/m^3.
Recommended controls for RCS dust	▪ Damping down and using a brush, shovel and bucket for minor/small amounts. For regular removal/site cleaning: ▪ Rake, shovel and bucket/wheelbarrow to remove larger pieces in bigger areas ▪ Remove dust using high-efficiency particulate filter vacuum methods (vacuum attachments fitted to an H or M Class extraction unit) ▪ Replace dry sweeping with an industrial dust/water vacuum cleaner or use wet sweeping, removing water and debris with a squeegee. ▪ As much as possible, thoroughly wet the dusty materials or waste before transporting or handling ▪ Covered chutes and skips where needed ▪ Use appropriate Respiratory Protective Equipment (RPE) depending upon location duration and type of work. ▪ Do not use compressed air to clean as this will create dust in the air

Possible Actions by National labour Inspector	**High Health Risk** - Consider **immediate action** when all controls missing/ineffective (e.g. stop work, use of Notices, use of administrative fines etc.)
	Medium Health Risk - Consider **action** in situations where one control is missing/ ineffective (e.g. use of Notices requiring action)
	Low Health Risk - No action required where all controls are present and effective

Designing Out Risks	▪ Limiting waste materials during design/planning ▪ Consider where waste material is created and how frequently it needs removing during risk analysis ▪ Consider general arrangements to stop dust being created in the first place by, for example, using the correct dust controls when making rubble/debris
Maintenance of control equipment & (RPE)	▪ Inspect and maintain vacuum cleaners ▪ Carry out thorough examination and testing on extraction system as required ▪ Inspect and maintain re-usable RPE, use disposable RPE just once ▪ Workers should be trained in the correct operation of the vacuum cleaner, particularly in the handling of dust bags or collector and use of RPE

2.11 Bench-top masonry saw

Poor Practice – No/insufficient water suppression and lack of RPE (HSE, GB)

Good practice – Use of water suppression (shown) and RPE worn by the operator (HSE, GB)

General comment	Operating equipment such as a bench saw without appropriate dust suppression can result in exposure to significant airborne concentrations of RCS. The task requires the control measures in this sheet to be properly applied, to reduce exposure below the benchmark OELV 0.1 mg/m^3.
Recommended controls for RCS dust	▪ Adequate supply of water for water suppression in line with manufacturer's instructions (in the absence of a prescribed rate in the manual, studies show a minimum of about 0.5 litres per minute is required to optimise dust suppression e.g. an 8 litre container would be used in about 16 minutes). [Note see also page 12 of part 1] ▪ Respiratory Protective Equipment (RPE) e.g. FFP3 disposable masks or half mask respirators with a P3 filter should be used

Possible Actions by National labour Inspector	**High Health Risk** - Consider **immediate action** when all controls missing/ineffective (e.g. stopping the work, use of Notices, use of administrative fines etc.)
	Medium Health Risk- Consider **action** in situations where one control is missing/ ineffective (e.g. use of Notices requiring action)
	Low Health Risk - No action required where all controls are present and effective

Designing Out Risks	▪ Get material cut off-site and delivered ▪ Use low quartz-containing material ▪ Use lower-energy equipment like block splitters ▪ Limit the number of cuts during design/layout ▪ Set up dedicated areas away from other workers for cutting activity
Maintenance of control equipment & respiratory protective equipment (RPE)	▪ Make sure water jets are working ▪ Ensure adequate supply of water & correct flow rate ▪ Replace worn cutting disks to reduce cutting time ▪ Maintain hoses and bottles ▪ Inspect and maintain re-usable RPE use disposable RPE just once. ▪ Workers should be trained in the correct operation of the equipment and use of RPE

2.12 Wall sanding

Poor Practice – Use of a pole sander without extraction (HSE, GB)

Good practice – Use of pole sander with extraction (HSE, GB)

General comment	Some wall sanding tasks may result in exposure to significant airborne concentrations of RCS depending on the material sanded and the method and tool used e.g. dry wall sanding with a block sander (different tools can be used for sanding operations: ventilated sander, pole sander, wet sponge and block sander). The task requires the control measures in this sheet to be properly applied, to reduce exposure below the benchmark OELV 0.1 mg/m^3.
Recommended controls for RCS dust	▪ On-tool extraction – Use extracted tools. Select an M or H class extraction unit. Wet sanders and ventilated pole sanders might be an option, and where the above controls are not available use ▪ Respiratory Protective Equipment (RPE) e.g. FFP3 disposable masks or half mask respirators with a P3 filter should be used.

