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# Silica baseline survey

## Annex 3 Stonemasonry industry

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# Silica baseline survey

## Annex 3 Stonemasonry industry

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**Aims and Objectives**

This Silica Baseline Survey aims to develop baseline intelligence on exposure and control of respirable crystalline silica in key industry sectors. These sectors are:

- Brickworks and Tile Manufacture
- Stonemasonry
- Quarrying
- Construction

**The objectives are:**

1) to establish whether exposure control practices (both the application of engineering controls and the use of RPE) are adequate to reduce exposures below the WEL for RCS
2) to form an opinion about the long-term reliability of the controls
3) to identify common causes of failures of exposure control
4) to provide data by which the effect of HSE interventions can be assessed.

This annexe to the main SBS report includes the site visit data and detailed discussion of observations in the stonemasonry sector.

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# EXECUTIVE SUMMARY

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Stonemasonry

Quarrying

Construction

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This annexe to the main SBS report includes the site visit data and detailed discussion of observations in the stonemasonry sector.

## Main Findings

There is need for adequate COSHH assessments for all work with stone. Without well-organised controls based on thorough planning, unacceptable respirable dust exposures are likely, even if silica exposure should happen be low due to work on stone of low silica content.

RCS exposure is highly dependant upon the type of stone worked. Of 94 measurements of RCS exposure, nearly 20% exceeded the WEL that applied when the samples were taken (0.3 $mg.m^{-3}$,) with a further 23% exceeding the more recent limit of 0.1 $mg.m^{-3}$. The picture was in fact worse than these figures show, as during at least two visits all or most of the stone being worked had a low silica content. 21% of measurements showed respirable dust exposure above 4 $mg.m^{-3}$.

In many locations there is a lack of engineering control equipment. What equipment has been installed is often of limited effectiveness, due either to the selection of unsuitable equipment or inadequate design and installation.

## Recommendations

Vocational training should include more information on the health risks from inhaled respirable crystalline silica, the causes of exposure and controls, also more information about stone composition. The availability and uses of Silica Essentials should also be highlighted during courses.

Tools designed to be compatible with dust-suppression should be developed or adopted, e.g. powered by compressed-air or by electric motors useable in wet conditions. Introduction of water-based dust suppression systems will require parallel modifications to PPE (i.e. that necessary for wet work) and drainage arrangements to cope with stone dust in workshop run-off.

In parallel with improved dust suppression, greater expertise needs to be applied to the selection, performance and maintenance of other engineering control measures (e.g. LEV.) The suppliers of LEV need also to improve the standard of their offerings.

The expertise applied to the selection, training, cleaning and use of personal protective equipment requires upgrading in the same way as control expertise needs improving.

Initiatives are still required to improve industry knowledge of control measures and the revised WEL.

# 1 INTRODUCTION

## 1.1 SILICA BASELINE SURVEY

HSE has established a Disease Reduction Programme (DRP) as part of the FIT3 strategic programme. The aim of the DRP is to reduce the incidence of work-related ill health caused by exposure to hazardous substances. Respiratory disease, covering occupational asthma as well as the longer latency diseases such as Chronic Obstructive Pulmonary Disease (COPD) and silicosis, accounts for a significant proportion of work-related ill health and so the DRP has a specific project to address this.

The Silica Baseline Survey is being undertaken to support the respiratory disease project and focuses on four industrial sectors where ongoing exposure to Respirable Crystalline Silica (RCS) is suspected. These are Construction, the Brick making and heavy clay industry, Stonemasonry and Quarrying. This Annexe to the main SBS report contains the detailed descriptions of site visits, other exposure data, discussion and sector-related conclusions for the stonemasonry industry. The work on the other sectors is reported in sister annexes.

This report takes forward much earlier HSE work. Many of the documents reporting such work have been quoted here, either directly or with alterations to make the information more specific to the activity under discussion.

## 1.2 BACKGROUND

Crystalline forms of silica (Quartz, plus the much less common minerals cristobalite and tridymite which form at high temperatures, which are all composed of silicon dioxide) are the commonest minerals in the earth's crust (exceeded only by the wider feldspar group, according to some authors. Feldspars are also silicates, but incorporate atoms of aluminium and either sodium, potassium, calcium or barium in the crystal matrix.) Quartz therefore forms a proportion of most stone worked for building or decorative purposes. When silica-containing stone is sawn, chiselled or abraded the silica crystals are split or shattered to release fragments of a range of sizes. Most significantly, a proportion are sufficiently small that if they are inhaled they evade the various air-cleansing mechanisms of the human respiratory tract and penetrate to the depth of the lung where gas-exchange takes place. Particles of this size range are termed "respirable."

Historically, exposure to respirable crystalline silica (RCS) in a wide variety of workplaces has caused a large burden of serious and often fatal respiratory disease. Exposure limits have been imposed and controls have been required but it has not been practicable thus far to reduce exposures sufficiently to eliminate disease.

In a discussion paper produced before the UK exposure limits were reduced in 2006, (HSE 2003) HSE looked at the consequences of exposure across the whole of UK industry in a range of circumstances. HSE predicted that the following number of silicosis fatalities would be prevented over a sixty-year period at the various possible exposure limits:

**Table 1** Estimates of silicosis fatalities at different exposure limits

| Potential Exposure Limit (8hr TWA) | Deaths prevented |
|---|---|
| 0.3 $mg.m^{-3}$ | 36 fatalities / 1 PA |
| 0.1 $mg.m^{-3}$ | 185 fatalities / 3 PA |
| 0.05 $mg.m^{-3}$ | 300 fatalities / 5 PA |
| 0.01 $mg.m^{-3}$ | 455 fatalities / 8 PA |

Exposure to RCS clearly represents a significant ongoing health hazard wherever earth-derived raw materials are worked and HSE is addressing respiratory disease as one strand of the Disease Reduction Programme, part of the "FIT 3 initiative." This report focuses on the work done to assess the position regarding RCS exposures in the Stonemasonry industry, one work area where an ongoing health risk is considered possible. The detailed information shown here is summarised in the parent report which draws together the HSL work on the SBS.

**U.K. Stonemasonry industry**

Stone has historically been worked almost wherever it occurs across the UK, initially for the construction of buildings and subsequently to provide mainly the external cladding and some interiors and architectural features. Monumental masonry (i.e. the production of gravestones) is another long-established activity. A small amount of dimension stone production and monumental masonry continue relatively unchanged, but a significant new activity is the production of stone and stone-effect work surfaces for domestic kitchens. Another relatively recent activity (in the historical perspective) is the cleaning of buildings, where abrasive methods may be used to remove the soiled outer surface from the stone or brick face of a building, which is addressed in the construction sector report.

EH74/2: Respirable Crystalline Silica Exposure Assessment Document (HSE 1999) suggested that 1,000 employees in the stonemasonry industry were exposed to silica out of a total of 2,000 stonemasons in the UK. However, this was considered to be an under-estimate and a figure of 2,000 stonemasons being exposed to RCS was proposed in the 2003 RIA for RCS.

UK Office of National Statistics (ONS) data from 2005 (ONS 2005) reveals that approximately 1200 businesses in the UK have the Standard Industrial Classification (SIC) code 26.70—Cutting, shaping and finishing of ornamental and building stone. The estimated total workforce for the sector is some 7900, but besides those actually working stone this figure will include administrative staff as well as sales staff in the newer "retail sector". The figures from tables A3.1 ("Local Units in VAT-based enterprises by employment size band) and B3.1 (VAT-based enterprises by employment size band) and the derivations of employment numbers are shown below and as table 1 in Appendix A.

**Table 2** Employment statistics from ONS data

| **Activity:** 26.70 - Cutting, shaping and finishing of ornamental and building stone | **Employment size band:** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **0 - 4** | **5 - 9** | **10 - 19** | **20 - 49** | **50 - 99** | **100 - 249** | **250+** | **Total** |
| Notional size | 2 | 7 | 15 | 35 | 75 | 175 | 250 | |
| Number of **local units in VAT-based enterprises:** | **785** | **225** | **115** | **55** | **15** | **0** | **0** | **1200** |
| Cumulative % | 66% | 85% | 94% | 99% | 100% | | | |
| Employment numbers: | 1570 | 1575 | 1725 | 1925 | 1125 | 0 | 0 | 7920 |
| Number of **VAT-based enterprises** | **645** | **200** | **105** | **60** | **15** | **0** | **0** | **1025** |
| Cumulative % | 63% | 82% | 93% | 99% | 100% | | | |
| Employment numbers: | 1290 | 1400 | 1575 | 2100 | 1125 | 0 | 0 | 7490 |

They reveal that 99% of "local units" have a workforce of less than 50 and none had (in 2005) 100 or more employees. They are thus almost all small enterprises (<50) and all are in the SME category (<250). Most are actually "micro-businesses." This size distribution is closely reflected in the size ranges of the "VAT-based enterprises," which suggests that there has been negligible consolidation in the industry and that there is very little vertical structure or grouping. This has negative implications for the time, expertise and other resources available within the companies to be applied to health and safety issues and it also has also adverse implications for the practicalities of communicating such information.

Thee somewhat larger numbers in the industry from this assessment (7500 to 7900 altogether) are reasonably consistent with the earlier 1999 HSE estimates, and might also reflect recent growth as a result of the fashion for polished stone kitchen and bathroom worktops and sink surrounds.

Of the stonemasons visited for the SBS the location of the sites seemed equally distributed between two types; those located near to the quarry dressing and supplying their stone or those located on industrial estates in the vicinity of their customer catchment area.

## Materials

Stonemasons work a wide variety of rock types, with almost as great a range of silica contents.

Depending on the intended use of the worked stone, the rock type may have been selected for its hardness or impermeability (e.g. granite or marble for kitchen or bathroom worktops) or for its workability (e.g. a soft limestone or a relatively poorly cemented sandstone, to be carved into decorative features for a building façade.) Rocks of all 3 geological types, igneous, metamorphic and sedimentary, are used and the mineral composition and the degree to which individual mineral grains are cemented or interlocked will determine the physical and chemical characteristics, or whether stone can be worked to give to a polished surface.

Sandstone is a sedimentary rock composed principally of quartz grains and the term covers rocks with a range of characteristics. It may be cemented by silica precipitated from groundwater, and thus very hard and almost impermeable, but potentially able to release RCS from every fracture caused by masonry work. It may instead be poorly cemented by

carbonate or other minerals and differ markedly from the stone described above. Many igneous rocks have a significant silica content, granite being perhaps the most familiar type with up to 40% quartz, besides mica and feldspars. There are however many types of igneous rock with negligible silica. An example would be the stone sold as "Blue Pearl Granite," but actually Larvikite, composed virtually entirely of feldspar with almost zero silica content. This loose use of the name "granite" for any dark igneous rock introduces a measure of confusion when attempting to correlate exposures with the type of rock being worked.

Pure limestones and the metamorphosed form, marble, are principally composed of calcite grains or crystals, the colour of the stone being influenced by other minerals. However quartz is present in many limestones and as the content increases so the natural stone may be described as a sandy limestone, eventually reaching the status of a lime-cemented sandstone. Even relatively pure limestones formed as deep-sea deposits may contain 1 or 2% silica. A further important factor is the deposition of quartz from circulating groundwater over geological time. This is of relatively minor significance in stonemasonry, where a vein of quartz would probably make a sheet of softer stone unusable on account of its locally greater hardness. Exposure controls are still required in workshops that generally only work limestones, however, as some may contain dispersed quartz. A further point is that in the industry stones are routinely selected principally for their decorative or other surface characteristics regardless of their silica content. (In the quarrying of aggregates the potential presence of quartz veins means that crushing stone relatively poor in quartz is almost always likely to release RCS.)

Another material that is used in the stonemasonry industry is reconstituted stone, in which grains of crushed rock have been mixed with resin and moulded to produce a material with the appearance and feel of stone, but without the disadvantages and costs associated with the need to source blocks of stone, then cut and polish them. When worked it will still release fragments of the original minerals of which it is composed, however.

The effect of rock type on RCS exposure was summarised in HSE's Respirable Crystalline Silica Exposure Assessment Document (EH74/2, HSE 1999) and is reproduced as Table 2 in Appendix A.

**Overview of relevant processes:-**

Stone is cut in workshops to produce products such as fireplaces, statues and memorials. However, many kitchen companies now also cut and abrade a variety of stone types using a range of water-suppressed and dry abrading techniques to produce "granite" and marble worktops and other surfaces.

Those stonemasons producing products which may be used in a domestic environment e.g. kitchen or bathroom work surfaces, or ornamental headstones have showrooms where the public could browse the product range.

The majority of sites producing domestic products procure their stone from intermediate suppliers who commonly source it from overseas in various semi-prepared shapes and thickness. Bespoke design features and fittings are then applied at the site to the customer's requirements.

HSE guidance published in 2001 (Controlling exposure to stonemasonry dust – HSG 201) estimated the then-current exposures from different stonemasonry processes. Powered disc cutting and powered disc polishing were reported to produce RCS exposures between 2 and 100 $mg.m^{-3}$. Pneumatic chiselling was assumed to generate less dust, but exposures between 0.7 and 10 $mg.m^{-3}$ were considered possible, and hand chiselling was likely to produce exposures between 0.3 and 2 $mg.m^{-3}$. However, it was acknowledged that the daily RCS exposures of stonemasons were due to a range of activities and might have been highly

variable – depending on the stone being cut, the shape of the item being produced, the method of cutting and the controls used. Table 3 in Appendix A shows estimated exposures to respirable stone dust from various stonemasonry processes and operations.

Stone-working takes place in workshops (where fixed extraction ventilation is feasible) or on worksites where controls are often limited to on-tool extraction for personal protection.

Over the course of the SBS in the stonemasonry sector a number of significant issues were identified that are likely to be contributing to the incidences of high exposure that continue to occur. These are summarised in Section 6 of this report 'Discussion & Conclusions'.

## 1.3 HYGIENE STANDARDS

In the UK exposure to RCS is regulated under the Control of Substances Hazardous to Health Regulations 2002 (as amended) (HSE 2002 and 2004.) There is a duty to apply the "Principles of good control practice" listed in Schedule 2a of the Regulations and exposure should not exceed the Workplace Exposure Limit (WEL) set in EH40, (HSE 2005.) The WEL that applied at the start of this project was 0.3 $mg.m^{-3}$ and it was reduced to 0.1 $mg.m^{-3}$ in October 2006. The new limit was included in the updated List of approved workplace exposure limits published by HSE in 2007 (HSE 2007).

The Social Dialogue Agreement for silica (SDA) (ref NEPSI) is a parallel initiative, agreed at European level. A number of Industry Sector Associations have made a binding agreement to implement the requirements of both the exposure monitoring and reporting protocol and the associated "good practice guides." The good practice guides are similar to the COSHH Essentials guidance published by HSE and, if implemented in full, should result in exposures below the WEL. Although the SDA is not binding on employers who are not members of the participating trade associations, the nature of NEPSI makes it clear that all the actions suggested in the guidance are acknowledged as practicable by employers, and other organisations should therefore also be able to adopt the same standards.

## 1.4 HISTORICAL EXPOSURE DATA AND RESEARCH PAPERS

Previous studies of RCS exposure in the stonemasonry sector have shown that occupational exposure to RCS is heavily influenced by the particular task, the stone being worked and the use of power tools.

In all discussion of exposure data there is a natural split at 1997. This is because the RCS MEL was amended in January 1997 when the UK adopted the ISO/CEN convention for respirable dusts as defined in BS EN 401. To maintain the equivalent level of control, the MEL for respirable crystalline silica was adjusted from 0.4 $mg.m^{-3}$ to 0.3 $mg.m^{-3}$ when sampled by the new convention.

HSE, 1998, suggested that large fixed saws used wetting as a primary dust control, but as this also prevented damage and reduced the wear of the blade, it should not be costed under silica reduction. Although additional controls were necessary to reduce exposure below 0.3 $mg.m^{-3}$ when cutting high silica stone, no additional engineering controls were used by the sawyers studied. Even with wet-sawing, the fine droplets produced are often contaminated with siliceous particles and must be extracted because they are within the respirable size range and so provide a potential route into the lung for RCS. Control of exposure could however be attained by a combination of mist suppression and LEV, although enclosure might be needed to reduce air movements that would disperse contaminated droplets. Angle grinders used by stonemasons are smaller than those used in the construction industry and likely to be electrically powered, thus water suppression was not a simple option. LEV was the main control found but RPE was almost universally used. An essential control measure for stonemasons is to replace FFP3 filters on a regular basis. Power chisels significantly

increased exposure to respirable crystalline silica; of five samples available in the 1998 study only one exposure was below 0.1 $mg.m^{-3}$, and most operators relied on RPE for protection.

It has been recognised in the pottery industry that contaminated clothing acts as a dust reservoir and when the person moves respirable particulate may be released. Certain types of non-knitted, synthetic fibre workwear release less dust than cotton, and may be appropriate for stonemasons, although the use of impermeable aprons to prevent contamination is also a valid strategy. As other direct causes of inhalation exposure are controlled (and especially in the light of a reduced WEL) the relative importance of contamination of workwear will rise and employers' laundering policies may need to be revised.

As would be expected, the respirable crystalline silica exposure is dependent both on the task and on the type of rock being worked, and this latter factor is emphasised by Table 7 in Appendix A, which summarises the effect of rock type on RCS exposure – the data provided by HSE's Respirable Crystalline Silica Exposure Assessment Document (HSE, 1998).

This document also shows that from HSE visit reports between 1992 and 1995, 46% of RCS exposures in stonemasonry were above 0.1 $mg.m^{-3}$, 31% were above 0.2 $mg.m^{-3}$ and 11% were above 1.0 $mg.m^{-3}$.

