HSE

Health and Safety Executive

Silica baseline survey

Annex 1 Brickmaking industry

Prepared by the **Health and Safety Laboratory**
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Annex 1

Health and Safety Executive

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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 brickmaking sector.

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CONTENTS

1 INTRODUCTION 1
1.1 Silica Baseline Survey 1
1.2 Hygiene standards 1
1.3 Overview of the Industry 1
1.4 Brickmaking: Industry employment profile 2
1.5 Manufacturing processes 3
1.6 Exposure data - Brick making and heavy clay 6

2 SBS SITE METHODOLOGY 9
2.1 Site selection 9
2.2 Assessment of controls 9
2.3 Exposure measurements 11

3 FINDINGS, OBSERVATIONS & IDENTIFIED ISSUES 13

4 DISCUSSION 17

5 CONCLUSIONS 19

6 APPENDICES 21
Appendix A Tables 21
Appendix B: Summaries of Visit reports 26
Appendix C: Control Competence Survey Tables 63
Appendix D: Brickmaking: Standard Industrial Classification (SIC) 66

7 REFERENCES 67

EXECUTIVE SUMMARY

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Main Findings

Of 97 worker exposure measurements considered in the SBS, 29% exceeded 0.1 $mg.m^{-3}$ 8hr TWA. This includes 5% which indicated RCS exposure above 0.3 $mg.m^{-3}$. These SBS results suggest that recent HSE & industry estimates of silica exposures may be lower than in reality.

Automation of various processes has been unable to eliminate generation of dust as bricks are moved, so risk of exposure remains for process supervisors etc. However demand for bricks produced using traditional, dustier, methods remains. These production facilities continue to require high numbers of workers and it would be difficult to retro-fit engineering controls

Engineering control measures were often found to have varying degrees of success in achieving adequate control of exposure. Unsatisfactory control is often a result of a lack of knowledge or understanding of occupational hygiene principles at the design & installation stage of engineering controls.

Selection process, training and face-fit testing were often inadequate to ensure the effective use of RPE.

Recommendations

There is a continued need for adequate COSHH assessments for all tasks involving the use of silica containing materials.
Engineering control measures (e.g. LEV) are neither universally installed nor fully effective. Better-specified and engineered systems are necessary if the full benefits of such investment are to be realised.

Where personal protective equipment has to be relied upon to control exposure it needs to be used much more effectively. This will require better selection, training, cleaning and then maintenance/replacement of equipment.

Exposure monitoring and health surveillance programmes should continue in order to improve the data pool and knowledge of exposure profiles.

Communication between HSE and the UK brickmaking industry is considered to have been relatively good historically. The remaining causes of RCS exposure may be addressed if the effective working relationship can be maintained between HSE, industry, unions and trade association health & safety representatives. The issue of communicating with and influencing smaller employers (who may not belong to trade associations) will remain in the brick and heavy clay sector, as it does elsewhere in industry.

Research into substitution of non-silica based alternatives in surface dressing might offer a means of eliminating one source of exposure. RCS generation from the comminution of fired clay particles will remain an ever-present hazard, however, and any new facilities should incorporate robust exposure mitigation features such as well-designed engineering controls..

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 Brick and heavy clay Industry.

Activities in the brick and heavy clay industry pose a RCS exposure risk partly because the basic raw material, clay, is a sedimentary rock, and thus contains a proportion of fine-grained quartz in addition to the clay minerals. The other main cause of potential RCS exposure is the application of sand to the surfaces of clay bricks before firing for a variety of reasons (explained below.)

1.2 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 protocols 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. Approximately 35 employers are members of the British Ceramic Confederation (which is a signatory to the SDA) either directly or through the Brick Development Association.

1.3 OVERVIEW OF THE INDUSTRY

The "brick making and heavy clay" industry covers a wide variety of clay brick and tile manufacturing operations. They range from the highly automated production of facing bricks, with computerised kilns and processes, to traditional, labour-intensive production by hand.

There are three main methods of making bricks from clay –

- soft mud moulding by hand or by machine
- extrusion/wire-cutting and
- semi-dry pressing (the Fletton process)

Some bricks are produced by other methods. Calcium silicate bricks are produced by a further process which involves autoclaving items pressed from a mixture of sand and lime, while Portland cement and sand or other fine aggregate is mixed to produce bricks made of concrete.

According to a recent sustainability survey undertaken by the Brick Development Association (BDA, 2002) just under 6000 employees are estimated to be involved in brick manufacture at about 70 sites in the UK. Clay tile manufacture, which can use production methods similar to brick manufacture, has an estimated total workforce of around 1000 spread over about 15 sites – predominantly small sites in the south of England. The aggregate figure of some 10,000 derived from the ONS figures for 2005 (see Appendix A table 4c) is about 50% higher, but besides including the tile industry also presumably includes companies not in BDA membership.

Within brick making a few large companies dominate the industry and some of these possess RCS exposure data.

Bricks are made from relatively soft sedimentary rocks – clays, marls, shales and mudstones - that are prepared by being crushed, ground and mixed with water before being moulded, extruded, shaped and faced. Firing at temperatures between 900 and 1250°C causes partial vitrification or melting and converts the bricks to a durable form by converting some of the mineral content to a glass which binds the other materials, while inert components like quartz help prevent excessive shrinkage. There are three main methods of making bricks - soft mud moulding by hand or by machine, extrusion and wire-cutting, and semi-dry pressing (the Fletton process).

The clay used for bricks may contain up to 40% free silica. Highest dust exposures are found at clay preparation (processes such as milling, transporting and screening) then during the "facing" of bricks (i.e. dressing with siliceous dust, which produces localised exposures to RCS), and during "de-hacking" (i.e. removal from the kiln, sorting and stacking for despatch) where silica-containing dust from facings, frogs or from loose surface materials is made airborne. As elsewhere in the ceramics industry, regular cleaning of floors and surfaces helps to reduce standing dust which can otherwise be crushed, made airborne and so become available for inhalation. Where coal and clinker residues are incorporated into the clays these also contribute silica.

Concrete tiles make up about 60% of the market and clay tiles only 10%. However clay tile production still amounts to about 100 million annually and they are more durable and, with better colour retention, they sell as a premium product.

There are also a few producers of hand-crafted clay tiles but the processes involved are similar to the production of bricks.

The range of activities considered to be within Brickmaking and a similar classification are shown in the extract from the SIC codes in Appendix E, which also shows the exclusions.

1.4 BRICKMAKING: INDUSTRY EMPLOYMENT PROFILE

The ONS data for 2005 shows that there were approximately 270 "Local Units" (in 185 "VAT-based enterprises") in the UK with the Standard Industrial Classification (SIC) code 26.40:

"Manufacture of bricks, tiles and construction products, in baked clay." The original data from the ONS tables is reproduced in appendix A Tables 4a and 4b. The conventional consideration of "Small" and "Medium" enterprises uses categories of less than 50 and 50 to 249 employees respectively. The ONS employment statistics are summarised to show this distribution in table below:

Table 1 Employment statistics from ONS data

SIC code and description	Classification by:	Number of units in employment size band:		
		<20 employees	<50 employees	50 - 249 employees
2640: Manufacture of bricks, tiles and construction products, in baked clay	local units:	160 (59%)	205 (76%)	65 (24%)
	VAT-based enterprises:	145 (78%)	165 (89%)	15 (8%)
2661 Manufacture of concrete products for construction purposes	local units:	575 (66%)	755 (86%)	115 (13%)
	VAT-based enterprises:	435 (72%)	545 (90%)	45 (7%)

This data suggests that approximately 40% of Brickmaking and heavy clay businesses have workforces of 20 or more persons and thus the majority of these businesses fall into the category of medium or large enterprises. Although another 40% (or around 110) of businesses have fewer than 5 employees it is believed that these do not actually represent conventional brickmaking businesses, i.e. clay/press/kiln etc. These businesses are likely to consist of small enterprises producing very small volume or bespoke tile and clay products.