Possible Actions by National labour Inspector	**High Health Risk** - Consider **immediate action** when all controls missing/ineffective (e.g. stop work, use of Notices, use of administrative fines etc.)
	Medium Health Risk - Consider **action** in situations where one control is missing/ ineffective (e.g. use of Notices requiring action)
	Low Health Risk - No action required where all controls are present and effective

Designing Out Risks	▪ Adopt dust-free sanders with on-tool ventilation systems ▪ Reduce the number of workers in the area where sanding operations take place ▪ Use signals to prevent unnecessary workers from entering the area where sanding operations are ongoing
Maintenance of control equipment & respiratory protective equipment (RPE)	▪ Make sure the extraction flow rate is right for the work ▪ Hose connections should be tight-fitting and secure without obvious leaks ▪ Maintain hoses ▪ Carry out thorough examination and testing on extraction system as required ▪ Inspect and maintain re-usable RPE, use disposable RPE just once ▪ Workers should be trained in the correct operation of the equipment and use of RPE

2.13 Sanding concrete floors

Poor Practice – sanding concrete floors without on-tool extraction (GDWW, B)

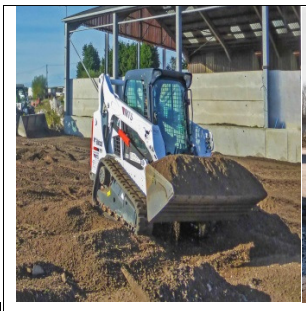
Good practice – sanding concrete floors with on-tool extraction (HSE, GB)

General comment	Studies show that using a grinding machine on concrete floors without control can result in exposure to significant airborne concentrations of RCS. The task requires the control measures in this sheet to be properly applied, to reduce exposure below the benchmark OELV 0.1 mg/m3. Concrete floors can be polished using wet or dry methods. Although each has its advantages, dry polishing is the method most commonly used in the industry today. Wet polishing uses water to cool the diamond abrasives and eliminate grinding dust but it creates slurry that must be removed. A combination of the dry and the wet methods can be used.
Recommended controls for RCS dust	▪ Use on-tool extraction on all grinding (sanding) machines –Select an M or H class extraction unit. ▪ Wet methods are an alternative to dry methods. ▪ Respiratory Protective Equipment (RPE) e.g. FFP3 disposable masks or half mask respirators with a P3 filter should be used.

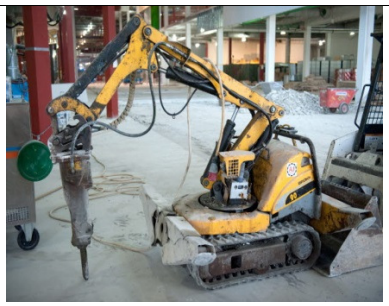
Possible Actions by National labour Inspector	**High Health Risk** - Consider **immediate action** when all controls missing/ineffective (e.g. stopping the work, use of Notices, use of administrative fines etc.)
	Medium Health Risk- Consider **action** in situations where one control is missing/ ineffective (e.g. use of Notices requiring action)
	Low Health Risk - No action required where all controls are present and effective

Designing Out Risks	▪ Reduce the number of workers in the area where sanding operations take place ▪ Use signals to prevent unnecessary workers from entering the area where sanding operations are ongoing
Maintenance of control equipment & respiratory protective equipment(RPE)	▪ Make sure the extraction flow rate is right for the work ▪ Hose connections should be tight-fitting and secure without obvious leaks ▪ Maintain hoses ▪ Carry out thorough examination and testing on extraction system as required ▪ Inspect and maintain re-usable RPE, use disposable RPE just once ▪ Workers should be trained in the correct operation of the equipment and use of RPE

2.14 Utility vehicle demolition



Good Practice – Utility vehicle cabin fitted with in-cab ventilation and material wetted before loading and transportation (MTS group Ltd, GB and JCB, GB)



Good practice – Use of remote controlled utility vehicle (SWEA, S)

General comment	Studies show that using a utility vehicle (e.g. Bobcat) for demolition work can result in exposure to significant airborne concentrations of RCS. The task requires the control measures in this sheet to be properly applied, to reduce exposure below the benchmark OELV 0.1 mg/m^3. Utility vehicles are used both for carrying demolition equipment for cutting down building materials and for transport of demolition debris out of the work site.
Recommended controls for RCS dust	▪ The cabin should be fitted with in-cab ventilation with suitable filtration and kept clean ▪ Wetting of the material at the demolition location before work starts ▪ Wetting of the demolition debris before loading and transportation ▪ Consider Respiratory Protective Equipment (RPE) for workers close to the demolition site

Possible Actions by National labour Inspector	**High Health Risk** - Consider **immediate action** in situations where controls are missing/ ineffective e.g., no filtered cabs being used, significant dust clouds being generated or bystander exposure occurring (e.g. Use of Notices requiring action)
	Medium Health Risk- Consider **action** in situations where one control is missing/ ineffective (e.g. use of Notices requiring action)
	Low Health Risk - No action required where all controls are present and effective