In 1997, HSE agreed to study the most cost-effective, affordable and maintainable control measures for power tools used in stonemasonry. This report (Brown, 1998) looked at available control systems. Booths were available but airflows within the booth may be unsatisfactory and RPE may still be necessary. Down-draught benches were suitable for some processes but information on airflow rates was often scanty. Dust extraction tools were numerous and the optimal arrangement was having the firm that designed the tool also designing the extraction. Retrofitting, although possible, was often less satisfactory. Air was usually extracted from a chamber formed by a shroud or hood of the dust collection system and the surface being cut, and the tool was contained within this. Water was principally used on saws, grinders and core borers and was often used to cool the blade as well as suppress dust. Where there was a filtration system on the tool, it only worked well with a vacuum system installed throughout the plant to which stone cutting tools could be attached.

A recent French study (Regnier et al, 2001) suggested that downdraught booths could produce a 100-fold reduction in RCS exposures from cutting and polishing using hand-held tools and formed the basis for the Silica Essentials recommendations for stonemasonry.

# 2 SITE ASSESSMENT METHODOLOGY

## 2.1 SITE SELECTION

One of the principal objectives of the study was to obtain baseline occupational hygiene data and information relating to exposure to respirable crystalline silica in the stonemasonry industry. In order to achieve this a range of factors were considered when selecting sites, including:

§ Known examples of good / bad hygiene practice.

A number of sites had been previously visited by HSE representatives and these included sites where notably good or bad hygiene practice had been identified. Good practice included; innovative, well-designed engineering controls, good health & safety management etc. Bad practice included; evidence of over exposures, ineffective or poorly designed engineering controls, poor health & safety management.

§ A range of classical and emerging stonemasonry activities

Longstanding stonemasonry activities such as headstone production, ornamental masonry and building restoration were included alongside emerging activities such as the production of kitchen worktop manufacturers.

§ Use of stone with significant silica content

Sites which worked with stone known to contain significant silica content e.g. sandstone, granite etc. were selected. The volume of work with high silica stone was not known during selection and as a result the volumes varied considerably between sites. Some sites worked exclusively with high silica stone and others worked principally with low silica stone but occasionally worked with medium silica content stone such as granite.

After a sufficient number of suitable sites had been identified the sites selected for inclusion in the survey, with the exception of those previously visited by HSE, were chosen at random. The majority of sites volunteered to participate in the survey. Some sites were visited with a representative from HSE FOD.

The following gives a summary of the sites selected for inclusion in the Silica Baseline Survey

HSE FOD (NE) Region (All sites used granite & limestone):

3 producing kitchen work surfaces

1 making stone fireplaces, kitchen tops and cobbles

2 involved in headstone production

"Midlands:"

3 producers of bathroom & kitchen work surfaces (granite & limestone)

1 manufacturer of stone fireplaces, kitchen tops and cobbles

2 producers of sandstone walling blocks, paving slabs and bespoke masonry items.

1 undertaking building restoration in sandstone and limestone

1 producing architectural items (window & door surrounds)

1 making bathroom & kitchen work surfaces (granite-containing composite stone)

1 producer of stone fireplaces (marble & granite)

2 sites were visited twice; one following improvements and a second following relocation of business and expansion of stonemasonry work.

## 2.2 ASSESSMENT OF CONTROLS

The objective of the SBS was to gather information on the current effectiveness of RCS exposure control in the selected parts of UK industry as well as to measure exposures. A full explanation of the procedure adopted is given in the SBS main project report, but is summarised briefly below.

An important aspect of this study is that control competence is not judged simply by measurement of exposures. The success of exposure control depends on the correct application of a wide variety of measures. Control of emission at source (by engineered controls) is recognised as the most effective measure, but in some circumstances is not practicable, and the use of RPE is necessary to maintain exposure at a safe level. However the ongoing effectiveness of all exposure control regimes depends on the underpinning actions being maintained, termed "competency" here. The SBS site visits assessed the resilience of the control regime by considering the robustness of the range of factors involved. This technique was applied because it was expected to give a better assessment of whether exposures would be likely to remain within the WEL than would a single day's measurement. The views and professional opinion of the visiting occupational hygienist were therefore captured in a structured way that allowed an objective assessment of competence to be made. The same criteria could then be used at some future date to judge change.

It should be noted that the Control competence ratings ranged from 0 to 5, where 0 indicated manifest failure and was numerically valid.

A similar assessment was made of the effectiveness of the RPE regime if use was necessary to maintain control of exposure. For RPE competence a rating of N/A was included instead of 0, which indicated adequate control by other methods. However this does not address the residual need which has to be acknowledged, e.g. for circumstances when engineered controls have to be worked on. The factors considered are shown (with the indicators of the ranges of dutyholder performance) in the site competency assessment checklists, which are reproduced in appendix 5 of this annexe. A shift in the profile of these indicators will provide strong evidence of the desired improvements in the industries. The factors themselves are shown below:

"Control competence" was assessed by

- Comprehensiveness of COSHH assessment
- Awareness of literature and information sources
- Application of appropriate, effective, well maintained controls at process
- Degree of management and operator understanding of exposures
- Level of operator training
- Designation of areas and use of RPE when appropriate
- Well informed management
- Competence of supervision

i.e. overall evidence of coordinated approach to control – skills and knowledge available

"RPE competence" was assessed by

- Verifiable policy on RPE linked to COSHH assessment.
- Face fit testing programme
- Equipment routinely available and range of products available through selection process
- Appropriate storage facilities
- Initial training and refresher training
- Operator understands role of RPE in controlling exposure
- Clearly defined roles and responsibilities

Achievement of a rating of 4 for control competence and, if necessary, for RPE competence, was intended to identify sites which "achieved the COSHH Essentials standard." This indicated a system of exposure control sufficiently robust that ongoing compliance with the WEL could be anticipated. A grade of 5 would have indicated exemplary performance in every aspect of control: it was not seen anywhere.

Worker exposure to airborne respirable dust and RCS was measured during the time on site and generated a further input to the baseline survey. It has to be recognised that the results of the monitoring show exposures as they were on the day, when a visit was made by appointment. In some cases the level of awareness of the composition of the stone was such that during a visit specifically arranged to monitor silica exposure it was found that despite measurements of excessive respirable dust exposure no RCS was detected in the samples

## 2.3 EXPOSURE MEASUREMENTS

**General**

In general, personal monitoring was undertaken in accordance with approved inhalation exposure monitoring strategies described in the Health and Safety Executive publication HS(G)173 - Monitoring Strategies for Toxic Substances.

For each field study personal monitoring was conducted in areas where the operations were deemed to offer the greatest risk of exposure to airborne RCS. For comparison purposes, sampling was also conducted on operatives and in locations that had been included in the dutyholders' exposure monitoring, where these results had been made available in advance of the visit.

Background levels of respirable dust and respirable crystalline silica in the work area atmospheres were measured at strategic static locations in a similar manner.

**Occupational Exposure Monitoring Methods:**

Respirable dust was measured by drawing air at a defined flow rate (2.2 l.min-1) through a pre-weighed membrane filter held in a cyclone sampling head. The flow rate for the pumps was measured and recorded prior to the start of the sampling and re-checked periodically and again at the end of the sampling. The filter heads were mounted as close as possible to the operative's breathing zone, e.g. on the lapel of his overalls.

All samples were analysed at the UKAS-accredited Health & Safety Laboratory (HSL), Buxton. Crystalline silica was quantified by x-ray diffraction (XRD) techniques.

**Table 3** Sampling and Analytical Methodologies used in this Investigation

| Hazardous Substance | Method Reference | Analytical Technique |
|---|---|---|
| Respirable dust | MDHS 14/3<br>(General methods for sampling and gravimetric analysis of respirable and inhalable dust) | Gravimetric analysis |
| Respirable Crystalline Silica (RCS) | MDHS 51/2<br>(Quartz in respirable airborne dust) and MDHS 101 | X-Ray diffraction |

MDHS – Methods for the determination of hazardous substances

**Verbal follow-up questionnaire**

The companies which had been visited during the course of the SBS work were also asked about their level of knowledge and their sources of information by a brief verbal questionnaire administered by telephone. 14 sets of answers were obtained which revealed the level of legislation and silica risk awareness in the industry…

# 3 RESULTS

Short summaries of the visit reports are included as appendix B of this annexe. The site observations are shown, together with a brief table showing the data generated and a summary line that has been transferred to a compilation table at the end of the appendix.

**Control competence assessments**

Of 14 stonemasonry sites rated for control competence, the majority were given classifications of 0 or 1. This was in the context of "evidence of unacceptable levels of over-exposure" when judged against the criterion of the exposure which applied at the time of the visit, i.e. a WEL of 0.3 $mg.m^{-3}$, and negligible exposure controls or inadequate maintenance of any that existed.

**Table 4** Distribution of control competence ratings

| Control Competence Rating: | 0 | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| Number of sites: | 1 | 5 | 2 | 2 | 1 | 0 |

(Range: 0, "Manifest failure to recognise hazard and failure to provide any form of controls," 4: The COSHH Essentials Standard, 5: Exemplary control consistent with risk. Detail in Appendix D)

One site was revisited 7 months after an initial visit revealed competence of 0: conditions were barely improved by then (control competence improved to "1") and the respirable dust exposure was still excessive, although the stone being worked was generating minimal RCS.

Almost none of the sites had made a thorough assessment of the consequences of silica exposure as required by COSHH. This was one of the factors involved in the low "Control competence" ratings they received, but equally was probably a part of the reason why their control competence was so low.

**RPE competence assessments**

Two sites were considered not to require RPE to achieve control of exposures. One site was allocated a rating of "1", one other "4" and 9 were allocated "2," which indicates adequate control by RPE, but very little resilience in terms of the expertise with which it was used or confidence in the likelihood of ongoing effectiveness in the longer term. The single site rated 4 was the same location which achieved the same rating for control competence.

**Table 5** Distribution of RPE competence ratings

| RPE Competence Rating: | N/R | 1 | 2 | 3 | 4 | 5 |
|---|---|---|---|---|---|---|
| Number of sites: | 2 | 1 | 9 | 0 | 1 | 0 |

(Range: N/R RPE not required, 1, "No evidence of use or provision" 4: "RPE used to achieve adequate control," 5: Exemplary RPE programme. Detail in Appendix D)

**Exposure monitoring:**

Of 91 personal measurements of exposure 17, or 19%, indicated 8-hr TWA exposure to RCS above the WEL of 0.3 $mg.m^{-3}$ which applied when the measurements were made and a total of 37 (41%) were above the more recent limit of 0.1 $mg.m^{-3}$.

18 measurements (20%) indicated exposure to respirable particulate above 4 $mg.m^{-3}$ and 3 of these were when low-silica stone was being worked. If stone containing a significant proportion of silica had been in use it is probable that these further samples would have shown unacceptable RCS exposure, further increasing the numbers mentioned above.

**Verbal follow-up questionnaire**

The responses to the questionnaire are shown in detail in table 7. A summary of the totals is shown below.

**Table 6** Summary of questionnaire responses

| **Questions:** | **WEL:** | | **Control** | **Know/have guidance?** | | | | **Know diseases?** | | | **Want info via:** | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **Aware of reduction?** | **Know new?** | **Improvemts planned?** | **HS (G) 201** | **INDG 315** | **COSHH** | **COSHH & Silica essentials** | **Silicosis** | **Lung cancer** | **Copd / emphysema** | **Internet?** | **post?** |
| **Total Y:** | 4 | 1 | 2 | 6 | 2 | 10 | 6 | 4 | 1 | 5 | 13 | 13 |
| **Total N:** | 10* | 3 | 1 | 7 | 11 | 3 | 7 | 9 | 12 | 8 | 0 | 0 |
| | | | 1 "Poss" | | | | | 3 more guessed "lungs" | | | | |

*One company stated that they were no longer working stone and are included only in the total of 10 who did not know of the impending reduction in the WEL for RCS.

# 4 DISCUSSION

**Stonemasonry – Exposure Control Measures**

Engineering controls are used in stonemasonry workshops, but there is still a high reliance on RPE to control high exposures, even when power tools (which generate dust concentrations beyond the protection afforded by RPE) are used. Although power chiselling has the potential to produce high respirable crystalline silica exposures, HSE's Respirable Crystalline Silica Exposure Assessment Document (HSE, 1998) suggested that very few operators used engineering controls, relying only on RPE.

The site given number 7 in Appendix B was allocated ratings of 4 for both Control and RPE competence. Notwithstanding this, two out of 6 measurements showed exposure to RCS above 0.1 $mg.m^{-3}$, due principally to work practices that negated the effect of the controls.

A series of recent (2002/2003) HSE visits to stonemasonry companies revealed several sites where inexpensive improvements could be made. A site visit in 2003 to a company using marble, granite and limestone to produce bathroom and kitchen worktops showed that though some equipment was wet-fed, masons used angle grinders and edge polishers without water suppression. Extraction was by flexible ducts above the workstation. Although booths are recommended (HSG 201), the use of type-H vacuum cleaners to remove dust daily, or at least the damping down of dust will reduce RCS exposure by themselves.

Another similar site visited earlier (in 2002), where granite was the main stone being used, revealed that RCS exposures ranged between 0.15 and 0.4 $mg.m^{-3}$ (8-hour TWA.) Changes such as the refurbishment of extract ducts and the installation of down-draught extraction for work with hand tools, plus increased use of wet cutters and polishers reduced all RCS exposure to below 0.15 $mg.m^{-3}$ (8-hour TWAs).

Visits by HSE (in 2002 and 2003) to a marble and limestone fireplace manufacturer showed all RCS exposures were below 0.07 $mg.m^{-3}$, probably more a consequence of the low silica content of the material than the efficiency of the controls - although the automated wet-cutting machines controlled dust emissions effectively. In the dry process area, the use of segregation and improved engineering controls made significant differences – a reassuring confirmation of HSE guidance suggesting that large-scale use of rotary tools should take place in a separate area.

The results of the questionnaire responses received from the sites visited during this study indicate that despite the production of detailed, practical guidance and the publicised plan to significantly reduce the current WEL there was very little awareness of either the guidance available or of the impending reduction of the hygiene standard. Only 2 companies were aware of INDG315 and barely half knew of HS(G)201. Out of 13 active employers, only 4 could identify silicosis as a disease of stoneworkers and only one identified lung cancer as a health risk.

Communication between HSE and SME's has long been recognised as a difficult area and not limited to the stonemasonry sector. Research has shown that HSE's 'Good Health is Good Business' campaign, one of HSE's largest recent campaigns, was found to have reached only 28% of small companies compared to 73% of larger organisations (Honey et al .1997).

Another study (Rakel et al.1999) found that non-compliances were present across industrial sectors and in relation to specific health hazards even when levels of knowledge and awareness were adequate. This was supported by the results of the Silica Baseline Survey. Even at those sites where there was a demonstrable knowledge of current legislation and the health risks associated with exposure to RCS, non-compliances were commonplace.

It is acknowledged that in many SME's, Environment, Health and Safety matters are generally one of a range of priorities competing for management attention and resources. This means that HSE is faced with a greater challenge in raising awareness and knowledge of legislation and guidance in the stonemasonry sector. Recent (2006-07) interventions and enforcement has provided opportunities for direct communication with industry and is considered to have received useful publicity. Further involvement with stakeholders is ongoing and it is recognised that training providers could play an important role in improving compliance with the WEL.

In traditional stonemasonry many stonemasons are still highly exposed to RCS and it is even possible that exposures have got worse since the 1980s, reflecting the spread of power tools. The potential incidence of silicosis (and other risks) might therefore be increasing. Given the relatively small numbers of stonemasons, the fact that they show up in the SWORD figures is unusual and therefore the prevalence is disturbing. It is possible that they are still the highest at-risk group. This could be the consequence of a number of factors.

· Many stonemasons are craftsmen or women (more women are now coming into the trade) and having learnt the trade it is a career they stay in. They therefore work with stone most of their professional life, rather than spending only a few years in the industry.

· In the 1980s electrically powered disc cutters and polishers were introduced, and these are capable of causing very high exposures (HSG 201 (HSE 2001) shows that exposures of 5 to 10 $mg.m^{-3}$ RCS were typical and 50 or even 100 $mg.m^{-3}$ was possible· In recent years many kitchen companies have promoted worktops and sinks made of granite, other stone types and silica-containing composites, causing a significant extension of stonemasonry.

· It is also possible that masons and their employers do not appreciate how heavily exposed they can be. The lack of formal exposure control planning (i.e. COSHH Assessments) together with the small size and turnover of the typical company in the sector also leads on to a very low priority being given to exposure measurement of any kind.

The results from the field investigations undertaken for the SBS indicated that 42% of RCS exposures in stonemasonry were above 0.1 $mg.m^{-3}$. This demonstrates that there appears to have been very little overall reduction in the levels of RCS that stonemasons are being exposed to since the HSE visits between 1992 and 1995.

This failure by the stonemasonry industry to make significant improvements in control of exposures to RCS since 1995, despite the publication of various HSE practical guidance documents aimed at this sector (HSG 201 & INDG315), indicates that comprehensive enforcement of the 2006 WEL would be likely to have a major impact on the industry.

**Stonemasonry: Industry profile**

This investigation has shown that the majority of stonemason businesses continue to fall into the category of small to medium enterprises (SME's). ONS data from 2005 reveals that approximately 1200 businesses in the UK have the Standard Industrial Classification (SIC) code 26.70 - Cutting, shaping and finishing of ornamental and building stone.

The data reveals that most stonemasonry businesses (almost 85%) have workforces of fewer than 10 persons and could therefore be classified as small or micro businesses. Less than 6% of stonemasonry businesses have more than 20 employees and all have fewer than 100. The average size of a UK stonemasonry business is estimated to be 6 employees. It should be noted however that SIC code 26.70 *excludes* activities carried out by operators of quarries, e.g. production of rough-cut stone, so the numbers discussed in this report might be under-estimates.