1.5 MANUFACTURING PROCESSES

Clay is usually quarried on the brick production site and often stockpiled before use. This may entail clay being excavated from the quarry by bucket and drag-line and sent on long conveyors to the stockpile – processes similar to quarrying although dust levels are usually lower because the clay is damper and only conveyor maintenance staff are likely to be at risk of significant exposure. Although clay preparation areas are large, staffing levels tend to be low. Where the quarry industry has relied more on the segregation of workers, methods of exposure control in brick manufacturing consist of enclosing and extracting all the grinding plant, conveyors and transfer points. This can be expensive and spillages and fugitive emissions are difficult to prevent. Thus cleaning and general housekeeping is important. Vacuum cleaning should be routine, but at some sites brush sweeping still occurs with formal housekeeping taking place at shutdown/breakdown. Regular and efficient cleaning is important for exposure control in all brickworks and in principle vacuum cleaning would be the preferred option.

The clay is crushed and ground (either wet or dry) to a fine consistency before being mixed and then either extruded or moulded into bricks. Dry pan mills are inherently very dusty, but in the clay preparation area respirable dust levels are less dependent on weather conditions because dust is also produced by vehicle movement. If pan mills are used, they rotate and mould damp clay, but with stone rollers at medium or high speed new surfaces are created and dry dust can be thrown out. Full-time attendance at this process is unnecessary and CCTV monitoring is possible.

Description of the three main brick production processes:-

Soft mud moulding, by hand or by machine.

If made by hand, the clot of clay (containing more than 20% water) is coated with sand and added to a mould that has been pre-coated with sand. For machine-moulding, the bricks are produced by mixing clay with additives such as colourants and sand (for body), the particle size is reduced to below 1 mm, and water is added to produce a fluid mix. This mix is forced through steel dies by spiral blades into sanded moulds and no two bricks are identical. The moulds are washed with water, dried and sand is added again in preparation for the next clay addition.

Extrusion and wire cutting.

This process represents about 40% of the total UK production. Plastic clay (containing 15 – 20% water) is driven through a die to form a continuous column. Perforations are formed by core bars in the die-head. Surface texturing is carried out immediately and colours may be added. The column is cut into bricks by a multiple wire cutter and the bricks are palletised onto a drier.

The semi-dry process is used for Fletton bricks where the clay naturally has a water content of 17 to 20%. A fine granular material is produced from the clay by grinding and pressing without reducing the natural moisture. A mechanical press compacts the material and a “frog” is imprinted in the surface which assists drying and firing.

Stiff plastic pressing is an unusual process and is a combination of extrusion which forms a brick-shaped clot which is pressed in a mould to form the brick.

Once the brick is formed from the clay the general surfacing, setting, drying, firing and dehacking procedures are similar across the three main brick production methods. They are summarised below. In a completely different process the production of calcium silicate bricks involves mixing silica sand and lime, pressing the damp mixture and then autoclaving the bricks so that the silica-lime reaction binds the sand grains.

Surfacing

Surfacing of the damp clay bricks with a coating made up of sand and other materials such as oxides and colourants is usually applied via a jet of compressed air. The sand impregnates (penetrates and adheres to) the soft clay surface but has the potential to cause high silica exposures. Sand is used as a coating on bricks both as a parting medium and to convey decorative finishes and pigments. In automated brick production, this process can be enclosed and extracted. When hand-made bricks are produced, the coating is applied by rolling and placing bricks into dyed sand, making control much more difficult, but the mechanical nature of this process means that potential exposures are lower.

Setting

Setting prepares the bricks for the drying and firing stages. Where kiln cars are loaded to carry bricks automated setting machines are available at a cost of £2 million upwards and can replace 6 to 8 employees needed for the task. Packs are built by robot (block setting) - one operator can oversee the robot and one operator usually manually discards non-standard bricks.

These operations are the most labour intensive and difficult to control because dust is generated every time bricks are moved or knocked against each other when they are moved and stacked. Bricks with frogs are the worst culprits in this respect because the frogs collect dust.

Automation is possible but expensive. Production by extrusion and cutting is amenable to interfacing with automatic stacking and thus lower staffing levels The number of employees exposed will fall but the bricks will still knock against each other (possibly at a faster rate) and dust will be released into the surrounding air.

Drying

Kiln cars are stacked with bricks in an open pattern to allow optimal airflow and dried at a relatively low temperature (100°C.) The Fletton process does not require a drying stage, however.

Firing

Three types of kilns are used in brickmaking – tunnel kilns, gas-fired intermittent kilns and Hoffmann kilns. Tunnel kilns are the modern option and the operators do not need to enter the kiln area because special carts are used for the bricks. Exposure is thus much lower.

Gas-fired intermittent kilns require more manual handling of the bricks and dust movement will increase potential RCS exposure.

It is believed that about five companies still use Hoffmann kilns, the oldest type. Bricks have to be individually set and removed in a succession of oven spaces round the kiln block - a labour-intensive process.

Clamp–firing is still used at some sites for premium product bricks. There are only four sites left using this traditional firing system and they produce bricks used for top-specification housing and there is a wide and natural variation in the colouring because of the firing method. The bricks are set to form the clamp, which often sits on a floor composed of hardcore topped with crushed brick above a surface of loose sand. Bricks are stacked by hand and covered with a single layer of refractory brick. The clamp roof may be composed of materials such as asbestos cement. Adequate damping down of clamp floors and roadways was essential to help control RCS exposure in these sites because of the problems inherent in installing engineering controls in clamps.

Dehacking

This is the name used to describe the process of removing fired bricks from either the individual ovens in old Hoffman kilns or from kiln cars where tunnel kilns are in use, sorting and grading them before stacking then for despatch. The "dehacking" is mostly done by hand and dust is always dislodged during this process. Coating with non-silica surface dressings has not been seriously investigated by the industry but the options and potential gains are limited, as dust generated from the fired brick will contain crystalline silica derived from the clay anyway.

This labour-intensive task is usually carried out over a large area with the consequential problems for controlling RCS exposure. Whole packs of bricks may be lifted and separated, and sand spillage from the coating or frogs is another source of the silica exposure.

After bricks have been fired in a kiln, the dehacking process inevitably generates a significant amount of dust and employees can work long shifts, reliant on RPE to reduce exposure. Filtered air cabs can be fitted to forklift trucks used in these kilns but this reduces visibility owing to dust deposition on cab windows. HSE ergonomists recommend the use of filtered air supplies to cabs rather than RPE. The fitting of gas-firing (rather than coal-firing) to kilns could reduce general dust exposure. Exposure monitoring data suggests that although total dust levels are high, the respirable silica content is usually relatively low.

Tile manufacture

Roof Tile manufacture is a similar process to brick manufacture. The marls used for tile production will contain up to 50% silica and about 10% water. After storage, grinding and rolling to reduce the particle size below 1 mm, water is added to "sour" the mixture. The clay is extruded, the edges are trimmed and oil is dribbled onto the surface.

Sand is blown onto the surface of the moist tiles but the exposure problem arises from the excess sand. Too little extraction above the production line allows escape of dust, while too strong a suction rapidly blocks filters. Sand that falls below the production line is captured on a conveyor belt and reused.

After drying (36 hours) the tiles are set for firing. As in brick manufacture, setting is a potentially dusty operation, but in some tile manufacturing sites this process is reported to be fully enclosed.

Dehacking may be automated, but sorting (where the tiles are checked for soundness) could cause silica exposure. However, it appears that the dust from this process is relatively dense and settles quickly. Hand-sorting needs to be performed without clashing the tiles together to reduce dust and silica exposure, but even with extraction applied, respirable crystalline silica exposure can exceed 0.1 $mg.m^{-3}$. Because of the relatively large areas, the options for significantly reducing silica exposure are limited to robotics or mechanical handling. In the case of hand-made tiles, the process is similar but after extrusion, the clays are placed into moulds lined with sand and the surfaces are not coated with sand.

Other brickmaking processes: ("Concrete" and Calcium silicate bricks)

The production of bricks by these methods involves sand or other aggregate and cement or lime, wet processes and autoclaving (i.e. heating in steam.) The bricks can be expected to be damp when produced, but dehacking and subsequent handling would be expected to cause potential RCS exposure if drying out had occurred. The fact that a dense stack of bricks can be steamed effectively and the lower incidence of mis-shapen bricks than is caused by firing clay means that the autoclave cars (equivalent to tunnel kiln cars) can be stacked exactly as required for final palletising and transport, effectively eliminating de-hacking. The potential for exposure to RCS re-suspended from dust in an inadequately cleaned workplace could however be higher than at a brickworks using clay given the potentially higher silica content of the feedstock and product. There is a much larger sister industry producing bricks and other masonry items from concrete but as they generally employ wet processes the RCS exposure risk is considerably less than in the clay brick industry.