Designing Out Risks	▪ Use remote-controlled demolition machine ▪ Use low dust generating techniques e.g. use of demolition shears ▪ Enclosure/segregation of the work site ▪ Limit the number of people that have access to the work site
Maintenance of control equipment & respiratory protective equipment (RPE)	▪ Utility vehicles to be maintained as per manufacturer's instructions ▪ Workers should be trained in the correct operation of the equipment and use of RPE when used ▪ Inspect and maintain re-usable RPE, use disposable RPE just once

2.15 Cross-cutting – Other, non-RCS Risks

General comment	▪ Construction work involving the generation of silica dust may also have other hazards. Whilst inspecting sites for exposure for silica dust, be aware of these other hazards as well. The following list of hazards posing danger to workers health and safety is not exhaustive: - 'Other dusts' such as asbestos, where work involves buildings built before 2000 NOTE: Asbestos exposure requires specific controls outside the scope of this guidance - Noise (caused by machinery and contact with material) - Vibrations (caused by the use of machinery) - Falling from heights (caused by the place where work is done, e.g. on scaffolds, on roofs) - Electrical shock (caused by bad wiring or badly-maintained equipment) - Unfavourable working position (bending, crouching to do work) - Jamming of machinery (rotating drills or blades getting stuck in the material, causing damage to limbs)
Recommended controls	▪ Other dusts: Extraction methods similar to silica dust. ▪ Noise: hearing protection (HP) should be worn when noise levels exceed the daily or weekly Upper Action Value (UAV) $L_{ED,d}$ OR $L_{EP,w}$ of 85 dB (A) (personal exposure). The instruction manual may provide information on the noise generated by the equipment. If the noise levels exceed the Lower Action Value (LAV) for daily or weekly personal exposure ($L_{ED,d}$ OR $L_{EP,w}$ of 80dB (A) (personal exposure) HP should be available on request. ▪ Vibrations: Use suitable low-vibration tools, use the right tool for each job, use properly maintained and repaired tools, make sure cutting tools and drills are kept sharp, and reduce the amount of time tools are used. ▪ Falling from heights: Perform tasks on a flat surface, on the ground when possible. If it is necessary to perform a task at height, create a flat and spacious working surface, use certified scaffolding. ▪ Electrical shock: Use properly maintained and repaired tools, use tools according to the manual ▪ Unfavourable working position: Perform tasks on a flat surface when possible. Use workbenches to make working in an upright position possible. Use steps when tasks require work above shoulder height, but be aware of 'working at height' requirements. Limit the time a task is performed. ▪ Jamming of machinery: Make sure cutting tools and drills are kept sharp, use the correct support (e.g. for a core drill), handle tools in such a way that in case of jamming the rotation energy cannot damage limbs (holding position) ▪ Flying debris: Use safety glasses to protect eyes, make sure bystanders are protected
Possible Actions by National Labour Inspector	NLIs should take action in line with the severity of the non-RCS risks, in accordance with their own regulatory regime.
Designing Out Risks	▪ Perform a good inventory; remove asbestos before any other work starts ▪ Use building materials that are made-to-measure ▪ Plan building work diligently, incorporate health and safety from the start (at the design stage) ▪ Buy and use tools that are designed for low vibration and noise emissions
Maintenance of control equipment & respiratory protection equipment (RPE)	▪ Use well-designed and maintained equipment ▪ Train workers in the correct operation of the tools as well as in the correct use of PPE ▪ Use personal hearing protection (otoplastics or ear muffs) and safety glasses which are compatible. Check regularly whether the protection is still functioning. Do not use PPE after its expiry date.

APPENDIX 1– List of SLIC CHEMEX RCS Sub-working group member organisations

MEMBER STATE	REPRESENTATIVE
BELGIUM	Federal Public Service Employment Labour and Social Dialogue General Directorate Wellbeing at Work Department of the supervision on chemical risks Laboratory for Industrial Toxicology (LIT) WTC III - Simon Bolivarlaan 30 bus 6 - 1000 Brussels Belgium
BULGARIA	General Labour Inspectorate Executive Agency 3, Knaiz Alexander Dondukov Blvd 1000 Sofia Bulgaria
GREAT BRITAIN	Health and Safety Executive (HSE) Field Operations Division, Occupational Hygiene / Noise & Vibration Unit Redgrave Court Merton Road Bootle, L20 7HS United Kingdom
IRELAND	Chemical and Prevention Division Health and Safety Authority Government Buildings The Glen Waterford Ireland
ITALY	National Institute for Insurance against Work Accidents (INAIL) Piazzale Giulio Pastore, 6 00144 Rome Italy Department of Occupational and Environmental Medicine, Epidemiology and Hygiene and Department of Technical Advice for Risk Assessment and Prevention
NETHERLANDS	Occupational Hygiëne and Chemical Safety Centre for Expertise Dutch Labour Inspectorate Inspectie SZW Parnassusplein 5 P.O. Box 90801 2509 LV The Hague
SWEDEN	Swedish Work Environment Authority Department of Regulation SE-112 79 Stockholm Sweden