# 5 CONCLUSIONS

Over the course of the SBS a number of significant issues were identified which are likely to be contributing to the incidences of high exposure occurring in the stonemasonry sector. A summary of these is listed below:

SBS results suggest that earlier industry estimates of silica exposures are considerably lower than actual exposures (0 % compared to the SBS figures of 19% above 0.3 $mg.m^{-3}$ and 41% above new WEL of 0.1 $mg.m^{-3}$.)

Even HSE estimates of exposures above the proposed WEL (0.1 $mg.m^{-3)}$ were less than half of the proportion actually found. Both of the underestimates would contribute to a lower level of attention to exposure reduction than is required

This is compounded by a poor level of awareness within the sector regarding the health risks posed by exposure to RCS, particularly amongst workers. There is also a poor level of understanding of the silica content of different stone types.

Responsibility for health & safety is often an additional duty of a production manager or similar (if such a formal designation exists – 85% of locations employ fewer than 10 workers and 94% employ fewer than 20 workers.) The industry pattern of dispersed employment and small units presents communication challenges, but the relatively small numbers might make an enforcement initiative viable**.**

There is a lack of formal health and safety knowledge, extending to a poor understanding of legislative requirements, particularly COSHH, and the requirements for LEV testing, face fit testing, health surveillance etc. Engineering controls that have been applied, e.g. LEV systems, are very often ill-conceived and not fit for purpose, reflecting the level of expertise in the supply industry. These failures are then unlikely to be recognised because of the low level of expertise available in-house in the stonemasonry industry and the general habit of not having exposures monitored (when external consultants might highlight the control failures.)

On-tool dust suppression or extraction has by no means been universally adopted and could be much more widely used. However it will need carefully planned "introduction" to gain user-acceptance and adequate maintenance to ensure ongoing use and effectiveness.

While reliance is being placed on RPE the exposure risk remains as long as selection, training and face-fit testing are not conducted.

It is possible that an increase in non-English-speaking EU workers in the sector will bring the problems associated with a transient workforce, such as increased training needs compounded by language problems.

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# 6 RECOMMENDATIONS

**The following points highlight key areas where improvements** to the general industry standard could result in significant improvements in control of exposure to RCS:

There is need for adequate COSHH assessments for all work with stone. Without well-organised controls based on thorough planning, unacceptable respirable dust exposures are likely, even if silica exposure should happen to be low due to an unusually low silica content stone.

Vocational training should include better information, instruction and training on silica health risks, causes of exposure and controls, also better technical knowledge about stone composition. The availability and uses of Silica Essentials should also be highlighted during courses.

There should be development or adoption of tools designed to be compatible with dust-suppression, e.g. powered by compressed-air or by electric motors useable in wet conditions. Introduction of water-based dust suppression systems will require parallel modifications to PPE (i.e. that necessary for wet work) and drainage arrangements to cope with stone dust in workshop run-off.

In parallel with improved dust suppression greater expertise needs to be applied to the selection, performance and maintenance of engineering control measures (e.g. LEV.) The suppliers of LEV need also to improve the standard of their offerings.

The expertise applied to the selection, training, cleaning and use of personal protective equipment requires upgrading in the same way as control expertise needs improving.

Initiatives are still required to improve industry knowledge of control measures, the revised WEL etc.

It might help reduce employee exposures if there was an increased perception in industry that failure to achieve compliance could result in consequences detrimental to business e.g. IN, PN or formal prosecution. To some extent this has been progressed by successful prosecutions in early 2007.

# 7 APPENDICES

## APPENDIX A: TABLES

Table 1: 2005 ONS Statistics for SIC 2670, Number of local units and VAT-based enterprises etc.

Table 2: Stonemasons' occupational exposure to respirable crystalline silica – effect of rock type

Table 3 Dust exposures caused by selected tasks

Table 4: Examples of UK Building Stone types and silica content

Table 5 Cases of respiratory disease reported to SWORD by chest physicians (1989-2005) or OPRA by occupational physicians (1996-2005).

Table 6: All cases of respiratory disease attributed to silica (SWORD 1989-2005 & OPRA 1996-2005) by diagnostic category

Table 7: Responses to SBS telephone follow-up questionnaire.

**Table 1**: 2005 ONS Statistics for SIC 2670, Number of local units and VAT-based enterprises etc. in stonemasonry

| **Activity:** 26.70 - Cutting, shaping and finishing of ornamental and building stone | **Employment size band:** | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | **0 - 4** | **5 - 9** | **10 - 19** | **20 - 49** | **50 - 99** | **100 - 249** | **250+** | **Total** |
| Notional size | 2 | 7 | 15 | 35 | 75 | 175 | 250 | |
| Number of local units in Vat-based enterprises: | **785** | **225** | **115** | **55** | **15** | **0** | **0** | **1200** |
| Cumulative % | 66% | 85% | 94% | 99% | 100% | | | |
| Employment numbers: | 1570 | 1575 | 1725 | 1925 | 1125 | 0 | 0 | 7920 |
| Number of VAT-based enterprises | **645** | **200** | **105** | **60** | **15** | **0** | **0** | **1025** |
| Cumulative % | 63% | 82% | 93% | 99% | 100% | | | |
| Employment numbers: | 1290 | 1400 | 1575 | 2100 | 1125 | 0 | 0 | 7490 |

**Table 2**: Stonemasons' occupational exposure to respirable crystalline silica – effect of rock type

| **Rock Type worked** | **No. of Results** | **% of Results in Respirable Silica Exposure Range (mg/m$^3$)** | | | | |
|---|---|---|---|---|---|---|
| | | **<0.1** | **0.1 - 0.2** | **0.2 - 0.4** | **0.4 - 1.0** | **>1.0** |
| Marble | 26 | 84 | 8 | - | 8 | - |
| Limestone | 8 | 88 | - | - | - | 12 |
| Granite | 42 | 78 | 11 | 11 | - | - |
| Sandstone | 9 | 17 | 22 | 28 | 14 | 19 |
| York Stone | 3 | 33 | - | - | 33 | 33 |

Source:EH74/2, table 24

**Table 3**: Dust exposures caused by selected tasks

| Process or operation | Estimated or measured exposure to respirable stone dust ($mg/m^3$) | Exposure time (mins) | Notes |
|---|---|---|---|
| Disc cutting | 200 | 60 | All work done on 'soft' stone containing no crystalline silica. |
| Disc polishing | 200 | 60 | As above |
| Pneumatic chiselling | 30 | 45 | As above |
| Hand chiselling | 10 | 60 | As above |
| Workroom exposure | 2.5 | 225 | Background exposure can be significant in mason's workshops |

**Table 4**: Examples of UK Building Stone types and silica content

| Stone name | Colour | Type | Approx quartz content (%) | Quarry |
|---|---|---|---|---|
| Aberllefenni | Blue-grey | Slate | 20-40 | Aberllefenni Quarry, Corris, Gwynedd |
| Alston | Buff | Limestone | <2 | Flinty Quarry, Alston, Cumbria |
| Apex | Brown, multicoloured | Sandstone | 70-90 | Apex Quarry, Horsforth, West Yorkshire |
| Bearrah Tor | Light Brown, Fawn | Granite | ~ 30 | Bearrah Tor Quarry, Launceston, Cornwall |
| Beer | Grey | Limestone | <2 | Beer Quarry, Exeter, Devon |
| Berwyn | Blue | Slate | 20-40 | Berwyn Slate Quarry, Llangollen, Clwyd |
| Birchover Gritstone | Light Pink/Buff | Sandstone | 70-90 | Birchover Quarry, Matlock, Derbyshire |
| Black Pasture | Light Buff | Sandstone | 70-90 | Chollerford Quarry, Chollerford, Northumberland |
| Blaxter | Light Buff | Sandstone | 70-90 | Blaxter Quarry, Otterburn, Northumberland |
| Blue Lias | Grey/Blue or Light Brown | Limestone | <2 | Station Quarry, Somerton, Somerset |
| Blue Lias Marble | Grey/Blue | Limestone | <2 | Tout Quarry, Chorlton Adam, Somerset |
| Blue Pennant | Grey/Blue or Brown | Sandstone | 70-90 | Gelligaer Quarry, Treharris, West Glamorgan |
| Bolton Woods | Grey Brown | Sandstone | 70-90 | Bolton Woods Quarry, Bradford, West Yorkshire |
| Bosahan | Grey | Granite | ~ 30 | Bosahan Quarry, Falmouth, Cornwall |
| Boughton | Dark Brown | Sandstone | 70-90 | Boughton Quarry, Chapel Brampton, Northamptonshire |
| Bowithic Rustic Slate | | Slate | 20-40 | Bowithic Quarry, Tintagel, Cornwall |
| Braich Ddu | Blueish Grey | Slate | 20-40 | Llechwedd Slate Mine, Blaenau Ffestiniog, Gwynnedd |
| Bramley Fall | Golden Brown, Fawn | Sandstone | 70-90 | Blackhill Quarry, Leeds, West Yorkshire |

| Stone name | Colour | Type | Approx quartz content (%) | Quarry |
|---|---|---|---|---|
| Brandy Crag | Silver Grey | Slate | 20-40 | Brandy Crag Quarry, Coniston, Cumbria |
| Briercliffe | Brown, Buff | Sandstone | 70-90 | Briercliffe Quarry, Burnley, Lancashire |
| Burlington | Blue-Grey | Slate | 20-40 | Burlington Quarry, Kirkby-in-Furness, Cumbria |
| Buttermere | | Slate | 20-40 | Honister Quarry, Cumbria |
| Cadeby | White to Cream | Limestone | <2 | Cadeby Quarry, Doncaster, South Yorkshire |
| Caithness Flagstone | Black/Blue | Sandstone | 70-90 | Spittal Quarry, Watten, Caithness |
| Cambridgeshire Clunch | White/Cream | Limestone | <2 | Barrington Quarry, Cambridge |
| Carstone | Golden Brown | Sandstone | 70-90 | Snettisham Carstone Quarry, Kings Lynn, Norfolk |
| Cathedral | | Limestone | <2 | Dean and Chapter Quarry, Lincoln |
| Chatsworth Grit | Buff, Pale Grey, Blue | Sandstone | 70-90 | Hayfield Quarry, Hayfield, Derbyshire |
| Chert | Grey | Chert | >90 | Marlow Stone Quarry, Lifton, Devon |
| Clipsham | Cream/Blue | Limestone | <2 | Holleywell Quarry, Oakham, Leicestershire |
| Clock Face | Buff, Grey | Sandstone | 70-90 | Clock Face Quarry, Huddersfield, West Yorkshire |
| Collyweston | Light Grey | Limestone | <2 | Bullimores Quarry, Peterborough, Northamptonshire |
| Copp Crag | Buff/Light Brown | Sandstone | 70-90 | Copp Crag Quarry, Byness, Lothian |
| Corncockle | Red | Sandstone | 70-90 | Corncockle Quarry, Lockerbie, Dumfries & Galloway |
| Corrennie | Red, Pink | Granite | ~ 30 | Tillyfourie Quarry, Aberdeen, Grampian |
| Cotswold | Cream | Limestone | <2 | Cotswold Hill Quarry, Cheltenham, Gloucestershire |
| Creeton | Grey/Blue | Limestone | <2 | Creeton Quarry, Grantham, Lincolnshire |
| Hillend Black | Black/Dark Grey | Dolerite | Up to 15 | Hillend Quarry, Airdrie, Strathclyde |

Extracts from “British building stones and their approximate quartz content, HSE information sheet, Version 2, published 4th March 2004

**Table 5**: Cases of respiratory disease reported to SWORD by chest physicians (1989-2005) or OPRA by occupational physicians (1996-2005).

Data are presented using the diagnostic categories specified on the SWORD reporting card. There were 747 estimated cases of respiratory disease attributed to silica, (417 actual) reported to SWORD between 1989-2005 and 27 estimated cases, (5 actual) reported to OPRA between 1996-2005. Please note the total number of diagnoses may exceed the total number of cases, as each case may have more than one diagnosis.

| Diagnostic Category | SWORD | | OPRA | |
|---|---|---|---|---|
| | Estimated | Actual | Estimated | Actual |
| A. Asthma | 15 | 4 | 0 | 0 |
| B. Inhalation accidents | 1 | 1 | 0 | 0 |
| C. Allergic alveolitis | 0 | 0 | 0 | 0 |
| D. Bronchitis/ emphysema | 41 | 19 | 0 | 0 |
| E. Infectious disease | 2 | 2 | 0 | 0 |
| F. Non-malignant pleural disease | 16 | 5 | 0 | 0 |
| G. Mesothelioma | 0 | 0 | 0 | 0 |
| H. Lung cancer | 28 | 6 | 0 | 0 |
| I. Pneumoconiosis | 654 | 379 | 27 | 5 |
| J. Other respiratory disease | 6 | 6 | 0 | 0 |
| Total Diagnoses | 763 | 422 | 27 | 5 |

**Table 6**: All cases of respiratory disease attributed to silica (SWORD 1989-2005 & OPRA 1996-2005) by diagnostic category

| Diagnostic Category | SWORD | | OPRA | |
|---|---|---|---|---|
| | Estimated | Actual | Estimated | Actual |
| Asthma | 0 | 0 | 0 | 0 |
| Inhalation accidents | 0 | 0 | 0 | 0 |
| Allergic alveolitis | 0 | 0 | 0 | 0 |
| Bronchitis/ emphysema | 0 | 0 | 0 | 0 |
| Infectious disease | 0 | 0 | 0 | 0 |
| Non-malignant pleural disease | 0 | 0 | 0 | 0 |
| Mesothelioma | 0 | 0 | 0 | 0 |
| Lung cancer | 2 | 2 | 0 | 0 |
| Pneumoconiosis | 65 | 32 | 1 | 1 |
| Other resp | 1 | 1 | 0 | 0 |
| Total Diagnoses | 68 | 35 | 1 | 1 |

The case in ‘other respiratory’ was assigned a diagnosis of bronchiolitis.

**Table 7**: Responses to SBS telephone follow-up questionnaire.

| | Questions: | WEL: | | Control | Know/have guidance? | | | | Know diseases? | | | Want info via: | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Company** | **Stone worked:** | **Aware of redn?** | **Know new?** | **Improvemts planned?** | **HS(G) 201** | **INDG 315** | **COSHH** | **COSHH & Silica essentials** | **Silicosis** | **Lung cancer** | **Copd / emphysema** | **Internet ?** | **post?** |
| 1 | sandstone | Y | Y | N | N | N | Y | Y | Y | | | Y | Y |
| 2 | granite | N | | | Y | N | Y | N | | "LUNGS | | Y | Y |
| 3 | sst, gritstone | Y | N | Poss | Y | N | Y | N | Y | | Y | Y | Y |
| 4 | Marble, gran | N | | | N | N | N | N | - | - | - | Y | Y |
| 5 | Sst | N | | | Y | N | Y | Y | | | Y | Y | Y |
| 6 | Limestone | N | | | Y | N | Y | Y | | | Y | Y | Y |
| 7 | Granite | Y | N | Y | N | N | Y | N | - | - | - | Y | Y |
| 8 | Gran, Marble, Sst, concrete | Y | N | Y | Y | N | Y | Y | | Y | | Y | Y |
| 9 | Sandstone | N | | | Y | Y | Y | Y | | "Lungs" | | Y | Y |
| 10 | Granite | N | | | N | N | N | N | | "Lungs" | | Y | Y |
| 11 | 80% sst 20% Lst | N | | | N | Y | Y | N | Y | | Y | Y | Y |
| 12 no production now | (marble, lst) | N | | | | | | | | | | | |
| 13 | granite 30% marble 70% | N | | | N | N | Y | Y | | | Y | Y | Y |
| 14 | Granite, marble | N | | | N | N | N | N | Y | | | Y | Y |
| **Totals:** | **Y** | 4 | 1 | 2 | 6 | 2 | 10 | 6 | 4 | 1 | 5 | 13 | 13 |
| | **N:** | 10 | 3 | 1 | 7 | 11 | 3 | 7 | | | | 0 | 0 |
| | | | | 1 POSS | | | | | | | | | |

## APPENDIX B: SURVEY VISIT SUMMARY REPORTS

Silica Baseline Survey – Summary Reports

The following pages contain Summary Reports for the visits made to the various **stonemasonry companies' sites** included in the baseline survey. Some were visited by FOD for enforcement reasons.

Although the reports have been anonymised descriptions of the operations undertaken and the exposure control measures at each site are provided.

## Site 1 Company 1

Two visits were made to Company 1. The first visit was made in January 2005. The second visit was made in August 2005 following improvement to exposure control measures introduced as a result of the findings of the initial report.

No work with sandstone took place during the second visit.

## Description of Facility / Operations

The company manufacture stone articles, such as fireplaces from stone. The stone they commonly use is magnesian limestone and less occasionally sandstone. Their premises consist of two large warehouse sized buildings and a segregated room between them.

In one of the warehouses stone is cut using water-cooled saws and in the other they manufacture tiles by polishing stone with an automatic polishing machine. In the segregated room the company hand cut, ground and polished stone. This later room was the one where the sampling was carried out.

In the segregated room there were 4 masons who hand cut, grind and polish the stone to the required shape. The work was done using hand held powered rotary tools fitted with the relevant discs. In order to achieve an acceptable finish the powered tools were used without water. The masons also occasionally use a chisel to decorate the stone.

There are approximately 20 people employed on the manufacturing site. The staff operate the following shift pattern: 7-4 or 8-5, with 1 hour of breaks. They may also work up to 1 hours overtime depending on the production demands.

## Materials

This firm manufacture stone pieces using Magnesian Limestone and sandstone.