1.6 EXPOSURE DATA - BRICK MAKING AND HEAVY CLAY

Previous studies of RCS exposure in the Brickmaking sector have shown that occupational exposure to RCS can vary considerably across the various stages of the production process. (It should be noted that in all discussions of exposure data, there is a discontinuity at 1997. This is because at that date 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.)

Table 1 (Appendix A) shows pre-1997 RCS exposure data held by HSE. 37% of pre-1997 values were over 0.1 $mg.m^{-3}$ and 63% were above 0.05 $mg.m^{-3}$. More recent data supplied by the industry (Table 2, Appendix A) suggests that there have been improvements in this sector. Sampling during the period 2002 to 2003 showed that of 33 samples for RCS from 3 sites, 3% indicated exposure above 0.3 $mg.m^{-3}$, 24% were above 0.1 $mg.m^{-3}$ and 48% were above 0.05 $mg.m^{-3}$.

Sampling by HSE (untabulated) in 2002 before improvements at one brick-manufacturing site which used clamp-firing showed that the RCS exposure of setter machine operators and of clamp setters ranged from 0.06 to 0.46 $mg.m^{-3}$ (8-hour TWAs).

From the responses to the 2003 HSE questionnaire (Table 3, Appendix A), it was believed that currently 0.4% of employees were exposed to RCS levels above 0.3 $mg.m^{-3}$, about 22% were exposed to RCS levels above 0.1 mg. m^{-3}, about 54% were exposed to RCS levels above 0.05 $mg.m^{-3}$ and about 72% were exposed to RCS levels above 0.01 $mg.m^{-3}$.

IOM study - Summary

The study (Reference a) was undertaken in the early 1990's over 18 sites operated by 10 different companies and included nearly 1400 mostly full-shift personal measurements of worker exposure. The average quartz exposure measured over the study, based on the measurements from all the plants, was 0.11 $mg.m^{-3}$. The study found that exposures exceeded 0.1 $mg.m^{-3}$ in 33% of all samples and on at least one occasion by all occupational groups, and at all sites.

The percentage of quartz (as it was reported) in the dust samples varied both across the range of tasks (6-20%) and across sites (5-21%). These variations were a consequence of the feedstock and processes carried out at each plant. 3% of all samples were found to show RCS exposure above the UK MEL of 0.4 $mg.m^{-3}$ which applied then.

The medical surveillance undertaken as part of the study (including a radiographic survey of workers) demonstrated that the estimated exposure-response relationship for quartz suggests significant risks of radiological abnormality even at exposures of 0.1 $mg.m^{-3}$ RCS.

The study identified the change of kiln types from Hoffman or Intermittent types to Tunnel type as the most significant event to influence the dust exposure history of the workforce in the industry. Employees at plants still using Hoffman kilns were exposed on average to 1.5 times the dust concentration of the workforce doing similar jobs in plant using other types of kiln.

Some of the sites employed traditional, labour-intensive processes and the layout and methods of work had changed little with time. Other sites had undergone a great number of changes and improvements.

Major changes identified related mainly to type of kiln, type of fuel or degree of automation. Other changes identified included relocation of activity, introduction of LEV or RPE.]

British Ceramic Confederation (BCC) Industry Exposure Data

Between 1994-1999 various BCC members have conducted exposure monitoring to quantify worker exposures to RCS. These have been compiled by the BCC and were provided to HSE as supporting data for this study.

The data from all the various contributing sites has been compiled and split into specific tasks. Task descriptions for which there were in excess of twenty data points included the following;

Setting machine

Clay Prep.

Dehacker

Extruders

Forklift driver

Handmaking

Packer

Sorter

Although full descriptions of the nature of each of these tasks are not provided they can be assumed to refer to the various worker operations related to this area or equipment.

During the course of the SBS exposure measurements were taken from some workers whose duties fitted the BCC task descriptions. For these categories the results from the SBS were compared against those from the BCC data.

Setting Machine operations

The BCC data contained 101 RCS exposure measurements for setting. The average of these readings was 0.17 $mg.m^{-3}$ 8hr TWA. Approximately 43% of the measurements were in excess of 0.1 $mg.m^{-3}$ 8hr TWA with the highest exposure recorded being 1.57 $mg.m^{-3}$ 8hr TWA.

The SBS obtained 10 data points for Setting operations and the average of these was 0.091 $mg.m^{-3}$ 8hr TWA, the highest exposure being 0.26 $mg.m^{-3}$ 8hr TWA.

Thus the SBS data (although very limited) would suggest that average exposures for workers involved in Setting operations have fallen since the BCC data was obtained, notwithstanding the 25% change in the measurement methods. This may be as a result of engineering changes and automation of Setting processes, however a number of recorded exposures were above the new WEL and the average was only slightly lower than the WEL. This would therefore indicate that although improvements have been made in controlling exposure from Setting operations, in many brickmaking facilities these operations continue to offer a significant risk of exposure close to or above the new WEL.

Dehacker operations

Thirty-nine exposure measurements were presented in the BCC data, the average of these readings being 0.12 $mg.m^{-3}$ 8hr TWA. Approximately 41% of the measurements were in excess of 0.1 $mg.m^{-3}$ 8hr TWA with the highest recorded exposure being 0.59 $mg.m^{-3}$ 8hr TWA.

The SBS obtained 12 data points for Dehacker operations. Ten of these data points were taken from one site where historically high exposures to RCS were commonplace in this area. Of these ten samples, six were taken prior to and four after the installation of a water mist dust suppression system in the dehacker area. The average exposure recorded prior to the water mist suppression system installation was 0.18 $mg.m^{-3}$ 8hr TWA, following the installation the average had dropped to 0.088 $mg.m^{-3}$ 8hr TWA. It should be noted that whilst these initial results indicated that the water mist system had proved effective in reducing worker exposures to RCS at this site further validation was considered necessary.

Overall the average of the SBS exposure measurements for dehacker operations was 0.17 $mg.m^{-3}$ 8hr TWA. This indicates that dehacker operations continue to be a significant source of potential exposure to RCS. Dehacker operations are one area where automation has increased in the industry and whilst this may have reduced the number of workers performing these duties, it does not appear to have lessened the hazard to which the workers are exposed.

2 SBS SITE METHODOLOGY

2.1 SITE SELECTION

As previously mentioned, 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 Brickmaking industry.

In order to achieve this within the timeframe and budget for the study sites for inclusion had to fulfil certain criteria, this included:

Known examples of good or bad hygiene practice.

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

A range of brickmaking methods

This has included a mixture of different production processes; hand made, extrusion, Fletton process etc., plus “Ashler” process (effectively concrete) brick production.

Brickmaking businesses of differing size and capacity

The UK brickmaking industry has gone through considerable consolidation over recent years and a large number of the UK brickmaking facilities are now part of large multi-site corporations. The survey attempted to include brickmaking facilities that reflected the different range of businesses in the industry, from large multi-site operations to small, independents.

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.

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 (with the indicators of the ranges of dutyholder performance) are shown in the site competency assessment checklists, which are reproduced in appendix C 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.

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 pre-selector 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. Sampling and analytical methods are summarised in table 1 below.

Table 2 Sampling and analytical methodologies used in this investigation

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

MDHS – Methods for the determination of hazardous substances.

As with most exposure monitoring, it has to be recognised that the results only show exposures as they were on the day, when a visit was made by appointment.

3 FINDINGS, OBSERVATIONS & IDENTIFIED ISSUES

Control and RPE competence assessments

Of the 9 brickmaking sites awarded a rating for adequacy of control measures, 4 sites achieved a rating of 4, i.e. achieved a level of control that would be deemed appropriate as per COSHH Essentials. The remaining five sites received ratings of 3.

The average rating awarded across the nine sites was slightly better than Rating 3, which can be summarised as '*Occasional over-exposure. Reasonable awareness of hazard and risk and desire to improve.*' This summary of control could be considered to appropriately reflect the overall picture of the industry obtained from this study.

Of the 7 sites awarded a rating for adequacy of RPE, no sites achieved a rating of 4, i.e. achieved a satisfactory standard where there was strong evidence of selection of suitable and adequate equipment and good practices in use.