Typical silica content: Sandstone >70%

Limestone: 1-2%

**Control Measures**

The hand stone masonry work is performed in segregated room. This room is not fitted with general ventilation although the door was open. There were a series of fans located in the room that were originally used to 'blow' the dust away from the masons. These were no longer used.

In the room there were four workstations for the masons. Two of these workstations were located in front of a water wall filtration system that consisted of a water filter to remove the stone dust from the air. This was fixed to a wall and was not connected to a booth. It was not that the capture efficiency was poor. This was due to the lack of a booth surrounding the working area and the distance that the stonemasons worked from the wall.

The remaining two masons did not have any controls to reduce dust levels. However, their workstations were located near the open door of the room.

The workers wore respiratory protective equipment (RPE) to the FFP1 standard. This was freely available and was changed each day. When questioned the masons indicated that they had not been face fitted for the RPE or trained in its use. It was noted that some of the workers were wearing the RPE incorrectly.

The masons supplied their own personal protective equipment (PPE). This consisted of safety boots and 'work clothes'. The work clothes varied according to the mason, but typically consisted of woolly jumpers, coats or cotton overalls. The company supplied a washing machine, but each worker preferred to wash their own PPE at home.

The room was cleaned using a broom, which was used to sweep up the dust.

| | |
|---|---|
| **Control competency rating (0 - 5)** | **1** – See Appendix D for descriptors |
| **RPE competency rating (NR, 1 – 5)** | **2** – See Appendix D for descriptors |

**Notes:**

**Control Competency:**

Dry cutting / polishing / chiselling are the principal sources of exposure to dust (RCS) at the sites, based on inspection of engineering controls and supporting exposure measurement data it is apparent that control of exposure is unsatisfactory.

Poor / inappropriate design of LEV systems, inadequate COSHH assessment for cutting operations, no records of examination & testing of LEV, no awareness of hazard, levels of exposure or risk etc.

**RPE Competency:**

Limited evidence of selection process, no face fit testing. No evidence of adequate training. No assessment of residual risk.

**Table of Results**

| 2/01/2005 Sample No | Sample type | Sample Position | Duration, Mins | Exposures, mg.m$^{-3}$ | | | |
|---|---|---|---|---|---|---|---|
| | | | | RCS | | Respirable dust | |
| | | | | Task | 8-hr TWA | Task | 8-hr TWA |
| 06079/05<br>06092/05 | PL | SM, Mason near water wall. Polishing, grinding limestone | 166 | 2.3 | 2.3 | 15.9 | 15.9 |
| 06080/05<br>06093/05 | PL | JW, Mason near water wall. Polishing, grinding limestone | 172 | 1.7 | 1.7 | 13.9 | 13.9 |
| 06081/05<br>06094/05 | PL | SG, Mason near open door. Polishing, cutting and grinding sandstone | 158 | 7.8 | 7.8 | 33.9 | 33.9 |
| 06082/05<br>06095/05 | PL | PR, Mason nearest open door. Polishing, cutting and grinding sandstone | 158 | 2.9 | 2.9 | 12.3 | 12.3 |
| 06083/05<br>06096/05 | SL | Static, Middle of wall opposite side of room to masons | 188 | 1.7 | | 9.8 | |
| 06084/05<br>06097/05 | SL | Static on wall to side of 'water wall' | 192 | 1.7 | | 14.6 | |
| 06085/05<br>06098/05 | SL | Static on wall in front of masons cutting sandstone, midway between their workstations | 189 | 2.8 | | 11.9 | |
| | | Geometric mean of personal measurements: | | | | | 17.4 |
| 16/8/05: | | | | | | | |
| 11565/04<br>11552/04 | PL | SM, Mason near water wall. Polishing, grinding limestone | 180 | <LOD | <LOD | 9.4 | 8.8 |
| 11566/04<br>11553/04 | PL | JW, Mason near water wall. Polishing, grinding limestone | 179 | <LOD | <LOD | 25.4 | 23.8 |
| 11567/04<br>11554/04 | SL | Static: middle of wall opposite side of room to masons | 218 | <LOD | | 2.9 | |
| | | Geometric mean of personal measurements: | | | | | 14.5 |

**Summary of results:**

Visit 1 - January 2005

The respirable dust concentration varied between 9.8 to 33.9 mg $m^{-3}$ and the calculated respirable 8hr TWA varied between 12.3 to 33.9 mg $m^{-3}$. The respirable silica concentrations as 8hr TWA ranged from 1.7 to 7.8 mg $m^{-3}$.

Visit 2 - August 2005

The respirable dust concentration varied between 9.4 to 25.4 mg $m^{-3}$ and the calculated respirable 8hr TWA varied between 8.8 to 23.8 mg $m^{-3}$. The respirable silica concentrations as 8hr TWA were all below the limit of detection i.e. <0.02 mg $m^{-3}$. Operations during Visit 2 did not include any work on high silica content stone as had been the case during Visit 1 but the respirable dust concentrations generated were excessive and any silica in the stone would probably have caused exposure over the WEL.

**Site data transferred to summary:**

| Site | Activities | Control strategy | Samples collected | | Number of measurements (8-hr TWAs) | | | | | Competency Descriptor Ratings | | Material type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | RCS | | | Respirable Dust | | | | |
| | | | Personal | Static | ≥0.3 $mg.m^{-3}$ | 0.3>x≥0.1 $mg.m^{-3}$ | Highest exposure $mg.m^{-3}$ | Exposure above 4 $mg.m^{-3}$ | Highest exposure $mg.m^{-3}$ | Control | RPE | |
| S1A | C | RPE & LEV | 4 | 3 | 4 | 0 | 7.8 | 4 | 34 | 0 | 2 | SS & LS |
| S1B | C | RPE & LEV | 2 | 1 | 0 | | <LOD | 2 | 23.8 | 1 | 2 | LS |

**Activity:** A: Primary / secondary sawing B: Boring, polishing (static) C: Cutting / polishing (hand-held). D: Chiselling (manual / pneumatic).

**Control strategy:** Silica Essentials Control approaches: W = Water suppression, LEV = Local exhaust ventilation, LAD= Local Air Displacement

**Company 2**

**Description of Facility / Operations**

The company manufacture kitchen worktop stone surfaces, commonly granite. Their premises consist of a small industrial unit and offices.

In the industrial unit the firm have various stone cutting machines, including saws, CNC cutters and edge polishers. The saws, CNC cutter and edge polisher are all water cooled to preserve tool life and reduce airborne stone dust. They also have some benches where hand polishing is performed.

The firm employ five staff to manufacture the stone items and some ancillary workers. The firm operate the following shift pattern: 8:00 to 16:30 with 45 minutes of breaks

**Materials**

This firm manufacture stone pieces using granites from various sources. Typical silica content: Granite (up to) 30%

**Control Measures**

The workers all wore overalls, hearing defenders, weight lifting belts and safety shoes. An external contractor laundered these overalls on a weekly basis.

In the industrial unit there was no planned general ventilation to reduce the worker's exposure to dust during the manufacturing process. There was local exhaust ventilation (LEV) provided for the hand polishing area of the workplace.

The LEV appeared to be relatively effective at capturing the dust. It was noted that the dust that was not captured by the bench travelled across the bench to the opposite side. This may exposure the worker on this side to silica. The bench had not undergone a 14-monthly examination as required by COSHH.

The CNC, powered saws and edge polisher all had water jets to control the dust produced whilst using these machines. The hand polishing was performed on a ventilated bench.

The workers all had access to RPE (FFP1) when they felt the need to use it. This RPE had not been face fit tested. It was worn by the worker's who were hand polishing the granite on the ventilated bench. It was noted that the RPE was worn incorrectly, often with only one strap being used.

The room was cleaned using a wash down and squeegee to move the water into a drainage channel in the floor of the unit.

| | |
|---|---|
| **Control competency rating (0 - 5)** | **1 – See Appendix D for descriptors** |
| **RPE competency rating (NR, 1 – 5)** | **N/A – See Appendix D for descriptors** |

**Notes:**

**Control Competency:**

Dry cutting / polishing / chiselling are the principal sources of exposure to dust (RCS) at the sites, based on inspection of engineering controls and supporting exposure measurement data it is apparent that control of exposure is unsatisfactory.

Poor / inappropriate design of LEV systems, inadequate COSHH assessment for cutting operations, no records of examination & testing of LEV, no awareness of hazard, levels of exposure or risk etc.

**RPE Competency:**

Limited evidence of selection process, no face fit testing. No evidence of adequate training. No assessment of residual risk..

**Table of Results**

| Sample No | Sample type | Sample Position | Duration, Mins | Exposures, mg.m$^{-3}$ | | | |
|---|---|---|---|---|---|---|---|
| | | | | RCS | | Respirable dust | |
| | | | | Task | 8-hr TWA | Task | 8-hr TWA |
| 11137/04 | PL | CY, factory owner / CAD draftsman | 197 | 0.03 | 0.03 | 1.1 | 0.03 |
| 11138/04 | PL | DH, CNC cutting (not much cutting work performed) | 203 | 0.02 | 0.02 | 1.3 | 0.02 |
| 11139/04 | PL | SM, Bench and edge grinding / polishing Approx 50% hand polishing on bench | 211 | 0.02 | 0.02 | 1.5 | 0.02 |
| 11140/04 | PL | DM, saw operative | 216 | 0.02 | 0.02 | 1.7 | 0.02 |
| 11141/04 | PL | MM, Bench polishing | 213 | 0.08 | 0.08 | 1.9 | 0.08 |

**Summary of results:**

The respirable dust concentration varied between 0.19 to 0.47 mg m-3 and the calculated respirable 8hr TWA exposures varied between 0.19 to 0.45 mg m-3. The respirable silica content measured concentrations varied between 0.02 to 0.08 mg m-3 and the 8hr TWA's varied between 0.02 to 0.08 mg m-3.

**Site data transferred to summary:**

| Site | Activities | Control strategy | Samples collected | | Number of measurements (8-hr TWAs) | | | | | Competency Descriptor Ratings | | Material type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | RCS | | | Respirable Dust | | | | |
| | | | Personal | Static | ≥0.3 $mg.m^{-3}$ | 0.3>x≥0.1 $mg.m^{-3}$ | Highest exposure $mg.m^{-3}$ | Exposure above 4 $mg.m^{-3}$ | Highest exposure $mg.m^{-3}$ | Control | RPE | |
| S2 | A & C | LEV | 5 | 0 | 0 | 0 | 0.08 | 0 | 2.32 | 1 | N/R | |

**Activity:** A: Primary / secondary sawing B: Boring, polishing (static) C: Cutting / polishing (hand-held). D: Chiselling (manual / pneumatic).

**Control strategy:** Silica Essentials Control approaches: W = Water suppression, LEV = Local exhaust ventilation, LAD= Local Air Displacement

**Company** 3

**Description of Facility / Operations**

This firm manufacture monumental masonry work in the North East of England. They use mainly granite, but some sandstone and marble are also utilised, depending on the customer's requirements.

The company buy stone from various sources that they store on their yard. The stone is taken into the workshop where it is made into the required shape by the use of mechanical or hand tools.

The machine tools are generally water cooled to prolong tool life and reduce the dust levels. A large saw is used to cut the stone to the rough size required. These are then surface polished as necessary. If a decorative top is required a large grinding wheel is used and a borer is used to produce holes in as necessary.

Hand tools are used to produce the correct size and shape as necessary. The names on the headstone are produced by either an air operated hand chisel or by grit blasting. The grit blasting process consists of laying a mask on the stone and blasting it with an aluminium oxide powder. Some head stones are etched using the grit blasting technique to produce pictures on the stone.

There are 12 stonemasons employed by the company. They operate the following shift system: 8:00 to 17:00 with 1 hour of breaks.

**Materials**

This firm manufacture stone pieces using various granites also some sandstone and marbles.

Typical silica content: Granite (up to) 30%

Marble 1-2%

Sandstone >70%

**Control Measures**

The hand disc cutting and edge grinding are performed using a local exhaust ventilation (LEV) booth with an extraction fan in the wall. This had been manufactured by the company and had not undergone a through examination and testing.

It was noted that two workers used this booth. They were side-by-side, but one worker was nearer the booths entrance than the other. This meant that the dust generated by one worker was being carried towards the other by the extraction fan. Also, it was noted that the masons could not move the work-piece so they occasionally worked between the work-piece and the extraction fan in the booth. Both of these work practises would increase the exposure to the stone dust.

The majority of the main processes were water-cooled. This would significantly reduce the airborne stone dust generated by these machines. However there were several work processes were which were dry. These included hand carving and the hand cutting.

The workplace was cleaned regularly using water that was then swept into a drain.

The workers in the booth wore respiratory protective equipment (RPE) to FFP2 standard. The workers had not been face fit tested. It was noted that one worker wore the RPE incorrectly.

They all wore safety shoes but used their own clothes inside the factory

| | |
|---|---|
| **Control competency rating (0 - 5)** | **2 -- See Appendix D for descriptors** |
| **RPE competency rating (NR, 1 – 5)** | **2 – See Appendix D for descriptors** |
| **Notes:**<br>**Control Competency:**<br>Dry cutting / polishing / chiselling are the principal sources of exposure to dust (RCS) at the sites, based on inspection of engineering controls and supporting exposure measurement data it is apparent that control of exposure is unsatisfactory.<br>Poor / inappropriate design of LEV systems, inadequate COSHH assessment for cutting operations, no records of examination & testing of LEV, no awareness of hazard, levels of exposure or risk etc.<br>**RPE Competency:**<br>Limited evidence of selection process, no face fit testing. No evidence of adequate training. No assessment of residual risk. | |

**Table of Results**

| Sample No | Sample type | Sample Position | Duration, Mins | Exposures, mg.m$^{-3}$ | | | |
|---|---|---|---|---|---|---|---|
| | | | | RCS | | Respirable dust | |
| | | | | Task | 8-hr TWA | Task | 8-hr TWA |
| P1 | PL | LM, Borer | 185 | 0.07 | 0.07 | 0.89 | 0.89 |
| P2 | PL | BD, Hand carving using air chisel | 151 | 0.16 | 0.16 | 1.54 | 1.54 |
| P3 | PL | CR, main saw | 185* | 0.12 | 0.12 | 0.77 | 0.77 |
| P4 | PL | DT, Wet polishing | 191 | 0.04 | 0.04 | 0.63 | 0.63 |
| P5 | PL | DM, disc grinding and bead blasting | 213 | 0.06 | 0.06 | 0.65 | 0.65 |
| P6 | PL | MY Art carving (pictures onto head stones) | 199 | 0.04 | 0.04 | 0.50 | 0.50 |
| P7 | PL | CC, Marble disc grinding | 184 | 0.13 | 0.13 | 2.00 | 2.00 |

**Summary of results:**

The respirable dust exposure concentrations varied between 0.5 to 2 mg.m$^{-3}$ and the calculated respirable 8hr TWA exposures varied between 0.5 to 2 mg.m$^{-3}$.

The measured RCS exposure concentrations varied between 0.04 to 0.16 mg m$^{-3}$ and the 8hr TWA exposures varied between 0.04 to 0.16 mg m$^{-3}$.

**Site data transferred to summary:**

| Site | Activities | Control strategy | Samples collected | | Number of measurements (8-hr TWAs) | | | | | Competency Descriptor Ratings | | Material type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | RCS | | | Respirable Dust | | | | |
| | | | Personal | Static | ≥0.3 mg.m$^{-3}$ | 0.3>x≥0.1 mg.m$^{-3}$ | Highest exposure mg.m$^{-3}$ | Exposure above 4 mg.m$^{-3}$ | Highest exposure mg.m$^{-3}$ | Control | RPE | |
| S3 | A, B, C & D | RPE & LEV | 7 | 0 | 0 | 3 | 0.16 | 0 | 2 | 2 | 2 | |

**Activity:** A: Primary / secondary sawing B: Boring, polishing (static) C: Cutting / polishing (hand-held). D: Chiselling (manual / pneumatic).

**Control strategy:** Silica Essentials Control approaches: W = Water suppression, LEV = Local exhaust ventilation, LAD= Local Air Displacement

**Company 4**

**Description of Facility / Operations**

The firm manufacture stone kitchen worktops and gravestones in the North East of England using various granites and marbles.

The company buy stone from various sources that they store on their yard. The stone is taken into the workshop where it is made into the required shape by the use of mechanical or hand tools.

The workshop consists of a three main work areas. These are a 'lettering area', a hand masonry area and a general area.

In the lettering area the inscriptions are put onto the headstones. This is done using an etching technique either done by hand chiselling or grit blasting. In the general area the stones are cut, shaped, polished and drilled. This is done using machines or by hand. All the processes in this area are water cooled. In the hand masonry area there are two workers who were cutting and shaping stone using hand operated tools. These tools were not water-cooled.

There are 40 staff of which 25 are stone masons employed by the company. They operate the following shift system: 8:00 to 16:30 with 50 minutes of breaks.

**Materials**

This firm manufacture stone kitchen worktops and gravestones using various granites and marbles.

Typical silica content: Granite (up to) 30%

Marble 1-2%

**Control Measures**

In the hand masonry area stones are shaped using powered hand tools. These have local exhaust ventilation (LEV) fitted with an 'elephants foot' type captor hood. In each area there was only one worker working.

The majority of the main processes in the general work area were water-cooled. This would significantly reduce the airborne stone dust generated by these machines. LEV was not present in this area.

In the lettering area there was an enclosed grit-blasting booth present to reduce exposure during the grit blasting process.

The workplace was cleaned regularly using water that was then swept into a drain.

The workers in the hand masonry area and the hand polisher wore respiratory protective equipment (RPE) to the FFP3 standard. The workers had not been face fit tested.

They all wore safety shoes but used their own clothes inside the factory

| | |
|---|---|
| **Control competency rating (0 - 5)** | **1 – See Appendix D for descriptors** |
| **RPE competency rating (NR, 1 – 5)** | **2 – See Appendix D for descriptors** |
| **Notes:**<br>**Control Competency:**<br>Dry cutting / polishing / chiselling are the principal sources of exposure to dust (RCS) at the sites, based on inspection of engineering controls and supporting exposure measurement data it is apparent that control of exposure is unsatisfactory.<br>Poor / inappropriate design of LEV systems, inadequate COSHH assessment for cutting operations, no records of examination & testing of LEV, no awareness of hazard, levels of exposure or risk etc.<br><br>**RPE Competency:**<br>Limited evidence of selection process, no face fit testing. No evidence of adequate training. No assessment of residual risk. | |

**Table of Results**

| Sample No | Sample type | Sample Position | Duration, Mins | Exposures, mg.m$^{-3}$ | | | |
|---|---|---|---|---|---|---|---|
| | | | | RCS | | Respirable dust | |
| | | | | Task | 8-hr TWA | Task | 8-hr TWA |
| P 8 | PL | AE, Masons Shop, hand carving | 163 | 0.13 | 0.12 | 0.81 | 0.76 |
| P 9 | PL | AH, Hand carving using air chisel | 163 | <0.03 | <0.03 | 0.67 | 0.62 |
| P 10 | PL | SF, Grit / sand blast area | 152 | 0.06 | 0.05 | 0.66 | 0.62 |
| P11 | PL | PW, wet drilling of holes | 189 | 0.06 | 0.06 | 0.02 | 0.02 |
| P 12 | PL | SG, hand polishing stone (wet process) | 186 | 0.03 | 0.03 | 1.04 | 0.97 |
| P 13 | PL | BN, Main cutting using table saw | 190 | <0.02 | <0.02 | 0.15 | 0.14 |

**Summary of results:**

The respirable dust concentrations varied between 0.02 to 1.04 mg m$^{-3}$ and the calculated respirable 8hr TWA exposures varied between 0.02 to 0.97 mg.m$^{-3}$.

The highest respirable 8hr TWA exposure was for the worker hand polishing. This was a wet process and the cause of their exposure was uncertain. The hand masonry and lettering areas all had similar 8hr TWA exposures from 0.62 to 0.76 mg m-3.

The RCS measured concentrations varied between <0.02 to 0.13 mg m$^{-3}$ and the 8hr TWA exposures varied between <0.02 to 0.12 mg m$^{-3}$.

**Site data transferred to summary:**

| Site | Activities | Control strategy | Samples collected | | Number of measurements (8-hr TWAs) | | | | | Competency Descriptor Ratings | | Material type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | RCS | | | Respirable Dust | | | | |
| | | | Personal | Static | ≥0.3 mg.m$^{-3}$ | 0.3>x≥0.1 mg.m$^{-3}$ | Highest exposure mg.m$^{-3}$ | Exposure above 4 mg.m$^{-3}$ | Highest exposure mg.m$^{-3}$ | Control | RPE | |
| S4 | A, B, C & D | RPE & LEV | 6 | 0 | 0 | 1 | 0.12 | 0 | 0.97 | 1 | 2 | |

**Activity:** A: Primary / secondary sawing B: Boring, polishing (static) C: Cutting / polishing (hand-held). D: Chiselling (manual / pneumatic).

**Control strategy:** Silica Essentials Control approaches: W = Water suppression, LEV = Local exhaust ventilation, LAD= Local Air Displacement

Company 5

**Description of Facility / Operations**

The company manufacture kitchen worktops in granite. Their premises consist of a small industrial unit and offices. The layout of the building and the locations of the work areas are shown in figure 1.

In the industrial unit the firm have two saws and a variety of powered hand tools. These consisted of polishing and disc cutters. The saws and hand polishers were water cooled to preserve tool life and reduce airborne stone dust. The disc cutters were not water-cooled.

One worker was in charge of the saw and the other three workers were using hand tools. One worker was cutting holes using a router and the other two were edge polishing and disc cutting.

All the workers, except the saw operative, were involved in a mixture of polishing and cutting tasks. From observation of the workers it was noted that disc cutting produced large amounts of dust. It is likely that this was main exposure source for the workers.

The firm employ 4 staff to manufacture the stone items and fit kitchens. They operate the following shift pattern: 8:30 to 16:00 with 30 minutes of breaks.

**Materials**

This firm manufacture stone kitchen worktops using various granites.

Typical silica content: Granite (up to) 30%

**Control Measures**

In the industrial unit there was no planned general ventilation to reduce the worker's exposure to dust during the manufacturing process. During the sampling the external doors of the workplace were left open.

There was local exhaust ventilation (LEV) provided in one of the hand polishing areas of the workplace. This had not undergone a through 14-monthly examination and testing and was poorly designed. The captor hood was located in the ceiling of the workplace and could be dropped to capture dust. However, its reach was limited and could only be used at one bench.

The workers all had access to RPE (FFP3) when they felt the need to use it. The workers had not been face fit tested. It was mainly worn whilst the workers were disc cutting. The workers in the vicinity of this work including those standing next to the bench where the disc cutting was performed did not use RPE.

The room was cleaned using awash down and squeegee. The workers wore their own clothes in the workplace and also used safety shoes.

| | |
|---|---|
| **Control competency rating (0 - 5)** | **1 – See Appendix D for descriptors** |
| **RPE competency rating (NR, 1 – 5)** | **2 - See Appendix D for descriptors** |

**Notes:**

**Control Competency:**

Dry cutting / polishing / chiselling are the principal sources of exposure to dust (RCS) at the sites, based on inspection of engineering controls and supporting exposure measurement data it is apparent that control of exposure is unsatisfactory.

Poor / inappropriate design of LEV systems, inadequate COSHH assessment for cutting operations, no records of examination & testing of LEV, no awareness of hazard, levels of exposure or risk etc.

**RPE Competency:**

Limited evidence of selection process, no face fit testing. No evidence of adequate training. No assessment of residual risk..

**Table of Results**

| Sample No | Sample type | Sample Position | Duration, Mins | Exposures, mg.m$^{-3}$ | | | |
|---|---|---|---|---|---|---|---|
| | | | | RCS | | Respirable dust | |
| | | | | Task | 8-hr TWA | Task | 8-hr TWA |
| P25 | PL | SB senior, saw operative | 194 | <LOD | <LOD | 0.35 | 0.31 |
| P26 | PL | MB, wet/dry polishing and disc cutting | 120 | <LOD | <LOD | 0.74 | 0.65 |
| P27 | PL | GB, wet/dry polishing + grinding and routing | 193 | <LOD | <LOD | 0.51 | 0.45 |
| P28 | PL | SB junior, wet/dry polishing and disc cutting | 175 | 0.07 | 0.07 | 2.45 | 2.14 |

**Summary of results:**

The respirable dust concentrations varied between 0.4 to 2.5 mg m-3 and the calculated respirable 8hr TWA exposures varied between 0.3 to 2.14 mg m-3.

The RCS measured concentrations varied between LOD (Limit of detection, 0.03 mg m-3) to 0.07 mg m-3 and the 8hr TWA exposures varied between LOD to 0.07 mg m-3.

When compared against the results for the respirable dust the results for RCS were considerably lower than anticipated. It is suspected that the material being used was not granite.

**Site data transferred to summary:**

| Site | Activities | Control strategy | Samples collected | | Number of measurements (8-hr TWAs) | | | | | Competency Descriptor Ratings | | Material type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | RCS | | | Respirable Dust | | | | |
| | | | Personal | Static | ≥0.3 mg.m$^{-3}$ | 0.3>x≥0.1 mg.m$^{-3}$ | Highest exposure mg.m$^{-3}$ | Exposure above 4 mg.m$^{-3}$ | Highest exposure mg.m$^{-3}$ | Control | RPE | |
| S5 | A & C | RPE & LEV | 4 | 0 | 0 | 0 | 0.07 | 0 | 2.14 | 1 | 2 | Granite |

**Activity:** A: Primary / secondary sawing B: Boring, polishing (static) C: Cutting / polishing (hand-held). D: Chiselling (manual / pneumatic).

**Control strategy:** Silica Essentials Control approaches: W = Water suppression, LEV = Local exhaust ventilation, LAD= Local Air Displacement

**Company** 6

## Description of Facility / Operations

The company manufacture stone kitchen worktops and golf signs. The stone they commonly use is granite, though marble is also used. Their premises consist of a small industrial unit and offices. The layout of the building and the locations of the work areas are shown in figure 1.

In the industrial unit the firm have various stone cutting machines, including saws, CNC cutters and edge polishers. The saws, CNC cutter and edge polisher are all water cooled to improve tool life and reduce airborne stone dust. They also have some benches where hand polishing is performed, but this activity is not water-cooled.

The firm employ 11 staff to manufacture the stone items; there are also some ancillary workers. The firm operate the following shift pattern: 8:00 to 17:30 with 50 minutes of breaks.

## Materials

This firm manufacture stone kitchen worktops using various granites.

Typical silica content: Granite (up to) 30%

Marble 1-2%.

## Control Measures

In the industrial unit there was no planned general ventilation to reduce the worker's exposure to dust during the manufacturing process. However, several of the work processes were performed near open doors.

There was local exhaust ventilation (LEV) provided in one of the hand-polishing areas of the workplace. This had not been tested and was poorly designed. The captor hood was located under a workbench and did not capture the stone dust. The remaining areas did not have any LEV.

The CNC, powered saws and edge polisher all had water jets to control the dust produced whilst using these machines. The dust produced whilst hand polishing was not controlled.

The workers all had access to RPE (FFP2) when they felt the need to use it. The workers had not been face fit tested. It was thus only worn by the workers who were hand polishing and by others as they thought necessary.

The room was cleaned using a wash down and squeegee to move the water into a drainage channel in the floor of the unit.

The workers wore their own clothes in the workplace and also used safety shoes. In the stockyard they used hard hats whilst moving the stone.

Following visit 1 (April 2005) the company took steps to improve the existing control measures, particularly for the dry polishing and bevelling work (down draught bench). Based on the sampling results from visit 2 (February 2006), see below, the new control measures appear to have been successful in achieving a greater degree of control of the dusts generated.

| | |
|---|---|
| **Control competency rating (0 - 5)** | **0 - See Appendix D for descriptors** |
| **RPE competency rating (NR, 1 – 5)** | **1* – See Appendix D for descriptors** |
| **Notes: Control Competency:** none beyond a certain amount of water-based dust suppression and wet cleaning.<br><br>**RPE Competency:**<br>* - Face fit testing not conducted. Regulation 7 of COSHH states that the initial selection of RPE (full / half face including disposables) should include fit testing to ensure that the correct device has been chosen (in terms of size / fit etc.). | |

**Table of Results**

| Sample No | Sample type | Sample Position | Duration, Mins | Exposures, mg.m$^{-3}$ | | | |
|---|---|---|---|---|---|---|---|
| | | | | RCS | | Respirable dust | |
| | | | | Task | 8-hr TWA | Task | 8-hr TWA |
| Monitoring 28/04/05 | | | | | | | |
| P19 | PL | SW, dry polishing near door | 170 | 0.03 | 0.03 | 1.81 | 1.88 |
| P20 | PL | MB, Making golfing signs | 175 | <0.03 | <0.03 | 0.16 | 0.17 |
| P21 | PL | GN, Making golfing signs | 176 | <0.03 | <0.03 | 0.31 | 0.33 |
| P22 | PL | LH, Sawing (wet) | 158 | <0.03 | <0.03 | 0.06 | 0.06 |
| P23 | PL | CG, marble polishing in curtained area | 170 | 0.07 | 0.07 | 6.18 | 6.41 |
| P24 | PL | RG, Kitchen area, CNC + Hand grinding | 146 | 0.87 | 0.90 | 4.60 | 4.77 |
| Monitoring 2/2/06 | | | | | | | |
| S1 | PL | LH – Band saw operation (wet cutting) | 270 | 0.03 | 0.027 | 0.178 | 0.160 |
| S2 | PL | SW – Operation of saws (wet cutting) and hand polishing (dry). | 266 | 0.24 | 0.215 | 2.087 | 1.870 |
| S3 | PL | CG – Polishing and bevelling of small stones, operation of CNC machine (on AirBench). | 256 | 0.07 | 0.063 | 0.790 | 0.708 |

**Summary of results:**

Visit 1 – April 2005

The respirable dust concentrations varied between 0.06 to 6.18 mg.m$^{-3}$ and the calculated respirable 8hr TWA exposures varied between 0.06 to 6.41 mg.m$^{-3}$.

The respirable crystalline silica content measured concentrations varied between <0.03 to 0.87 mg.m$^{-3}$ and the 8hr TWA exposures varied between < 0.03 to 0.9 mg.m$^{-3}$.

It was noted that all the workers except one were working limestone rather than granite. The percentage of crystalline silica in granite is up to 30% and in limestone it is up to 4%. If the workers had been using granite it is likely that another two workers would have exceeded the WEL set for silica.

Visit 2 – February 2006

All RCS results from the 2006 monitoring were below 0.3 mg.m$^{-3}$, ranging from 0.027 to 0.215 mg.m$^{-3}$ 8hr TWA. Following the introduction of improved control measures for the dry polishing and bevelling work (i.e. a down-draught bench) the level of respirable dust exposure for these tasks was reduced by 85% and the RCS by over 90%.

**Site data transferred to summary:**

| Site | Activities | Control strategy | Samples collected | | Number of measurements (8-hr TWAs) | | | | | Competency Descriptor Ratings | | Material type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | RCS | | | Respirable Dust | | | | |
| | | | Personal | Static | ≥0.3 mg.m$^{-3}$ | 0.3>x≥0.1 mg.m$^{-3}$ | Highest exposure mg.m$^{-3}$ | Exposure above 4 mg.m$^{-3}$ | Highest exposure mg.m$^{-3}$ | Control | RPE | |
| S6a | A, B & C | RPE | 6 | 0 | 1 | 1 | 0.90 | 2 | 6.41 | 0 | 1 | Mostly limestone, 1 granite |
| S6b | A, B & C | LEV | 3 | 0 | 0 | 1 | 0.215 | 0 | 1.87 | | | N/A |

**Activity:** A: Primary / secondary sawing B: Boring, polishing (static) C: Cutting / polishing (hand-held). D: Chiselling (manual / pneumatic).

**Control strategy:** Silica Essentials Control approaches: W = Water suppression, LEV = Local exhaust ventilation, LAD= Local Air Displacement

**Company** 7

**Description of Facility / Operations**

The company are involved in the fabrication of bespoke kitchen surfaces / finishes. The material used is primarily granite, which they purchase semi-prepared from suppliers in various shades and thickness. Slabs are either 20 or 30cm in thickness and sink / tap apertures and drainage grooves are cut before bespoke fittings are applied as per the customer's requirements.

The main operations are performed in two areas: the main workshop and the dry cutting room.

The main workshop is a large open plan industrial warehouse facility where large items of plant (CNC machines, bridge saws etc.) are located. A range of wet and dry processes is undertaken in this area. The majority of the work is wet process however a small amount of dry hand finishing / polishing is also performed.

The dry cutting room is a much smaller area located at the side of the main workshop. This room is used solely for the dry cutting of stone using hand-held power tools. The work undertaken in the dry cutting room is done by one designated operative who is supplied with, and trained in the use of, appropriate PPE and RPE.

Operations on the day of the survey were described as normal by staff. Working hours were from 08.00 – 16.30hrs with a 30 minute lunch break and two fifteen minute breaks taken in the morning and afternoon.

**Materials**

This firm manufacture bespoke domestic stonework surfaces e.g. kitchen and bathroom surfaces, using semi-finished granite, marble and other stonework..

Typical silica content: Granite (up to) 30%

Marble 1-2%

**Control Measures**

Previous exposure monitoring undertaken at this site in 2003 led to the improvement of existing control measures. The main objectives of this survey were to measure employee exposure to RCS and to evaluate whether the new control methods installed had been effective in reducing exposure.

Since the previous monitoring the main changes to the existing control measures were;

· The introduction of the Ital Marmi 'Air Box' LEV system for control of dust generated during dry cutting operations.

· The full enclosure dry cutting operations within a designated room separate from the main workshop.

· The provision of more appropriate forms of PPE & RPE for operatives undertaking dry cutting operations

· The replacement of the main workshop LEV system with new system.

It should be noted that, on the day of the survey, operatives were observed undertaking work in such a way as to compromise the control offered by the new engineering controls i.e. positioning themselves between the capture hood and the dust source. Operatives may require a degree of re-training in the importance of positioning in maximising the performance of the LEV systems (ergonomics)..

| | |
|---|---|
| **Control competency rating (0 - 5)** | **4– See Appendix D for descriptors** |
| **RPE competency rating (NR, 1 – 5)** | **4* – See Appendix D for descriptors** |
| **Notes:**<br>**Control Competency:**<br>***** - Face fit testing not conducted. Regulation 7 of COSHH states that the initial selection of RPE (full / half face including disposables) should include fit testing to ensure that the correct device has been chosen (in terms of size / fit etc.).<br>**RPE Competency:**<br>Regulation 9 of COSHH states that the quality of the air supplied to breathing apparatus (e.g. air fed hood in dry cutting area) should be tested at least once every three months, and more frequently when the quality of the air supplied cannot be assured | |

**Table of Results**

| Sample No | Sample type | Sample Position | Duration, Mins | Exposures, mg.m$^{-3}$ | | | |
|---|---|---|---|---|---|---|---|
| | | | | RCS | | Respirable dust | |
| | | | | Task | 8-hr TWA | Task | 8-hr TWA |
| 1. | PL | Personal –ME Wet polishing in main workshop. | 350 | | 0.040 | | |
| 2. | PL | Personal – AC Finishing and polishing operations (dry) in main workshop. | 356 | | 0.147 | | |
| 3. | PL | Personal – MR Bridge saw (wet) operations in main workshop. | 357 | | 0.086 | | |
| 4. | PL | Personal – JH Various duties within main workshop except wet polishing. | 347 | | 0.061 | | |
| 5. | PL | Personal – CR Recessing work (wet) in main workshop. | 347 | | 0.035 | | |
| 6. | PL | Personal – TC Dry cutting of granite using various hand-held tools in designated side building. | 231 | | 0.246 | | |
| 7. | SL | Static – On top of the filing cabinet in the nearest office to the main workshop. | 344 | | <0.029 | | |
| 8. | SL | Static – On the frame of semi-enclosure next to the gent's toilet at the rear of the main workshop. | 323 | | 0.038 | | |

**Summary of results:**

The RCS 8hr TWA exposures varied between 0.035 to 0.25 mg m-3. The highest result was recorded from the operative undertaking dry cutting of granite using various hand-held tools in the designated side building.