Three sites achieved a rating of 3 and the remaining five sites were awarded a rating of 2. One site was not awarded a rating as RPE was neither provided nor utilised.

The average RPE rating awarded across the eight sites was slightly better than Rating 2, i.e. '*RPE used to achieve adequate control. Evidence of provision of suitable and adequate equipment but strong evidence of poor practices in use*'.

The principal issue identified with the provision and use of RPE was the lack of face fit testing conducted. Regulation 7 of COSHH states that the initial selection of RPE (full and half face masks including disposables) should include fit testing to ensure that the correct device has been chosen (in terms of size and fit etc.). All site H & S officers to whom this non-compliance was identified said that they would address this issue as soon as possible or that they had already taken steps to achieve compliance.

Note: At any site where RPE was neither provided nor utilised no rating was made. None of these sites had a standard of control deemed appropriate as per COSHH Essentials, i.e. all were awarded competency ratings of lower than 4. Therefore it can be assumed that the reasons that RPE was not introduced may have been because of a false assumption that existing control was satisfactory at these sites.

Exposure monitoring:

The results of worker exposure measurements considered during the SBS show that approximately 34% exceeded 0.1 $mg.m^{-3}$ 8hr TWA. . This includes the one measurement made during the SBS brick work which indicated RCS exposure above 0.3 $mg.m^{-3}$; together with a further 4 from FOD monitoring data gathered in 2002 (site B11 in the site visit summaries.) Industry responses to the questionnaire circulated in 2003 before the RIA was prepared considered that approximately 24% of personnel might be potentially exposed above 0.1 $mg.m^{-3}$ 8hr TWA

Thus the results of the SBS indicate that the most recent industry estimates of the number of employees within the brick making sector exposed to RCS above the proposed revised WEL of 0.1 $mg.m^{-3}$ 8hr TWA was rather optimistic and a significantly higher number of staff are potentially at risk of unacceptable exposure.

(It should be noted that both the SBS and the industry questionnaires covered only a small proportion of the industry and each could therefore only be considered to present a “snapshot” of the industry.)

When the SBS measurements are considered alongside the broad range of observations made and information received from dutyholders, it becomes possible to form an impression on whether good occupational hygiene standards are being employed at any site and, more importantly, whether any exposure measurements indicate a situation likely to be sustained in the longer term. Thus, whatever the range of exposures measured during a site visit, a “Control Competence” grading of less than 4 (indicating a failure to follow the principles of good practice as explained in COSHH essentials) will make ongoing compliance with the 2006 WEL unlikely.

SBS exposures and the new WEL

Over the course of the study 97 exposure measurements were obtained. 28 of these results were in excess of the new WEL i.e. above 0.1 $mg.m^{-3}$ 8hr TWA, and were obtained from workers involved in various different tasks.

Table 3 Tasks and RCS exposures

At least one worker performing the following tasks had exposure above the 2006 WEL:	
Dehacker Forklift truck Extruder supervision Setting Drawing Hoffman kiln (floor man) Clay prep	Mixer supervision Sand mixing Angle device Specials Pan house Handmade duties (throwing etc.) Make operative
None of the measurements taken from workers performing the following tasks exceeded the 2006 WEL:	
Fitter Kiln car cleaning Sorting Finger car	Packaging Ashler press (concrete bricks) Spengler press

12 personal measurements were made at brickworks using traditional “Hoffman” kilns; 7 (or 58%) of these indicated exposure above the 2006 WEL of 0.1 $mg.m^{-3}$ 8hr TWA. A total of 21 of the 85 measurements made at plants not using Hoffman kilns (25%) indicated exposure above the new WEL of 0.1 $mg.m^{-3}$ 8hr TWA.

Issues

These results demonstrate that there remain a wide range of tasks associated with the brickmaking process which will offer the potential for significant exposure following the reduction of the WEL.

At the majority of sites visited the H & S officers had followed the general requirements of the CoSHH Regulations (i.e. risk assessments and exposure monitoring) to help them identify the tasks which presented the most significant risks of exposure to RCS. In many cases this had proved successful in allowing them to identify areas where exposure control required improvement.

Management at many of the sites had acknowledged the exposure risk issues and spent time and money on the installation of engineering controls. However, as the results of the SBS would indicate, these controls have had only limited success and the 2006 reduction to the WEL for RCS has meant that these controls may now be deemed to offer an insufficient level of control of exposure.

There may be numerous reasons why engineering controls fail to achieve a satisfactory level of control at any particular site. One of the recurring reasons identified in many businesses, not just brickmaking, would appear to be a lack of knowledge or understanding of occupational hygiene principles of control in the design and installation of engineering control measures.

This lack of knowledge / understanding at the design & installation stage encompasses such factors as:

(1) Lack of knowledge of (or ability to identify) processes, operations and tasks and which work-groups may be at significant risk of exposure

(2) Limited ability to estimate or measure degree of exposure and comprehend extent of the risk

(3) Poor understanding of how contaminants become airborne and move and how surfaces become contaminated

(4) Limited ability to identify & understand how people become exposed and rank-order "significant" sources

It should also be noted that even in situations where appropriately designed & effective systems have been installed the ongoing performance of these systems can be handicapped by poor maintenance. It is therefore important that regular reviews of control measures are undertaken and that suitable maintenance regimes are established. This will help to ensure that the significant levels of capital investment that can be involved with engineering controls are not wasted.

From observations and discussions with the brick making sector management it could be seen that there was a good level of awareness within the sector regarding the health risks posed by exposure to RCS.

All sites visited during the SBS had a health & safety manager, either full or part time, who had undertaken risk assessment regarding the risks posed by RCS at his / her site. All people with H & S responsibilities demonstrated a good knowledge of the health risks associated with RCS (silicosis etc.) and had identified the highest risk (i.e. dustiest) processes undertaken at their facility.

All sites had at some stage undertaken exposure monitoring, in-house or by external consultant, in order to evaluate the levels of exposure in terms of compliance with the WEL (or MEL).

All sites performed some form of health surveillance on employees whose work may lead them to be exposed to RCS.

4 DISCUSSION

The results of this work suggest that recent HSE & industry estimates of silica exposures may be lower than actual exposures. 29% of measurements indicated exposures above the WEL, whereas employer estimates in responses to the survey that preceded the RIA estimated 21.5% above 0.1 $mg.m^{-3}$.

Demand for bricks produced using traditional, dustier, methods remains. During the SBS twice the proportion of exposures were above 0.1 $mg.m^{-3}$ at plants using Hoffman kilns compared with other kilns, despite the numbers of samples at “other” kilns being greatly increased by the inclusion of results from a FOD sampling campaign which followed the incidence of silicosis at one plant (28% of personal samples and 37% of all samples)

Whilst technological advances have allowed a greater degree of automation to be introduced to brick manufacturing facilities in place of older labour-intensive methods there remains a market for various traditionally manufactured brick products e.g. for restoration purposes on historical buildings.

Although technological advances have meant that there is now a greater amount of automation of processes at brickmaking facilities, demand for bricks manufactured using older, labour intensive methods remain. These traditional production facilities would be difficult to introduce engineering controls to as it has to be acknowledged that there is significant difficulty retrofitting new or emerging dust control technology to older brick manufacture process plant. Although a large part of the industry is grouped in large organisations, the capital costs for introduction of engineering controls are potentially prohibitive, particularly at smaller or independent brickmaking facilities. Such sites may still need to rely on RPE to protect workers involved in operations such as brick throwing and the setting and removal of bricks from the kilns

Although some processes have been subject to automation, it does not eliminate the actual generation of dust as bricks are moved mechanically. The risk of exposure therefore remains for process supervisors etc.

Engineering control measures were found to have varying degrees of success in achieving adequate control of exposure. Unsatisfactory performance of engineering controls is often a result of a lack of knowledge or understanding of occupational hygiene principles at the design or installation stages.

At most of the sites visited for the SBS it was found that where RPE was needed, suitable selection processes, training and face-fit testing were not conducted. This undermines the potential value and effectiveness of the protection given, and is likely to lead to employees experiencing RCS exposure when relying on respirators that do not fit or are not being worn correctly.