The previous monitoring result for this operative had been 25% higher and had exceeded the WEL. This result indicated that the new control measures had been successful in reducing exposure to RCS for this activity.

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**Site data transferred to summary:**

| Site | Activities | Control strategy | Samples collected | | Number of measurements (8-hr TWAs) | | | | | Competency Descriptor Ratings | | Material type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | RCS | | | Respirable Dust | | | | |
| | | | Personal | Static | ≥0.3 $mg.m^{-3}$ | 0.3>x≥0.1 $mg.m^{-3}$ | Highest exposure $mg.m^{-3}$ | Exposure above 4 $mg.m^{-3}$ | Highest exposure $mg.m^{-3}$ | Control | RPE | |
| S7 | A & C | RPE & LEV | 6 | 2 | 0 | 2 | 0.25 | N/a | N/a | 4 | 4 | Granite |

**Activity:** A: Primary / secondary sawing B: Boring, polishing (static) C: Cutting / polishing (hand-held). D: Chiselling (manual / pneumatic).

**Control strategy:** Silica Essentials Control approaches: W = Water suppression, LEV = Local exhaust ventilation, LAD= Local Air Displacement

**Company 8**

**Description of Facility / Operations**

The company manufacture sandstone blocks & slabs for walling, paving and bespoke items.

Main processes are the cutting and polishing of sandstone. The process begins with the delivery of sandstone blocks weighing 4 to 16 tonnes, and finishes with the production of walling blocks, paving slabs and bespoke masonry items. Processes include wet and dry systems.

The survey work was done at two sites. The visit to Site 1 was conducted by Chris Keen in June 2005, this work did not include taking exposure measurements from the stonemasons conducting dry cutting work.

The visit to Site 2 was conducted by Paul Brough in May 2006, this work included taking exposure measurements from wet and dry stonemasonry workers. These operations had recently been relocated here from the Matlock site.

Operations at Site 1 consist principally of the cutting of larger stones with saws and wire cutters. Operations at Site 2 were in three main work areas; the main cutting workshop (MCW) where the majority of static saws (wet cutting) are located, the main masonry workshop (MMW) where minor dry cutting, polishing and chiselling are performed and the dry cutting masonry workshop (DCW) where hand held power tools are used for dry cutting operations.

**Materials**

Cutting and polishing of sandstone.

Typical silica content: Sandstone >70%

**Control Measures**

Site 1

In terms of controlling exposure to respirable crystalline silica within the main cutting workshop areas, reasonable quality exposure controls, primarily water sprays, are fitted to all items of machinery which could potentially generate dust.

Site 2

Good general ventilation (main doors to the workshop were left wide open) however workers were conducting much of their chiselling, cutting and polishing operations out of the range of the LEV system located in the workshop. During winter, when the main doors are likely to remain closed due to the lower temperatures, ambient dust concentrations in the workshop may be even greater.

The LEV system present in the dry cutting masonry workshop had no capture hood fitted. Additionally the extraction system for the DCW has no filtration system and at present all dust extracted from the workplace is exhausted directly to atmosphere outside the building.

All the operatives involved in masonry work used RPE to control their exposure to airborne dust. The masons undertaking dry cutting in the DCW use ori-nasal P3 filter respirators whilst masons in the MMW used Moldex P3 disposable respirators. No operatives have been given training in use of their RPE, no storage facilities were provided and no face fit testing had been conducted. For these reasons the RPE was unlikely to be operating to it's full potential.

| | |
|---|---|
| **Control competency rating (0 - 5)** | **1 - See Appendix D for descriptors** |
| **RPE competency rating (NR, 1 – 5)** | **2 – See Appendix D for descriptors** |
| **Notes:**<br>**Control Competency:**<br>Dry cutting / polishing / chiselling are the principal sources of exposure to dust (RCS) at the sites, based on inspection of engineering controls and supporting exposure measurement data it is apparent that control of exposure is unsatisfactory.<br>Poor / inappropriate design of LEV systems, inadequate COSHH assessment for cutting operations, no records of examination & testing of LEV, no awareness of hazard, levels of exposure or risk etc<br>**RPE Competency:**<br>Limited evidence of selection process, no face fit testing. No evidence of adequate training. No assessment of residual risk | |

**Table of Results**

| Sample No | Sample type | Sample Position | Duration, Mins | Exposures, mg.m$^{-3}$ | | | |
|---|---|---|---|---|---|---|---|
| | | | | RCS | | Respirable dust | |
| | | | | Task | 8-hr TWA | Task | 8-hr TWA |
| Site 1, Matlock | | | | | | | |
| 05360/05 | PL | IJ – general duties | 290 | 0.064 | 0.084 | 0.16 | 0.21 |
| 05361/05 | PL | GS – saw operator | 337 | 0.049 | 0.064 | 0.27 | 0.35 |
| 05362/05 | PL | PG - profiler | 310 | 0.113 | 0.148 | 0.3 | 0.39 |
| 05363/05 | PL | IS – cropper operator | 310 | 0.137 | 0.18 | 0.3 | 0.39 |
| 05364/05 | PL | AB – saw operator | 228 | 0.123 | 0.161 | 0.4 | 0.53 |
| 05365/05 | PL | BK – dressing wallstone | 267 | 0.078 | 0.102 | 0.17 | 0.22 |
| 05366/05 | PL | AW – multi wire operator | 319 | 0.14 | 0.184 | 0.14 | 0.18 |
| Site 2, Grindleford | | | | | | | |
| 1 | PL | NC – Main masonry workshop | 290 | 0.61 | 0.686 | 1.20 | 1.34 |
| 2 | PL | AW – Dry cutting workshop | 337 | 1.61 | 1.912 | 20.05 | 23.81 |
| 3 | PL | GJ – Dry cutting workshop | 310 | 1.26 | 1.496 | 27.40 | 32.54 |
| 4 | PL | RC – Main cutting workshop | 310 | 0.07 | 0.079 | 0.28 | 0.32 |
| 5 | PL | SD – Wet cutting in Main masonry workshop | 228 | 0.18 | 0.203 | 0.55 | 0.62 |
| 6 | PL | MB – Main masonry workshop | 267 | 0.73 | 0.821 | 0.96 | 1.08 |
| 7 | PL | GE – Main masonry workshop | 319 | 0.37 | 0.416 | 0.81 | 0.91 |
| 8 | SL | Static – Main masonry workshop, on wall between MB & GE | 290 | 0.13 | 0.146 | 0.29 | 0.33 |

**Summary of results:**

Site 1 – June 2005

The respirable dust concentrations ranged from 0.14 to 0.4 mg.m$^{-3}$ and the calculated respirable 8hr TWA exposures varied between 0.18 and 0.53 mg.m$^{-3}$.

The respirable crystalline silica content measured concentrations varied between 0.05 and 0.14 mg.m$^{-3}$ and the 8hr TWA exposures varied between < 0.06 an 0.18 mg.m$^{-3}$.

Site 2 – May 2006

The respirable dust concentrations varied between 0.28 and 27.4 mg.m$^{-3}$ and the calculated respirable 8hr TWA exposures varied between 0.32 and 32.54 mg.m$^{-3}$.

The respirable crystalline silica content measured concentrations varied between 0.07 and 1.61 mg.m$^{-3}$ and the 8hr TWA exposures varied between 0.08 and 1.91 mg.m$^{-3}$.

**Site data transferred to summary:**

| Site | Activities | Control strategy | Samples collected | | Number of measurements (8-hr TWAs) | | | | | Competency Descriptor Ratings | | Material type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | RCS | | | Respirable Dust | | | | |
| | | | Personal | Static | ≥0.3 mg.m$^{-3}$ | 0.3>x≥0.1 mg.m$^{-3}$ | Highest exposure mg.m$^{-3}$ | Exposure above 4 mg.m$^{-3}$ | Highest exposure mg.m$^{-3}$ | Control | RPE | |
| S8a | A & C | W | 7 | 0 | 0 | 5 | 0.18 | 0 | 0.53 | 3 | 2 | |
| S8b | A, B, C & D | LEV & RPE | 7 | 1 | 5 | 1 | 1.91 | 2 | 32.54 | N/A | N/A | |

**Activity:** A: Primary / secondary sawing B: Boring, polishing (static) C: Cutting / polishing (hand-held). D: Chiselling (manual / pneumatic).

**Control strategy:** Silica Essentials Control approaches: W = Water suppression, LEV = Local exhaust ventilation, LAD= Local Air Displacement

Company 9

**Description of Facility / Operations**

The company are involved in the fabrication of bespoke kitchen surfaces / finishes. The material used is primarily "granite," which they purchase from suppliers in various semi-prepared shapes and thickness. The slabs of granite are bought from suppliers in China. Sink / tap apertures and drainage grooves are cut before bespoke fittings are applied in accordance with the customer's requirements.

The main operations undertaken are performed in two areas: the main workshop and the grinding and polishing (G & P) workshop.

The main workshop is a large open plan industrial warehouse facility where large items of plant (CNC machines, bridge saws etc.) are located. The majority of the work in this area is wet process.

The G & P workshop is a much smaller area located at the side of the main workshop. This room is used solely for the dry cutting of stone using hand-held power tools. The work undertaken in the G & P workshop is done by one designated operative who is supplied with PPE and RPE. Occasionally, when workloads are high, another operative may assist him. Previously there was a second area for this type of activity, located at the opposite end of the main workshop, however this area is now closed.

Operatives work predominantly with granite but may, on occasion, also do work with marble, sandstone or limestone depending on customer requests.

Working hours were from 08.00 – 17.00hrs with a 60-minute lunch break taken in the kitchen area above the G & P workshop. Tea breaks were taken in the workplace.

**Material**

This firm manufacture bespoke domestic stonework surfaces e.g. kitchen and bathroom surfaces, using semi-finished granite, reconstituted granite, marble and other stone.

Typical silica content: Granite (up to) 30%

Marble 1-2%

**Control Measures**

The initial cutting of large slabs is done using wet saws in the main workshop area. The water is effective in controlling the dust generated by this work.
The G & P workshop is a much smaller area located at the side of the main workshop. This room is used solely for the dry cutting of stone using hand-held power tools and has three positionable LEV hoods. These capture dust generated within range of the hood and extract it to the fan / filter unit located outside the building. The filtration is HEPA bag filters that are shaken down into a hopper at the end of each shift.
Inspection of the capture hoods and the flexi-ductwork revealed them to be poorly maintained with numerous defects evident that may significantly affect performance. Labels fitted to the hoods and fan / filter unit indicated that the system had undergone examination & testing on in June 2005.

No general ventilation is provided to the G & P workshop unless the doors are open. Operatives generally keep the doors shut to prevent dust and noise migrating into the main workshop (where visitors may be present).

Vacuum cleaners were not available to staff to remove excess dust from surfaces instead compressed air guns were used to blow excess dust from surfaces.

Operatives wear disposable P2 respirators during work in the G & P workshop. Safety shoes, eyewear and hearing protection (muffs) are also worn for dry cutting work. No storage facilities were provided for respirators when not in use and the internal surfaces of respirators found left on work surfaces had become contaminated with settled dust.

| | |
|---|---|
| **Control competency rating (0 - 5)** | **2 – See Appendix IV for descriptors** |
| **RPE competency rating (NR, 1 – 5)** | **2* – See Appendix IV for descriptors** |
| **Note:**<br>*** - Face fit testing not conducted. Regulation 7 of COSHH states that the initial selection of RPE (full / half face including disposables) should include fit testing to ensure that the correct device has been chosen (in terms of size / fit etc.).** | |

**Table of Results**

| Sample No | Sample type | Sample Position | Duration, Mins | Exposures, mg.m$^{-3}$ | | | |
|---|---|---|---|---|---|---|---|
| | | | | RCS | | Respirable dust | |
| | | | | Task | 8-hr TWA | Task | 8-hr TWA |
| 0015605 | SL | Static – On back wall of G & P workshop, behind bench 1. | 325 | Inhalable dust 7.82 mg.m$^{-3}$ | | | |
| 0015705 | PL | NG – Dry stone cutting and polishing | 247 | Inhalable dust measurement and 8-hr TWA: 87.4 mg.m$^{-3}$ | | | |
| 0015805 | SL | Static – On front wall of G & P workshop in front of bench 2. | 333 | Inhalable dust 27.9 mg.m$^{-3}$ | | | |
| 0015905 | PL | NG – Dry stone cutting and polishing | 248 | <0.04 | <0.04 | 11.546 | 11.547 |
| 0016005 | SL | Static – On back wall of G & P workshop, behind bench 1. | 305 | <0.03 | | 1.385 | - |
| 0016105 | SL | Static – On front wall of G & P workshop in front of bench 2. | 332 | <0.03 | | 4.764 | - |
| 0016205 | SL | Personal – LA working on wet cutter in main workshop (morning) and assisting in G & P workshop (afternoon) | 218 | <0.05 | | 1.438 | 1.439 |

**Summary of results:**

The low concentrations of silica measured are thought to be the consequence of the type of stone being worked. Although it was described as "granite," it was also called "blue pearl granite" and was probably a rock known as Larvikite, composed almost exclusively of feldspar minerals and effectively free of quartz. If any other type of stone had been in use an unacceptable RCS exposure would undoubtedly have occurred. (Marble containing 1 or 2% quartz could have caused exposure of 0.2 mg.m$^{-3}$ RCS.)

**Site data transferred to summary:**

| Site | Activities | Control strategy | Samples collected | | Number of measurements (8-hr TWAs) | | | | | Competency Descriptor Ratings | | Material type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | RCS | | | Respirable Dust | | | | |
| | | | Personal | Static | ≥0.3 mg.m$^{-3}$ | 0.3>x≥0.1 mg.m$^{-3}$ | Highest exposure mg.m$^{-3}$ | Exposure above 4 mg.m$^{-3}$ | Highest exposure mg.m$^{-3}$ | Control | RPE | |
| S9 | A & C | RPE, LEV & W | 3 | 4 | 0 | 0 | <LOD | 1 | 11.54 | 2 | 2 | Zero-silica stone suspected. |

**Activity:** A: Primary / secondary sawing B: Boring, polishing (static) C: Cutting / polishing (hand-held). D: Chiselling (manual / pneumatic).

**Control strategy:** Silica Essentials Control approaches: W = Water suppression, LEV = Local exhaust ventilation, LAD= Local Air Displacement

**Company 10**

**Description of Facility / Operations**

The company are involved in the fabrication of architectural items such as window and door frames.

The site consists of a series of rooms where the stone is sawn, shaped by hand or planed.

There were three saws in regular operation, used to cut the stone to the rough dimensions required. The blades were water cooled to reduce wear on the saw blade and to reduce the airborne dust levels. The sawing operation was performed inside segregated rooms and the doors were always open.

In the hand stonemasonry areas the masons shaped the stone using hand chisels, compressed air chisels and disc cutters. This work was performed in segregated rooms at discrete workbenches.

The planing operation was being performed in a segregated room from the other work processes. This operation consists of using a cutting tool to produce large flat surfaces on the stone faces. The cutting tool is fixed whist the stone is moved underneath. This process is not wet though the operator damped the stone during the machining process.

Operations on the day of the survey were described as normal by staff, except the stone being cut was limestone rather than sandstone.

Working hours were from 08.00 – 16.30hrs with a 30 minute lunch break and two fifteen minute breaks taken in the morning and afternoon.

**Material**

The material used is mainly sandstone, which they obtain from their quarry. Other stones are used as necessary and these are purchased from suppliers in various semi-prepared shades and thickness.

Typical silica content: Sandstone >70%

**Control Measures**

At each work bench local exhaust ventilation (LEV) was available. The filtration system for the LEV was located in the relevant workroom and the filtered air was re-circulated. The use of the LEV was poor with the LEV hoods being positioned too far from the source for effective dust capture. The LEV was regularly checked and had undergone a 14-monthly examination and test.

All the workers wore safety shoes, ear defenders and overalls. The overalls were laundered by an external contractor at weekly intervals and were made from either terylene or cotton. Those used by the hand masons were made from terlyene to help reduce secondary dust exposure.

The workers all wore respiratory protective equipment (RPE) to FFP2 standard though this was not face fit tested. The RPE consisted of a 3M 6000 mask fitted with P2 filters. The filters were changed regularly and stored in sealed bags. It was noted that some of the workers did not wear the RPE correctly, leaving one strap unfastened. One worker's RPE was in poor condition with damage to the facial seal. Another worker did not have a daily shave and had stubble which could affect the RPE's performance.

| | |
|---|---|
| **Control competency rating (0 - 5)** | **3** – See Appendix D for descriptors |
| **RPE competency rating (NR, 1 – 5)** | **2** – See Appendix D for descriptors |

**Note:**

**Control Competency:**

LEV systems in place but often capture hoods are poorly positioned resulting in reduced performance, records of examination & testing of LEV in place, no awareness of hazard, levels of exposure or risk etc.

**RPE Competency:**

Face fit testing not conducted. Regulation 7 of COSHH states that the initial selection of RPE (full / half face including disposables) should include fit testing to ensure that the correct device has been chosen (in terms of size / fit etc.).

**Table of Results**

| Sample No | Sample type | Sample Position | Duration, Mins | Exposures, mg.m$^{-3}$ | | | |
|---|---|---|---|---|---|---|---|
| | | | | RCS | | Respirable dust | |
| | | | | Task | 8-hr TWA | Task | 8-hr TWA |
| 1. | PL | MH, planer | 176 | | 0.065 | | 0.03 |
| 2. | PL | WP, Saw operator | 200 | | 0.035 | | 0.27 |
| 3. | PL | JR, saw operator | 201 | | <LOD | | 0.14 |
| 4. | PL | MD, Hand stonemason (using limestone) | 218 | | <LOD | | 0.28 |
| 5. | PL | CC, Hand stonemason (using limestone) | 219 | | 0.026 | | 0.64 |
| 6. | PL | JP, Hand stonemason (using limestone) | 209 | | 0.029 | | 0.57 |

**Summary of results:**

The respirable dust calculated 8hr TWA exposures varied between 0.03 to 0.64 mg m-3.

The RCS 8hr TWA exposures varied between limit of detection for the analysis method employed (<0.04 mg m-3) and 0.065 mg m-3.

During the sampling exercise the operators were mainly cutting limestone with low silica content. They would normally cut sandstone with high silica content. There was only one worker cutting this stone (the planer operator).

**Site data transferred to summary:**

| Site | Activities | Control strategy | Samples collected | | Number of measurements (8-hr TWAs) | | | | | Competency Descriptor Ratings | | Material type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | RCS | | | Respirable Dust | | | | |
| | | | Personal | Static | ≥0.3 mg.m$^{-3}$ | 0.3>x≥0.1 mg.m$^{-3}$ | Highest exposure mg.m$^{-3}$ | Exposure above 4 mg.m$^{-3}$ | Highest exposure mg.m$^{-3}$ | Control | RPE | |
| S10 | A, C & D | RPE, LEV & W | 5 | 0 | 0 | 0 | 0.065 | 0 | 0.64 | 3 | N/R | Sands tone |

**Activity:** A: Primary / secondary sawing B: Boring, polishing (static) C: Cutting / polishing (hand-held). D: Chiselling (manual / pneumatic).

**Control strategy:** Silica Essentials Control approaches: W = Water suppression, LEV = Local exhaust ventilation, LAD= Local Air Displacement

**Company 11**

**Description of Facility / Operations**

The company are involved in the fabrication of architectural items such as bricks, plinths, blocks for use in the building of houses. They mainly use sandstone from their quarry, though other stones are used as necessary and these are purchased from suppliers in various semi-prepared shades and thickness.

The site consists of a large area inside a former quarry. There are two main work areas: the first is where staff make bricks using hand chisels. There are eight workers in this area. The other main area is a powered tool area, where they hand shape stone using saws, power tools and a guillotine. There is also a hand polishing operation where they remove the saw cuts using a wet stone. There are seven workers in this area. In both areas the work was undertaken in a semi-enclosed buildings that consisted of a roof and two or three walls.

In the powered tool area there were two saws that used water suppression, in operation though only one was in use at any given time. There were two workers involved in cutting blocks using the guillotine. There was one hand grinder/cutter who used a grinding machine to dry cut the stone. There was also a hand polisher.

In the brick making area there were eight workers who used hand chisels to form the brick face on the blocks cut using the guillotine.

Operations on the day of the survey were described as normal by staff. Working hours were from 08.00 – 17:00hrs with one hour of breaks.

**Material**

The material used is mainly sandstone, which they obtain from their quarry. Other stones are used as necessary and these are purchased from suppliers in various semi-prepared shades and thickness..

Typical silica content: Sandstone >70%

Limestone 1-2%

**Control Measures**

All the workers wore safety shoes, high viz jackets and ear defenders. Whilst working they wore their own work clothes which they laundered at home.

There was no local exhaust ventilation present and control was attempted by the use of respiratory protective equipment (RPE). The workers were all issued with RPE (FFP3) though its use was unsatisfactory. No operatives have been given training in use of their RPE, no storage facilities are provided and no face fit testing has been conducted. One worker was observed to use ori-nasal RPE whilst having a full beard. For these reasons the RPE is unlikely to be operating to it's full potential.

The high silica content of the stone being handled at the sites increases the challenge of adequately controlling exposures however management of dust exposure risks was unsatisfactory.

In terms of controlling exposure to respirable crystalline silica within the workshop areas, reasonable quality exposure controls, primarily water sprays, are fitted to saws that could potentially generate dust.

Subjectively, these do seem to provide effective dust suppression. However they are not used on all activities and the use of power tools to perform dry grinding works generated significant concentrations of airborne dust.

| | |
|---|---|
| **Control competency rating (0 - 5)** | **1– See Appendix D for descriptors** |
| **RPE competency rating (NR, 1 – 5)** | **2* – See Appendix D for descriptors** |
| **Notes:**<br><br>*** - Face fit testing not conducted. Regulation 7 of COSHH states that the initial selection of RPE (full / half face including disposables) should include fit testing to ensure that the correct device has been chosen (in terms of size / fit etc.).** | |

**Table of Results**

| Sample No | Sample type | Sample Position | Duration, Mins | Exposures, $mg.m^{-3}$ | | | |
|---|---|---|---|---|---|---|---|
| | | | | RCS | | Respirable dust | |
| | | | | Task | 8-hr TWA | Task | 8-hr TWA |
| 1. | PL | BE, Hand dressing stone bricks | 60 | | 0.176 | | 0.28 |
| 2. | PL | IF, hand stonemason, hand cutting stone using power tools | 145 | | 16.25 | | 43.5 |
| 3. | PL | SF, Hand dressing stone bricks | 10 | | <LOD | | 4.62 |
| 4. | PL | DA, Hand dressing stone bricks | 115 | | 0.160 | | 0.01 |
| 5. | PL | RS, Rubbing and checking stone surfaces after sawing, wet process | 158 | | 0.099 | | 0.05 |
| 6. | PL | DC, Circular saw operator (wet process) | 145 | | 0.086 | | 0.13 |
| 7. | PL | LA, Guillotine operator | 150 | | <LOD | | 0.11 |
| 8. | PL | CW, Guillotine operator | 204 | | 0.075 | | 0.16 |

**Summary of results:**

The respirable dust calculated 8hr TWA exposures varied between 0.05 to 43.5 mg m-3.

The RCS 8hr TWA exposures varied between limit of detection for the analysis method employed (<0.04 mg m-3) and 16.25 mg m-3

**Site data transferred to summary:**

| Site | Activities | Control strategy | Samples collected | | Number of measurements (8-hr TWAs) | | | | | Competency Descriptor Ratings | | Material type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | RCS | | | Respirable Dust | | | | |
| | | | Personal | Static | ≥0.3 $mg.m^{-3}$ | 0.3>x≥0.1 $mg.m^{-3}$ | Highest exposure $mg.m^{-3}$ | Exposure above 4 $mg.m^{-3}$ | Highest exposure $mg.m^{-3}$ | Control | RPE | |
| S11 | A, B, C & D | RPE & W | 8 | 0 | 1 | 2 | 16.25 | 2 | 43.5 | | | |

**Activity:** A: Primary / secondary sawing B: Boring, polishing (static) C: Cutting / polishing (hand-held). D: Chiselling (manual / pneumatic).

**Control strategy:** Silica Essentials Control approaches: W = Water suppression, LEV = Local exhaust ventilation, LAD= Local Air Displacement

**Company 12**

**Description of Facility / Operations**

The company produce decorative sandstone objects such as doorstops, garden statues and fire surrounds.

Huge blocks of stone are fed into an automatic water-cooled primary saw, where they are cut into more manageable slabs. The slabs are then taken to either one of two automatic water-cooled secondary saws, where they are cut to the desired size. After they have been cut they then go to either of the two masons to be "dressed". The masons achieve the final product by sanding or grinding the stone using power tools.
Working hours at the Company are 8am to 5.30pm Monday to Friday with 80 minutes of breaks.

**Material**
The material used is mainly sandstone, which they obtain from their quarry. Other stones are used as necessary and these are purchased from suppliers in various semi-prepared shades and thickness.
Typical silica content: Sandstone >70%
Limestone 1-2%

**Control Measures**

There were two stonemasons working on site on the day of the visit.

The shed the first mason worked in was 4.6m deep by 3.6m wide. There was a local exhaust ventilation system in this shed. This was in the form of a pipe in the ceiling that was open at one end and had an extraction face that was above the workbench. This pipe went through the wall at the side of the shed and out into the atmosphere. The mason wore a 3M dust master powered visor with a THP2 filter (451-00-02). Other PPE were safety boots, earplugs and gloves. Work clothes were taken home and washed.

The second mason worked in a different shed to Steve Peck. This shed was an old storage container that was 2.3m deep and 5.2m wide and had two open walls. There were 3 square holes (each one 50cm by 30cm) in one of the remaining walls and 3 windows (each one 40cm by 30cm) in the other. There was no local exhaust ventilation. General ventilation was provided by airflow through the shed. The mason wore a Sundstrom half-mask (S/M) with a SR510P3 particulate filter and a pre filter. The pre filter was changed weekly and the SR510P3 was changed every two weeks. Other PPE worn were gloves and safety glasses when grinding and ear defenders.

The primary and secondary saws were both water-cooled and appeared to suppress the dust formed. PPE required when working at either of these saws was earmuffs, safety boots, high vis coat, glasses and gloves. The operator would set the cutting program going and would then leave the saw.

| | |
|---|---|
| **Control competency rating (0 - 5)** | **3– See Appendix D for descriptors** |
| **RPE competency rating (NR, 1 – 5)** | **2* – See Appendix D for descriptors** |
| **Notes:**<br><br>* - Face fit testing not conducted. Regulation 7 of COSHH states that the initial selection of RPE (full or half face, including disposables) should include fit testing to ensure that the correct device has been chosen (in terms of size / fit etc.). | |

**Table of Results**

| Sample No | Sample type | Sample Position | Duration, Mins | Exposures, $mg.m^{-3}$ | | | |
|---|---|---|---|---|---|---|---|
| | | | | RCS | | Respirable dust | |
| | | | | Task | 8-hr TWA | Task | 8-hr TWA |
| 12691/05 | PL | GJ – Stonemason | 157 | 0.23 | 0.23 | 0.68 | 0.69 |
| 12692/05 | SL | Static in GJ's shed | 230 | 0.04 | - | 0.31 | - |
| 12693/05 | PL | MM - Sawyer | 135 | <0.03 | <0.03 | 0.09 | 0.09 |
| 12694/05 | PL | SP – Stonemason | 87 | 0.99 | 1.01 | 2.56 | 2.61 |
| 12695/05 | SL | Static in SP's shed | 166 | 0.15 | - | 0.59 | - |

**Summary of results:**

The measured respirable dust concentrations for the personal samples were in the range 0.09 $mg.m^{-3}$ to 2.56 $mg.m^{-3}$ with the 8-hour time weighted averages (8-hr TWA) ranging from 0.09 to 2.61 $mg.m^{-3}$.

The measured respirable crystalline silica concentrations for the personal samples ranged from <0.03 to 0.99 $mg.m^{-3}$ with the 8-hour time weighted averages (8-hr TWA) ranging from <0.03 to 1.01 $mg.m^{-3}$.

**Site data transferred to summary:**

| Site | Activities | Control strategy | Samples collected | | Number of measurements (8-hr TWAs) | | | | | Competency Descriptor Ratings | | Material type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | RCS | | | Respirable Dust | | | | |
| | | | Personal | Static | ≥0.3 $mg.m^{-3}$ | 0.3>x≥0.1 $mg.m^{-3}$ | Highest exposure $mg.m^{-3}$ | Exposure above 4 $mg.m^{-3}$ | Highest exposure $mg.m^{-3}$ | Control | RPE | |
| S12 | | | 3 | 2 | 1 | 1 | 1.01 | 0 | 2.61 | 3 | 2 | Sandstone |

**Activity:** A: Primary / secondary sawing B: Boring, polishing (static) C: Cutting / polishing (hand-held). D: Chiselling (manual / pneumatic).

**Control strategy:** Silica Essentials Control approaches: W = Water suppression, LEV = Local exhaust ventilation, LAD= Local Air Displacement

**Company 13**

**Description of Facility / Operations**

The company cut and carve sandstone and limestone to manufacture objects such as statues, gateposts and ornamental brickwork used in the restoration of buildings.

The company receive huge blocks of stone (limestone or sandstone); these are cut using either of the two primary saws in the yard. If smaller size blocks are required then they are cut again using one of four secondary saws in the cutting area. These saws are automatic and are operated by the cutters. The required cutting program is entered on to the machine and the machine left to run. If the blocks need further work (i.e. carving or decorative effects) they go to the masons.

The masons draw the required design on the block in pencil and use either powered grinders or hand chisels to form the design.

Working hours at are 8.00am to 4.30pm with 60 minutes of breaks.

**Material**

The material used is mainly sandstone.

Typical silica content: Sandstone >70%

Limestone 1-2%

**Control Measures**

In the masons' yard there were five extraction booths, each one being 3m wide by 2.5m deep by 4m high. These booths had a 'wall' at the rear down which water ran. The water collected at the bottom of this system. The water from these booths was recycled using a filtration system with the solids disposed of as waste.

The RPE worn by the masons consisted of a 'Protector' compressed air fed helmet/visor combination with internal filters. The filters are changed when the display on the system goes red. When the RPE is not in use during the working day it is hung up on the side of the booth. At night it is stored in boxes. It was observed that the insides of these boxes were dusty.

PPE worn by the cutters consisted of safety boots, gloves, ear defenders and an overall. The employees wash the overalls at home.

The four secondary saws in the cutting area are water-cooled which also helps to suppress any dust that is produced. These saws have no local exhaust ventilation.

PPE worn by the cutters consisted of gloves, body warmer, safety boots, ear defenders, high vis coat and an overall (washed at home).

| | |
|---|---|
| **Control competency rating (0 - 5)** | **3– See Appendix D for descriptors** |
| **RPE competency rating (NR, 1 – 5)** | **2* – See Appendix D for descriptors** |

**Notes:**

**Control:**

**The group H & S manager was not on site on the day of the survey. The inspection of risk assessment and safety report documents relating to potential RCS exposures was not conducted. The plant supervisor stated that air sampling for RCS had been conducted this information was not available during the visit.**

**RPE**

*** - Face fit testing not conducted. Regulation 7 of COSHH states that the initial selection of RPE (full / half face including disposables) should include fit testing to ensure that the correct device has been chosen (in terms of size / fit etc.).**

**Table of Results**

| Sample No | Sample type | Sample Position | Duration, Mins | Exposures, $mg.m^{-3}$ | | | |
|---|---|---|---|---|---|---|---|
| | | | | RCS | | Respirable dust | |
| | | | | Task | 8-hr TWA | Task | 8-hr TWA |
| 00723/06 | PL | MC – Mason working limestone | 250 | 0.07 | 0.07 | 17.84 | 16.73 |
| 00724/06 | PL | DC – Mason (sandstone) | 243 | 0.91 | 0.85 | 1.71 | 1.60 |
| 00725/06 | SL | Static in MC's booth | 320 | <0.02 | - | 0.13 | - |
| 00726/06 | SL | Static in DC's booth | 314 | 0.02 | - | 0.07 | - |
| 00727/06 | PL | Simon Whittingham – Cutter * Pump failure at 1445 – result will be an underestimate | 212 | <0.03 | <0.03 | 0.07 | 0.07 |
| 00728/06 | PL | GJ - Cutter | 236 | 0.03 | 0.03 | 0.37 | 0.35 |
| 00729/06 | SL | Static in cutting area/room | 207 | <0.03 | - | 0.19 | - |
| 00730/06 | SL | Static in JT's booth | 190 | 0.03 | - | 0.09 | - |

**Summary of results:**

The measured respirable dust concentrations for the personal samples were in the range 0.07 mg.m$^{-3}$ to 17.84 mg.m$^{-3}$ with the 8-hour time weighted averages (8-hr TWA) ranging from 0.07 to 16.73 mg.m$^{-3}$.

The measured respirable crystalline silica concentrations for the personal samples ranged from <0.03 to 0.91 mg.m$^{-3}$ with the 8-hour time weighted averages (8-hr TWA) ranging from <0.03 to 0.85 mg.m$^{-3}$ .

The highest 8-hr TWA for the respirable crystalline silica was that of the mason who was working with sandstone on the day of the visit. The measured silica content for this sample was 50 % of the measured dust concentration, which is typical of sandstone (Sandstone is usually >70 % silica).

**Site data transferred to summary:**

| Site | Activities | Control strategy | Samples collected | | Number of measurements (8-hr TWAs) | | | | | Competency Descriptor Ratings | | Material type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | RCS | | | Respirable Dust | | | | |
| | | | Personal | Static | ≥0.3 mg.m$^{-3}$ | 0.3>n≥0.1 mg.m$^{-3}$ | Highest exposure mg.m$^{-3}$ | Exposure above 4 mg.m$^{-3}$ | Highest exposure mg.m$^{-3}$ | Control | RPE | |
| S13 | A, C,D | LEV | 4 | 4 | 1 | 0 | 0.85 | 1 | 16.73 | 3 | 2 | Sandstone |

**Activity:** A: Primary / secondary sawing B: Boring, polishing (static) C: Cutting / polishing (hand-held). D: Chiselling (manual / pneumatic).