With approximately 85% of the UK brick making operations under the management of fewer than six companies the issue of communication with industry is made less problematic. In other more fragmented business sectors HSE has encountered difficulties in effectively communicating information to industry in order to achieve improved standards with regard to heath & safety issues. Communication between HSE and the UK brickmaking industry is considered to have been relatively good historically and RCS exposures may be further reduced if the effective working relationship can be maintained between HSE, industry, unions and trade association health & safety representatives. The issue of communicating with and influencing smaller employers (who may not belong to trade associations) will remain in the brick and heavy clay sector, as it does elsewhere in industry.

The British Ceramics Confederation is a signatory to the Social Dialogue Agreement and represents both the Brick Development Association (BDA) and the Clay Roofing Tile Council (CRTC.) The BDA has some 34 members and the CRTC 5 (2008 figures.). These employers will be required to implement the SDA equivalent of HSE's Silica Essentials and to undertake monitoring, the performance at both of which will be anonymised and published. However this does not put pressure on non-trade association members other than to establish that all the SDA guidance is by definition practicable. It is possible that employers' insurers might use the data required to be produced for the SDA as a means of assessing their own financial risks, i.e. their potential liabilities. They might then apply pressure to minimise RCS exposures as a consequence, although the requirements of the UK COSHH regulations would not seem to have been used in this way.

5 CONCLUSIONS

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

(1) SBS results suggest that previous recent HSE & industry estimates of silica exposures may be lower than actual exposures.

(2) Demand for bricks produced using traditional, dustier, methods remains.

(3) Traditional production facilities continue to require high numbers of workers and it would be difficult to retro-fit engineering controls.

(4) Automation of various processes has been unable to eliminate generation of dust as bricks are moved, so risk of exposure remains for process supervisors etc.

(5) Engineering control measures were often found to have varying degrees of success in achieving adequate control of exposure.

(6) Unsatisfactory control is often a result of a lack of knowledge or understanding of occupational hygiene principles at the design & installation stage of engineering controls.

(7) The capital costs for the introduction of engineering controls are recognised as potentially prohibitive, particularly at smaller independent brickmaking facilities. (This is partly due to the difficulty of retrofitting emerging dust control technology to older brick manufacture process plant.)

(8) Suitable selection processes, training and face-fit testing were often not conducted where RPE was relied upon to achieve exposure control.

(9) The implementation of the SDA might put additional pressure (on those employers who are members of NEPSI-affiliated associations) to reduce exposures at least to the UK WEL of 0.1 $mg.m^{-3}$.

Recommendations

The following points highlight key areas where improvements in the control of RCS exposure could make compliance with the revised WEL a realistic expectation:

1 There is a continued need for adequate COSHH assessments for all tasks involving the use of silica-containing materials.

2 Better exposure control technology might be developed by continuing the established communication and knowledge-sharing between stakeholders: industry, HSE, BCC etc.

3 This might lead to improvement in the development and selection, performance and maintenance of engineering control measures (e.g. LEV)

4 The underpinning policies, the training of staff and selection and maintenance of Respiratory Protective Equipment need to be greatly improved if adequate control of exposure has to be achieved by this method.

5 Exposure monitoring and health surveillance programmes should continue in order to assess the effectiveness of exposure controls, to improve the data pool and to increase knowledge of exposure profiles.

6 Reductions in exposure might follow increased perception in industry that failure to achieve compliance could result in consequences detrimental to the business e.g. compensation claims or increased regulatory pressure. NEPSI-affiliated employers are required to declare their performance and an inadequate standard should lead to peer-pressure to avoid what would be seen as unwelcome attention or stricter hygiene standards.

7 Research into substitution of non-silica based alternatives in surface dressing might offer a means of eliminating one source of exposure. RCS generation from the comminution of fired clay particles will remain an ever-present hazard and any new facilities should incorporate mitigation features.

6 APPENDICES

APPENDIX A TABLES

Table 1: Personal exposures to RCS (HSE OHVR data 1992-97) published in the HSE booklet – "Respirable Crystalline Silica – Exposure Assessment Update, EH74/2"

Table 2: Estimates of RCS exposure in UK brickmaking and heavy clay industry and the approximate numbers exposed

Table 3: Questionnaire responses - Summary tables of employee exposure to RCS for brick making / heavy clay industry

Table 4: Employment statistics 2005

Table 5 Brickmaking: Summary of SBS site assessment results

Table 1: Personal exposures to RCS (HSE OHVR data 1992-97) published in the HSE booklet – "Respirable Crystalline Silica – Exposure Assessment Update, EH74/2"

Sector	Number of sites	Number of samples	Percentage of values above 0.2 $mg.m^{-3}$	Percentage of values above 0.1 $mg.m^{-3}$	Percentage of values above 0.05 $mg.m^{-3}$
Brick/heavy clay	5	28	14	64	82

Source: RIA table 1

Table 2: Estimates of RCS exposure in UK brickmaking / heavy clay industry and the approximate numbers exposed**.**

Sector	Total numbers in the industry sector	Total numbers exposed above 0.01 mg/m^3	Total numbers exposed above 0.05 mg/m^3	Total numbers exposed above 0.1 mg/m^3	Total numbers exposed above 0.3 mg/m^3
Brick and heavy clay	6,000	4,980[1]	4,320[1]	1,320[1]	24[(1)]

Table 3: Questionnaire responses – Summary from table of employee exposure to RCS for brick making / heavy clay industry

Sector	Total No. of workers Surveyed/Sector	Total exposed to RCS	0.3 $mg.m^{-3}$ RCS or above	0.1 $mg.m^{-3}$ RCS or above	0.05 $mg.m^{-3}$ RCS or above	0.01 $mg.m^{-3}$ RCS or above
Heavy clay/bricks	2993	2231 (74.5%)	13 (0.4%)	646 (21.5%)	1614 (54.0%)	2143 (71.6%)

Source: Totals line from RIA table 23

Table 4: ONS Employment statistics 2005

a) SIC2640, Manufacture of bricks, tiles and construction products, in baked clay

Enterprise level	Employment size band:							
	0 - 4	**5 - 9**	**10 - 19**	**20 - 49**	**50 - 99**	**100 - 249**	**250+**	**Total**
Number of local units in Vat-based enterprises (Table A3.1)	110	25	25	45	50	15	5	270
Number of Vat-based enterprises: (Table B3.2)	105	25	15	20	10	5	5	185

b) 2661 Manufacture of concrete products for construction purposes

SIC code and description	Employment size band:							
	0 - 4	**5 - 9**	**10 - 19**	**20 - 49**	**50 - 99**	**100 - 249**	**250+**	**Total**
Number of local units in Vat-based enterprises (Table A3.1)	275	145	155	180	70	45	5	875
Number of Vat-based enterprises: (Table B3.2)	235	105	95	110	25	20	15	605

c) Employment numbers derived from ONS figures.

Activity	Employment size band:							
	0 - 4	**5 - 9**	**10 - 19**	**20 - 49**	**50 - 99**	**100 - 249**	**250+**	**Total**
2640 heavy Clay Brick	110	25	25	45	50	15	5	270
Notional size	2	7	15	35	75	175	250	
Derived Employment numbers:	220	175	375	1575	3750	2625	1250	9970

Activity	Employment size band:							
	0 - 4	**5 - 9**	**10 - 19**	**20 - 49**	**50 - 99**	**100 - 249**	**250+**	**Total**
2661 Manufacture of concrete products for construction purposes	275	145	155	180	70	45	5	875
Notional size	2	7	15	35	75	175	250	
Derived Employment numbers:	550	1015	2325	6300	5250	7875	1250	24565

Table 5 Brickmaking: Summary of SBS site assessment results

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	
B1	A	W	5	3	0	0	0.099			4	2	
B2	A	LEV, RPE	9	2	0	5	0.23	0	2.2	4	2	Argillaceous rocks: clay, shale and slate
B3	A	LEV	5	2	0	2	0.198	0	1.236	4	2	Coal measure shale, clay
B4	D	LEV	7	3	0	3	0.214	0	1.37	4	3	
B5	B	N/A	9	2	0	0	0.092	0	0.845	3	N/A	
B6	E		7	2	0	5	0.24	0	3.31	3	2	Clay, Hoffman kilns
B7	F & A	LEV & W	11	1	1	3	0.357	0	1.12	3	3	"clay"
B8	C	N/A	7	0	0	0	0.092	1	4.97	3	3	Sand, silica sand
B9	B		10	4	0	0	0.09	0	0.75	3	2	
B10		W										Visit postponed indefinitely
B11	A		27	25	4	5	0.79	3	11.06	N/A	N/A	Clay, shale
Totals:			**97**	**45**	**5**	**23**		**4**				
Percentages:					**5%**	**24%**		**4%**				

Activity: A: Extruded clay brick production, B: Hand made bricks, C: Concrete bricks, D: Clay & terracotta products, E: Fletton process / London bricks, F: Soft clay brick production

Control strategy: Silica Essentials Control approaches: W = Water suppression, LEV = Local exhaust ventilation

APPENDIX B: SUMMARIES OF VISIT REPORTS

In the results tables in this section the following abbreviations are used to describe sample types: PL: Personal, Long term, SL: Static, long term, CM: Combined measurement.