**Control strategy:** Silica Essentials Control approaches: W = Water suppression, LEV = Local exhaust ventilation, LAD= Local Air Displacement

Company 14

**Description of Facility / Operations**

The Company manufactures marble and granite work surfaces for use in kitchens and bathrooms. There are approximately 40 employees including 10 skilled stonemasons. Processes include cutting, shaping and polishing operations using both hand-held and automated tools.

Although some marble is worked, the vast majority of processes involve granite.

The site was visited on three occasions, the second and third visits being made following the introduction of improvements to engineering controls provoked as a result of receiving an Improvement Notice from HSE in 2001.

**Material**

The material used is mainly granite.

Typical silica content: Granite (up to) 30%

Marble 1-2%

**Control Measures**

The installation of automated wet cutters and polishers has greatly reduced the number of workers directly involved in dusty processes and allowed increased throughput of finished product. However, dust control for processes involving hand held tools was still inadequate at the second visit, particularly on the LHS of the workshop where the majority of this work takes place.

On the third visit, the overhead extracted ducts on both LHS and RHS benches had been refurbished and three of the workstations on the LHS had been fitted with downdraught extraction, although this was not done on any of the RHS benches. This coupled with good downdraught extraction appeared to provide much improved control.

Operatives are supplied with filtering face pieces (3M FFP3) although usage was inconsistent and there was some evidence of misuse. For example, masks worn on top of the head or below the chin, loose straps and operatives with obvious beard stubble.

| | |
|---|---|
| **Control competency rating (0 - 5)** | **3– See Appendix D for descriptors** |
| **RPE competency rating (NR, 1 – 5)** | **2* – See Appendix D for descriptors** |
| **Notes:**<br>**Control Competency:**<br>**Control was improved primarily as a result of intervention by HSE. Improvements included introduction automated wet cutting and polishing and of downdraught extraction**<br>**RPE Competency:**<br>*** - Face fit testing not conducted. Regulation 7 of COSHH states that the initial selection of RPE (full / half face including disposables) should include fit testing to ensure that the correct device has been chosen (in terms of size / fit etc.).** | |

**Summary of results:**

Visit 1 (pre-improvements)

Six personal samples were taken and the measured respirable crystalline silica concentrations ranged from 0.14 mg/m$^3$ to 0.4 mg/m$^3$ with the 8-hour time weighted averages (8-hr TWA) ranging from 0.14 mg/m$^3$ to 0.4 mg/m$^3$.

Visit 2 (improvements not yet been fully implemented)

Two personal samples were taken and the measured respirable crystalline silica concentrations ranged from 0.38 mg/m$^3$ to 0.69 mg/m$^3$ with the 8-hour time weighted averages (8-hr TWA) ranging from 0.38 mg/m$^3$ to 0.69 mg/m$^3$.

Visit 3 (post improvements)

Six personal samples were taken and the measured respirable crystalline silica concentrations for the personal samples ranged from <0.04 mg/m$^3$ to 0.15 mg/m$^3$ with the 8-hour time weighted averages (8-hr TWA) ranging from <0.04 mg/m$^3$ to 0.15 mg/m$^3$.

**Site data transferred to summary:**

| Site | Activities | Control strategy | Samples collected | | Number of measurements (8-hr TWAs) | | | | | Competency Descriptor Ratings | | Material type |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | RCS | | | Respirable Dust | | | | |
| | | | Personal | Static | ≥0.3 $mg.m^{-3}$ | 0.3>x≥0.1 $mg.m^{-3}$ | Highest exposure $mg.m^{-3}$ | Exposure above 4 $mg.m^{-3}$ | Highest exposure $mg.m^{-3}$ | Control | RPE | |
| S14a | | LEV & RPE | 6 | 1 | 2 | 4 | 0.4 | 5 | 10.9 | | | Granite |
| S14b | | LEV & RPE | 3 | 1 | 2 | 0 | 0.69 | 1 | 9.77 | | | |
| S14c | | W, LEV & RPE | 5 | 3 | 0 | 2 | 0.15 | 0 | 1.73 | 3 | 2 | Post improvements |

**Activity:** A: Primary / secondary sawing B: Boring, polishing (static) C: Cutting / polishing (hand-held). D: Chiselling (manual / pneumatic).

**Control strategy:** Silica Essentials Control approaches: W = Water suppression, LEV = Local exhaust ventilation, LAD= Local Air Displacement

Summary table of SBS data: Stonemasonry sector

| Site | Activities | Control strategy | Samples collected | | Number of measurements (all 8-hr TWAs) | | | | | Competency Descriptor Ratings | | Material type or comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | RCS | | | Respirable Dust | | | | |
| | | | Personal | Static | ≥0.3 $mg.m^{-3}$ | 0.3>x≥0.1 $mg.m^{-3}$ | Highest exposure $mg.m^{-3}$ | Exposure above 4 $mg.m^{-3}$ | Highest exposure $mg.m^{-3}$ | Control | RPE | |
| S1A | C | RPE & LEV | 4 | 3 | 4 | 0 | 7.8 | 4 | 34 | 0 | 2 | SS & LS |
| S1B | C | RPE & LEV | 2 | 1 | 0 | | <LOD | 2 | 23.8 | 1 | 2 | LS |
| S2 | A & C | LEV | 5 | 0 | 0 | 0 | 0.08 | 0 | 2.32 | 1 | N/R | |
| S3 | A, B, C & D | RPE & LEV | 7 | 0 | 0 | 3 | 0.16 | 0 | 2 | 2 | 2 | |
| S4 | A, B, C & D | RPE & LEV | 6 | 0 | 0 | 1 | 0.12 | 0 | 0.97 | 1 | 2 | |
| S5 | A & C | RPE & LEV | 4 | 0 | 0 | 0 | 0.07 | 0 | 2.14 | 1 | 2 | Granite |
| S6a | A, B & C | RPE | 6 | 0 | 1 | 0 | 0.90 | 2 | 6.41 | | | Mostly limestone, 1 granite |
| S6b | A, B & C | LEV | 3 | 0 | 0 | 1 | 0.215 | 0 | 1.87 | | | N/A |
| S7 | A & C | RPE & LEV | 6 | 2 | 0 | 2 | 0.25 | N/a | N/a | 4 | 4 | Granite |
| S8a | A & C | W | 7 | 0 | 0 | 5 | 0.18 | 0 | 0.53 | 3 | 2 | |
| S8b | A, B, C & D | LEV & RPE | 7 | 1 | 5 | 1 | 1.91 | 2 | 32.54 | N/A | N/A | |
| S9 | A & C | RPE, LEV & W | 3 | 4 | 0 | 0 | <LOD | 1 | 11.54 | 2 | 2 | Zero-silica stone suspected. |
| S10 | A, C & D | RPE, LEV & | 5 | 0 | 0 | 0 | 0.065 | 0 | 0.64 | 3 | N/R | Sandstone |

| Site | Activities | Control strategy | Samples collected | | Number of measurements (all 8-hr TWAs) | | | | | Competency Descriptor Ratings | | Material type or comment |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | RCS | | | Respirable Dust | | | | |
| | | | Personal | Static | ≥0.3 $mg.m^{-3}$ | 0.3>x≥0.1 $mg.m^{-3}$ | Highest exposure $mg.m^{-3}$ | Exposure above 4 $mg.m^{-3}$ | Highest exposure $mg.m^{-3}$ | Control | RPE | |
| | | W | | | | | | | | | | |
| S11 | A, B, C & D | RPE & W | 8 | 0 | 1 | 2 | 16.25 | 2 | 43.5 | | | |
| S12 | A & C | LEV & W | 3 | 2 | 1 | 1 | 1.01 | 0 | 2.61 | 1 | 2 | Sandstone |
| S13 | A, C & D | LEV | 4 | 4 | 1 | 0 | 0.85 | 1 | 16.73 | 3 | 2 | Sandstone |
| S14a | | LEV & RPE | 6 | 1 | 2 | 4 | 0.4 | 5 | 10.9 | | | Granite |
| S14b | | LEV & RPE | 3 | 1 | 2 | 0 | 0.69 | 1 | 9.77 | | | |
| S14c | | W, LEV & RPE | 5 | 3 | 0 | 2 | 0.15 | 0 | 1.73 | 3 | 2 | Post improvements |
| **Totals:** | | | **94** | **22** | **17** | **22** | | **20** | | | | |
| **Percentages:** | | | | | **18%** | **23%** | | **21%** | | | | |

**Activity:** A: Primary / secondary sawing B: Boring, polishing (static) C: Cutting / polishing (hand-held). D: Chiselling (manual / pneumatic).

**Control strategy:** Silica Essentials Control approaches: W = Water suppression, LEV = Local exhaust ventilation, LAD= Local Air Displacement

## APPENDIX C: STONEMASONRY INDUSTRY: FOLLOW-UP QUESTIONNAIRE

**Silica Baseline Survey**

**Company Name –**

Contact name -

1 What types of stone does your company most commonly use?

e.g. Sandstone, granite, marble, limestone etc.

If a variety what percentages for each%???

2 Are you aware of the forthcoming reduction to the current Workplace Exposure Limit (WEL) for respirable crystalline silica due to come into force from October 2006?

Note: Before 2005 the WEL was known as either an OES or MEL, some respondents may not be aware that OES and MEL's have been replaced.

If YES go to question 3. If NO go to question 5.

3 Do you know what the current WEL is and what the revised level will be? (OLD – 0.3mg/m3 8hr TWA / NEW - 0.1mg/m3 8hr TWA)

4 Do you have any plans to introduce or improve dust control measures in your workplace in response to the introduction of the new WEL in October 2006?

5 There are various pieces of HSE guidance aimed at helping employers control the risks posed by stonemasonry dust to their workers health; are you aware of / or have made use of any of the following?:

- HS(G) 201 'Controlling Exposure to Stonemasonry Dust: Guidance for Employers'
- INDG315 'Stone Dust & You; Guidance for Stonemasons'
- Control of Substances Hazardous to Health Regulations (COSHH Regs)
- COSHH / Silica Essentials

6 Do you know what long term illnesses are associated with exposure to respirable silica dust?

Examples: Silicosis

Lung cancer

COPD (emphysema, bronchitis etc.)

7 Do you have Internet access?

If YES go to question 8. If NO go to question 9.

8 Would you be interested in receiving further information from HSE via the internet regarding control of exposure to silica and the forthcoming changes to the Workplace Exposure Limit (WEL)?

9 Would you be interested in receiving further information from HSE through the post regarding control of exposure to silica and the forthcoming changes to the Workplace Exposure Limit (WEL)?

## APPENDIX D: STANDARD INDUSTRIAL CLASSIFICATION SUBDIVISIONS

Stonemasonry - Standard Industrial Classification (SIC)

For the purposes of statistical analysis data was obtained from the Office of National Statistics (ONS). Businesses that are considered stonemasonry type activities by ONS are designated the Standard Industrial Classification (SIC) code 26.70 - Cutting, shaping and finishing of ornamental and building stone.

This class includes: cutting, shaping and finishing stone for use in construction, in cemeteries, on roads, as roofing, etc.

This class excludes:

- activities carried out by operators of quarries, e.g.,
- production of rough cut stone cf. 14.11 (quarrying, rough trimming and sawing of monumental and building stone such as marble, granite, sandstone, etc)
- production of millstones, abrasive stones and similar products cf. 26.81

Activities included within this code:

SIC 26.70 Cutting, shaping and finishing of ornamental and building stone

| | |
|---|---|
| 4959 | Alabaster bowl cutting |
| 2450 | Cutting, shaping and finishing of stone for use in construction |
| 2450 | Decorated building stone |
| 2450 | Dolomite (ground) |
| 2450 | Funerary stonework |
| 2450 | Granite working |
| 2450 | Kerbstone (not concrete) |
| 2450 | Limestone (ground) |
| 2450 | Limestone working |
| 2450 | Litho stone working |
| 2450 | Marble masonry working |
| 2450 | Millstone and grindstone cutting |
| 2450 | Monumental stonework |
| 2450 | Paving stone |
| 2450 | Slate polishing |
| 2450 | Slate slab and sheet cutting and preparation |
| 2450 | Slate working |
| 2450 | Stone working |
| 2450 | Tiles made of slate |

## APPENDIX E: CONTROL COMPETENCE SURVEY TABLES

## Control competency descriptors

| Control Rating | Description |
|---|---|
| 0 | Evidence of unacceptable levels of over-exposure brought about through manifest failures to recognise hazard and risk coupled with a failure to provide any form of controls. (As a guide exposures at least twice relevant occupational exposure limit) |
| 1 | Evidence of unacceptable levels of over-exposure brought about through failures to recognise hazard and risk and take appropriate steps to control. Typically:<br>• Absent or inadequate COSHH assessment<br>• Evidence of rudimentary or inappropriate engineering controls<br>• Controls appropriate only for lower level of risk<br>• No supporting evidence of adequate control<br>• No records of examination and test of lev<br>• Poor maintenance of plant, enclosures and controls<br>• Poor training of operators<br>• No awareness of hazard, levels of exposure or risk<br>• Poor management |
| 2 | Evidence of over-exposure. Some understanding of hazard and risk and some controls in place but not receptive to need to improve. Typically:<br>• Inadequate COSHH assessment<br>• Engineering controls poorly maintained and/or poorly positioned<br>• Uncertain of adequacy of control<br>• Limited understanding of exposures<br>• Limited training of operators<br>• Some use of RPE<br>• Poorly informed management and supervision |
| 3 | Occasional over-exposure. Reasonable awareness of hazard and risk and desire to improve. Typically:<br>• Reasonable COSHH assessment recognising main concerns<br>• Application of reasonably effective controls at process<br>• Reasonable levels of maintenance<br>• Some understanding of exposures but few over-exposures<br>• Limited training of operators<br>• Some use of RPE<br>• Reasonably informed management<br>• Some supervision |

| **Control Rating** | Description |
|---|---|
| 4<br><br>The COSHH Essentials Standard | Adoption of good control practice consistent with risk. Reasonable awareness of hazard and risk and knowledge to implement effective strategies. Typically:<br><br>• Comprehensive COSHH assessment<br>• Aware of literature and information sources<br>• Application of appropriate, effective, well maintained controls at process<br>• Management and operator understanding of exposures<br>• Well trained operators<br>• Designated areas and use of RPE when appropriate<br>• Well informed management<br>• Competent supervision<br>Evidence of coordinated approach to control – skills and knowledge available |
| 5 | Exemplary control consistent with risk. Typically:<br><br>• Comprehensive COSHH assessment<br>• Literature and guidance to hand<br>• Competent well-trained staff at all levels<br>• Documented procedures<br>• Exposure and risk understood at process<br>• No evidence of over-exposure<br>• Evidence of engagement of all stakeholders<br>• All aspects of process considered |

## RPE competency descriptors

| Rating | Description |
|---|---|
| NR | RPE not required to achieve adequate control |
| 1 | RPE required to achieve adequate control. No evidence of use or provision of suitable and adequate RPE |
| 2 | RPE used to achieve adequate control. Evidence of provision of suitable and adequate equipment but strong evidence of poor practices in use:<br>• Limited evidence of selection process and face fit testing.<br>• Equipment normally available but anticipated problems with use<br>• Poor storage<br>• No evidence of adequate training programme<br>• No assessment of level of residual risk |
| 3 | RPE used to achieve adequate control. Evidence of provision of suitable and adequate equipment and some evidence of good practices. Limited evidence of management controls in use:<br>• Face fit testing<br>• Equipment readily available and used<br>• Appropriate storage facilities<br>• Adequate initial training<br>• Operator can answer questions about use of RPE<br>• Some understanding of role of rpe in reducing residual risk |
| 4 | RPE used to achieve adequate control. Verifiable policy on RPE linked to COSHH assessment. Strong evidence of selection of suitable and adequate equipment and good practices in use. Appropriate zoning of workplace and adequate supervision and control. Some minor concerns over procedural aspects and management control of programme:<br>• Verifiable policy on RPE linked to COSHH assessment.<br>• Face fit testing programme<br>• Equipment routinely available and range of products available through selection process<br>• Appropriate storage facilities<br>• Initial training and refresher training<br>• Operator understands role of RPE in controlling exposure<br>• Clearly defined roles and responsibilities |
| 5 | RPE used to achieve adequate control. Evidence of exemplary RPE programme with only minor deviations from agreed practices and policies.<br>• Verifiable policy on RPE linked to COSHH assessment.<br>• Face fit testing programme<br>• Wide range of appropriate equipment available for all users<br>• Appropriate storage facilities and procedures to allow audit<br>• Initial training and routine refresher training<br>• Operators understand role of RPE in controlling risk<br>• Everyone understands roles and responsibilities |

# 8 REFERENCES

(HSE 1998) EH74/2 Respirable Crystalline Silica: Exposure Assessment Document

HSE 2001: HSG201 Controlling exposure to stonemasonry dust: Guidance for employers, ISBN 0717617602

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HSE

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# Silica baseline survey

## Annex 3 Stonemasonry industry

**Aims and Objectives**

This Silica Baseline Survey aims to develop baseline intelligence on exposure and control of respirable crystalline silica in key industry sectors. These sectors are:

- Brickworks and Tile Manufacture
- Stonemasonry
- Quarrying
- Construction

**The objectives are:**

1) to establish whether exposure control practices (both the application of engineering controls and the use of RPE) are adequate to reduce exposures below the WEL for RCS
2) to form an opinion about the long-term reliability of the controls
3) to identify common causes of failures of exposure control
4) to provide data by which the effect of HSE interventions can be assessed.

This annexe to the main SBS report includes the site visit data and detailed discussion of observations in the stonemasonry sector.

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