Site B1

Description of Facility / Operations

The site has an office building where administrative and management duties are undertaken. Production operations are undertaken in the main large open plan building. Raw materials and products are stored in various external areas.

The principal operation at this site associated with exposure to RCS was the work undertaken by operatives in the dehacker line area. The plant has two main lines (B & C) each of which is typically managed by two operatives. The operatives work 12-hour shifts from 06.00 – 18.00hrs with one 30-minute lunch and two 15-minute breaks taken during the morning and afternoon.

Operatives observe line operations as bricks are auto fed-from the ovens through elevator cages, line grippers, feed belts and compactors. Each stage of the lines has the potential for minor failures and as such the line may have to be stopped, the failure corrected and the system re-set in order to allow normal production to resume.

The periodical measurement of bricks for quality control purposes was identified as one of the dustiest processes undertaken by the dehacker line operatives. The frequency of brick measurement is as required by throughput. It is performed on average 10-15 times per shift. The bench has no dust suppression system or LEV present.

Once bricks come out of the oven there is a considerable amount of dust covering their surfaces. As the brick passes through the various stages of the dehacker line there is considerable scope for this dust to become disturbed and to become airborne. Particularly high exposures may occur when operatives have to manually remove bricks from the lines.

Besides the operatives involved in management of the dehacker lines, one operative is involved in the shifting of brick batches using a forklift truck from the end of the lines to the external storage areas. The majority of this work is external.

Material

Fired clay bricks are manufactured at this site using Weald clay from the local quarry. Bricks are formed using soft-mud moulding methods.

Control Measures

Fan units and spray bars are located at various points in the vicinity of the dehacker plant. No local exhaust ventilation (LEV) is present on this plant. The positioning of the units required modification after initial testing to assess effectiveness indicated that they were too far away from the plant. In addition spray bars were fitted to each of the elevator cages.

General ventilation to the workplace is offered by louvres located in the ceiling skylights. In addition during summer months, when the weather is warmer, the main large access doors to the workshop are left open to allow fresh air into the building. No mechanical ventilation is present in the main workshop.

Following the modifications to the atomising spray mist units and the addition of the spray bars, exposure monitoring was undertaken and this indicated that exposure levels had been significantly reduced. Management felt that the reduction in exposure was sufficient to warrant the lifting of the requirement for personnel to wear respiratory protective equipment. This decision was to undergo further review following further independent validation of the effectiveness of the system.

Control competency rating (0 - 5)	**4** – See Appendix IV for descriptors
RPE competency rating (0 – 5)	**2** – See Appendix IV for descriptors

Notes:

Control Competency:

Following discussions with the UK H & S manager and site production manager, inspection of risk assessment and previous monitoring report documents relating to RCS exposures it was deemed that management have undertaken suitable and sufficient assessment of the risks posed. Competent supervision and evidence of co-ordinated approach to control were evident during inspections of operations.

Observations of operator methods and discussions with operators regarding exposure revealed a satisfactory level of awareness and training.

RPE Competency:

Decision to withdraw mandatory use of RPE for dehacking operations is based on limited evidence that exposure is now being controlled to satisfactory levels. RPE should continue to be made available to employees.

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

Results Table

Sample No	Sample type	Sample Position	Duration, Mins	Exposures, $mg.m^{-3}$			
				RCS		Respirable dust	
				Task	8-hr TWA	Task	8-hr TWA
A	PL	RW, Dehacker, Line C supervision duties*.	370	0.059	0.084		
B	PL	JH, Dehacker, Line B supervision and angled brick measuring bench duties.	367	0.069	0.099		
C	PL	SL, Forklift truck driver.	369	0.067	0.096		
D	PL	JH, Dehacker, Line B supervision duties.	359	0.060	0.086		
E		Field Blank – Held on site during sampling by HSL.	-	<LOD	-		
F	PL	PJ, Dehacker, Line C supervision duties*.	352	0.058	0.083		
G	SL	Above work desk adjacent Line C in dehacker area.	331	0.045	-		
H	SL	On switch unit adjacent hardboard storage area behind Line C.	330	0.068	-		
I	SL	On machine guard mesh above brick feed line C155.	333	0.041	-		
J		Control blank	-	<LOD	-		

* - Operative left dehacker area to perform alternative duties in external area of main factory for approximately 45 minutes during shift.

Summary of results:

Eight samples were taken and concentrations of respirable crystalline silica (RCS) were found to range from 0.041 $mg.m^{-3}$ (static test above dehacker line) to 0.099 $mg.m^{-3}$ 8hr TWA. All the results were well below the Workplace Exposure Limit (WEL) for RCS of 0.3 $mg.m^{-3}$ 8hr TWA (the highest result was 33% of the WEL).

The operative who had the highest results was involved in what was considered to be the dustiest of the operations undertaken by the workers in the Dehacker area (brick measuring bench duties).

The results indicated that exposure to RCS had been reduced for employees working in the dehacker area of the factory. The recent introduction of a water atomising dust suppression system has been the principal reason for these recent reductions in exposure.

Site data transferred to summary (Appendix A Table 5):

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	
B1	A	W	5	3	0	0	0.099			4	2	

Activity: A: Extruded clay brick production, B: Hand made bricks, C: Concrete bricks, D: Clay & terracotta products, E: Fletton process / London bricks, F: Soft clay brick production

Control strategy: Silica Essentials Control approaches: W = Water suppression, LEV = Local exhaust ventilation

Site 2

Description of Facility / Operations

The site manufactures bricks with clay from an adjacent quarry using extrusion / wire cutting methods.

Operatives undertake the majority of manufacturing operations in the large, open plan, main workshop. This building contains the following areas:

(1) Clay Prep Area

(2) Extruder Area

(3) Setting Area

(4) Kiln Area

(5) Dehacker Area

(6) Finger Car Area (loading / unloading)

The site has an indoor kiln through which the bricks are passed on kiln cars.

Another smaller building on the site houses the special products and 'cut & bond' operations. This work involves the use of power tools to cut brick products into the required shapes. Nine employees may work in this area although typically the volume of work in this area is low (on average less than 1 hour per month of extruded products).

Operatives work five day weeks of 11-hour shifts from 06.00 – 17.00hrs with one 30-minute lunch and occasional tea breaks (<5 mins) taken at various times. Operatives take tea breaks and lunch in rest room located in separate section of the main building or, in certain cases, operatives remained in the workplace for the break period.

Material

The site manufactures bricks with clay from an adjacent quarry using extrusion / wire cutting methods.

Control Measures

A dust suppression system had been introduced in the Clay Prep area and local exhaust ventilation (LEV) systems were present in numerous locations through the site.

Most of the LEV capture hoods are positioned at locations where clay is fed from one area to another and this movement of the clay liberates dust into the workplace atmosphere. The LEV is designed to prevent dust entering the general workplace atmosphere as opposed to the direct breathing zone of any workers. LEV system design appeared to be appropriate and working satisfactorily.

The site had recently installed a ‘Gotland’ vacuum cleaning systems in order to improve housekeeping.

The cutting operations in the Specials Plant use water for dust suppression and operatives wore disposable respirators with P3 grade particulate filtration.

For normal production operations operatives are not required to use RPE except for the sweeping of kiln cars.

Health surveillance (lung function testing) is conducted on all manufacturing employees on an annual basis.

Control competency rating (0 - 5)	**4** – See Appendix IV for descriptors
RPE competency rating (0 – 5)	**2*** – See Appendix IV for descriptors

Notes:

Control Competency:

Following discussions with the UK H & S manager and site production manager, inspection of risk assessment and previous monitoring report documents relating to RCS exposures it was deemed that management have undertaken suitable and sufficient assessment of the risks posed. Competent supervision and evidence of co-ordinated approach to control were evident during inspections of operations.

Observations of operator methods and discussions with operators regarding exposure revealed a satisfactory level of awareness and training.

Management had taken proactive measures to introduce engineering control measures (water mist suppression system, Gotland vacuum system) in order to attempt to reduce potential exposure to RCS as far as reasonably practicable.

RPE Competency:

Note: * - 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.).

Results Table

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	JW – Setting Machine operator	377	0.149	0.196	1.171	1.537
2	PL	DJ – Forklift truck driver	333	0.078	0.102	0.382	0.502
3	PL	BJ – Extruder operative	327	0.094	0.123	0.626	0.821
4	PL	KP – Dehacker operative	333	0.08	0.105	0.573	0.752
5	PL	RT – Cut & Bond area operative	372	0.175	0.230	1.674	2.197
6	PL	SD – Finger cart driver	392	0.041	0.054	0.128	0.167
7	PL	IH – Loading shovel operator (JCB) in Clay Prep area.	381	0.047	0.062	0.203	0.266
8	PL	TJ – Team leader: Make area	313	0.014	0.018	0.232	0.305
9	PL	JS – Kiln car cleaner	294	0.019	0.025	0.237	0.311
10	SL	Clay feed area – Upper level adjacent shaker unit	360	0.013		0.240	
11	SL	Dehacker line – On machine guard fencing.	337	0.014		0.175	

Summary of results:

The respirable dust concentration ranged from 0.13 to 1.67 $mg.m^{-3}$ and the calculated 8hr TWA exposures ranged from 0.17 to 2.2 $mg.m^{-3}$.

The respirable crystalline silica exposures ranged from 0.014 to 0.175 mg m-3 and the 8hr TWA ranged from 0.018 to 0.23 mg m-3. The highest exposure result was taken from the operative undertaking operations in the Cut & Bond area on the day of the survey.

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	
B2	A	LEV, RPE	9	2	0	5	0.23	0	2.2	4	2	Argillaceous rocks: clay, shale and slate

Activity: A: Extruded clay brick production, B: Hand made bricks, C: Concrete bricks, D: Clay & terracotta products, E: Fletton process / London bricks, F: Soft clay brick production

Control strategy: Silica Essentials Control approaches: W = Water suppression, LEV = Local exhaust ventilation,

Site 3

Description of Facility / Operations

Production of extruded bricks with firing of products done in traditional 'Hoffman' brick kilns. The raw material for the brick production is locally occurring Coal Measure Shale. The bricks are produced by extrusion and pressing, and a wide range of traditional sizes and surface textures are available. There are two Hoffman kilns, both are over seventy years old and are powered by methane gas taken from the adjacent landfill site.

Operatives work 8 hour 15 minute shifts from 07.00 – 15.30hrs with one 30-minute lunch and one 15-minute break taken during the morning. Operatives generally finish working at around 15.00hrs in order to go and get a shower. Typical actual working time (exposure duration) is approximately seven hours fifteen minutes.

Material

The raw material for the brick production is locally occurring Coal Measures Shale that is brought onto site by road from the working quarry located about a mile from the works.

Control Measures

There are no dust suppression system or local exhaust ventilation (LEV) systems present at the site.

The operatives working in the Pan House and Mixer areas are required to wear respiratory protection (P2 grade disposable mask) whilst undertaking their duties. This measure was introduced as a result of the high levels of RCS recorded during exposure monitoring on these operatives.

Health surveillance (lung function testing) is conducted on all manufacturing employees on an annual basis.

Whilst operatives were observed making use of their RPE, no face fit training or designated storage facilities had been provided.

Control competency rating (0 - 5)	**4** – See Appendix C for descriptors
RPE competency rating (0 – 5)	**2*** – See Appendix C for descriptors

Notes:

Control Competency: Following discussions with the H & S manager and inspection of risk assessment and safety report documents relating to potential RCS exposures it was deemed that management have undertaken suitable and sufficient assessment of the risks posed. Competent supervision and evidence of co-ordinated approach to control were evident during inspections of operations.

Observations of operator methods and discussions with operators regarding exposure revealed a satisfactory level of awareness and training.

Although it was identified that there is scope for improvement of existing controls at the site, due to the age of the facility and the traditional, labour intensive nature of operations it is acknowledged that any significant improvements (e.g. engineering controls; LEV etc.) would be potentially expensive and difficult to install.

RPE Competency::

Note: * - 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.).

Results Table

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	SF – Mixer Operator	335	0.105	0.095	0.855	0.775
2	PL	KM – Pan House operative	302	0.073	0.066	0.873	0.792
3	PL	KH – Floorman	290	0.219	0.198	1.364	1.236
4	PL	CB – Turntable operative (putting on)	291	0.062	0.056	0.375	0.340
5	PL	PA – Drawing operative	2826	0.143	0.130	0.795	0.720
6	SL	Static – Pan House work station	278	0.112		0.507	
7	SL	Static – Mixer work station	285	0.086		0.622	

Summary of results:

The respirable dust exposure concentrations ranged from 0.5 to 1.36 mg m^{-3} and the calculated respirable 8hr TWA exposures ranged from0.46 to 1.23 mg m^{-3}.

The RCS measured exposure concentrations ranged from 0.06 to 0.22 mg m^{-3} and the 8hr TWA exposures ranged from0.05 to 0.19 mg m^{-3}.

The highest exposure was taken from the worker who was undertaking Floorman operations in the kiln areas.

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	
B3	A	LEV	5	2	0	2	0.198	0	1.236	4	2	Coal measure shale, clay

Activity: A: Extruded clay brick production, B: Hand made bricks, C: Concrete bricks, D: Clay & terracotta products, E: Fletton process / London bricks, F: Soft clay brick production

Control strategy: Silica Essentials Control approaches: W = Water suppression, LEV = Local exhaust ventilation

Site 4

Description of Facility / Operations

Production of clay & terracotta products (airbricks, facing bricks, chimney pots etc.) using extrusion / wire cutting methods with adjacent clay quarry.

The Fire Cement production, although only a very minor part of overall activities, involves the manual addition of silica sand into a process vessel with the potential for acute exposure to RCS.

Operatives work seven hour thirty minute shifts from 07.00 – 15.30hrs with one 30-minute lunch and 15-minute break taken during the morning. Operatives are given 15-minutes 'shower/ wash' time before the official end of their shift.

Material

Production of clay and terracotta products using clay – Various types; Fireclay, Duckery, Chatterley, Wilnecote

Fire Cement production involves use of silica sand (99% RCS)

Control Measures

Water suppression systems are present on the cutting equipment used for the cutting and finishing that may be required to achieve the customers design requirements.

Local exhaust ventilation (LEV) systems are present in the Spengler Press, Fire Cement production and Clay Preparation areas. All LEV plant had undergone independent examination & test by a suitably competent person and had been deemed 'fit for purpose'.
The operative working in the Fire Cement production area is required to wear respiratory protection (P3 grade disposable mask) whilst undertaking this operation. This measure was introduced as a result of task specific risk assessment that identified the potential for exposure to significant levels of RCS. Whilst operatives were observed making use of their RPE, no face fit training or designated storage facilities had been provided.

Health surveillance (lung function testing) is conducted on all manufacturing employees on an annual basis.

Control competency rating (0 - 5)	**4** – See Appendix IV for descriptors
RPE competency rating (0 – 5)	**3** – See Appendix IV for descriptors

Notes:

Control Competency:

Following discussions with the UK H & S manager and site production manager, inspection of COSHH risk assessment and previous monitoring report documents relating to RCS exposures it was deemed that management have undertaken suitable and sufficient assessment of the risks posed. Competent supervision and evidence of co-ordinated approach to control were evident during inspections of operations.

Observations of operator methods and discussions with operators regarding exposure revealed a satisfactory level of awareness and training.

Management had taken proactive measures to introduce engineering control measures (water suppression system for cutting operations) in order to attempt to reduce potential exposure to RCS as far as reasonably practicable.

RPE Competency:

Note: * **-** 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.).

Results Table

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	SE: Spengler Press operative (air bricks)	333	0.086	0.0887	0.533	0.5493
2	SL	Static: On control unit of Spengler Press unit	332	0.039	-	0.250	-
3	PL	DS: Clay preparation (L50 Volvo driver)	310*	0.117	0.1207	1.001	1.0320
4	PL	TT: Plough operator (Clay prep area)	319	0.140	0.1444	0.958	0.9882
5	SL	Static: Upper level of clay prep area (above rotor stores	318	0.084	-	0.532	-
6	PL	NA: 60F mixer area (No.1 workshop)	308	0.100	0.1031	0.895	0.9227

Sample No	Sample type	Sample Position	Duration, Mins	Exposures, $mg.m^{-3}$			
				RCS		Respirable dust	
				Task	8-hr TWA	Task	8-hr TWA
7	PL	IC: TK1 Drawing (No.3 workshop)	295	0.015	0.0155	0.112	0.1152
8	PL	DP: Robot mixers	282	0.060	0.0619	0.520	0.5361
9	PL	LM: Fire cement production area	24	0.208	0.01	1.373	0.07
10	SL	Static: On right hand side of loading hatch of Fire Cement process vessel.	24	0.189	-	1.373	-

Summary of results:

The respirable dust concentrations ranged from 0.52 to 1.37 mg m-3 and the calculated respirable 8hr TWA exposures ranged from0.07 to 1.03 mg m-3.

The RCS measured concentrations ranged from 0.015 to 0.2 mg m-3 and the 8hr TWA exposures ranged from0.01 to 0.14 mg m-3.

The highest RCS exposure result (0.14 mg m^{-3} 8hr TWA) was taken from a plough operator working in the Clay Prep area.

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	Control	
B4	D	LEV	7	3	0	3	0.214	0	1.37	4	3	

Activity: A: Extruded clay brick production, B: Hand made bricks, C: Concrete bricks, D: Clay & terracotta products, E: Fletton process / London bricks, F: Soft clay brick production

Control strategy: Silica Essentials Control approaches: W = Water suppression, LEV = Local exhaust ventilation.

Site 5

Description of Facility / Operations

Production of handmade bricks, terracotta floor tiles, landscape pavers, garden edgings and various special products

Operatives undertake manufacturing operations in four main areas of the site. These areas are:

- Clay Feed Area
- The Handmade Plant (Production)
- Setting Area
- Packing Area

The handmade production method involves clay lumps being thrown into moulds manually by operatives prior to being transferred to drying chambers. The site has two kilns which are able to move between two locations. This means bricks from one kiln area may be loaded / unloaded whilst the other area has the kiln in operation.

Operatives work 8 hour 15 minute shifts from 07.45 – 16.30hrs with one 30-minute lunch and one 15-minute break taken during the morning. Operatives take tea breaks and lunch in rest room located in separate building on the site.

Material

Clay (15-30% Silica) & Sand (70+% silica)

Qualitative analysis of bulk sample of material taken from the FKS Setting Machine indicated that Quartz was the main component of the material with trace amounts of Kaolinite (clay), Feldspar and a mica (possibly Muscovite).

Control Measures

There are no dust suppression or local exhaust ventilation systems present at the site within the areas covered as part of this investigation. No other forms of engineering controls, designed specifically to control dust generated by the various operations, are present.

Operatives were not provided with any form of respiratory protective equipment (RPE).

Basic personal protective equipment; safety footwear, gloves and, in designated areas, hearing protection are provided and utilised by operatives.

The workers wore their own clothes in the workplace and also used safety shoes.

Control competency rating (0 - 5)	**3** – See Appendix IV for descriptors
RPE competency rating (0 – 5)	**NR** – See Appendix IV for descriptors

Notes:

Control Competency:

Control competency rating 3 generally applies to operations where there is 'Occasional over-exposure', the results from this investigation indicate that this is unlikely to be the case at this site. Rating 3 awarded as it was felt that current Controls did not merit rating 4.

RPE Competency:

RPE – Operatives are not provided with RPE.

Results Table

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	AA – Duties within Handmade plant	364	0.070	0.070	0.443	0.443
2	PL	GC – Duties within Handmade plant	168	0.048	0.048	0.201	0.201
3	PL	NB – Duties within Handmade plant	184	<0.025	<0.025	0.283	0.283
4	PL	PT – Duties within Handmade plant	352	0.092	0.092	0.845	0.845
5	PL	DW – Duties within Setting area (FKS Setting machine)	348	0.081	0.081	0.371	0.371
6	PL	DM – Duties within Packing area	362	0.071	0.071	0.734	0.734
7	PL	PS – Duties within Setting area (FKS Setting machine)	185	<0.025	<0.025	0.418	0.418
9	PL	TS – Duties within Packing area (FLT driver)	314	0.019	0.019	0.174	0.174
10	SL	Handmade plant mixer (high level)	340	0.026		0.078	
12	SL	FKS Setting machine (above feed line)	309	0.021		0.17	

Summary of results:

The respirable dust concentrations ranged from 0.17 to 0.48 $mg.m^{-3}$ and the calculated respirable 8hr TWA exposures ranged from0.17 to 0.84 $mg.m^{-3}$.

The RCS measured concentrations ranged from LOD (Limit of detection, 0.025 $mg.m^{-3}$) to 0.09 $mg.m^{-3}$ and the 8hr TWA exposures ranged from LOD to 0.09 $mg.m^{-3}$.

The levels of respirable dust and RCS recorded were much lower than anticipated considering the extremely dusty nature of many of the operations included within the scope of this investigation. The results indicate that, despite the dusty nature of the work, the dusts generated are in the main not of the respirable fraction (i.e. particles having aerodynamic diameters <10 μm) and as such are not small enough to deposit in the alveolar (gas exchange) region of the lung.

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	Control	
B5	B	N/A	9	2	0	0	0.092	0	0.845	3	N/A	

Activity: A: Extruded clay brick production, B: Hand made bricks, C: Concrete bricks, D: Clay & terracotta products, E: Fletton process / London bricks, F: Soft clay brick production

Control strategy: Silica Essentials Control approaches: W = Water suppression, LEV = Local exhaust ventilation

Site 6

Description of Facility / Operations

Production of London bricks using the Fletton Process with firing of products done in traditional "Hoffman" brick kilns. The raw material for the brick production is locally occurring clay that is quarried 3 miles from site. Bricks are coated with mixtures of sand and pigments to produce different finishes when bricks were fired.

Operatives work 41 hours each week when on days and 37 hours a week when on the night shift from 07.00 – 15.45hrs with one 30-minute lunch and one 15-minute break taken during the morning. Typical actual working time (exposure duration) is approximately seven hours and thirty minutes.

Material

The raw material for the brick production is locally occurring clay (Coal Measure Shale) from the working quarry located about three miles from the works. The approximate silica content of the material is unknown however qualitative analysis by XRD identified quartz as the most significant mineral present on the filters submitted.

Control Measures

There are no dust suppression system or local exhaust ventilation (LEV) systems present at the hopper and angle device. The sand cabinets and sand mixing process were fitted with LEV systems.

The operatives working in the sand cabinet and Mixer areas were required to wear respiratory protection (Moldex FFP2 type 2405 disposable mask) whilst undertaking their duties. This measure was introduced as a result of the potentially high levels of RCS exposure for these operatives.

Whilst operatives were observed making use of their RPE, no face fit training or designated storage facilities had been provided.

Control competency rating (0 - 5)	3 – See Appendix IV for descriptors
RPE competency rating (0 – 5)	2* – See Appendix IV for descriptors

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.

The LEV had been checked by the companies insurance and was on an annual testing schedule.

RPE

Note: * - 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.).

Results Table

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	TM, sand machine mixer operator lines 5 & 6	305	0.11	0.103	2.513	2.356
2	PL	GT, sand machine mixer operator lines & 4	293	0.12	0.11	1.724	1.616
3	PL	RL angle device attendant	280	0.26	0.24	3.534	3.313
4	PL	MF, angle device attendant lines 3&4	239	0.14	0.13	3.2	3.0
5	PL	Mr Q, setter	283	0.12	0.11	2.772	2.599
6	PL	Mr L, hopper room operator	258	0.09	0.08	1.136	1.065
7	PL	GW FLT driver	220	<0.02	<0.02	2.079	1.949
8	SL	Fixed point sample in sand cabinet, Line 3&4	141	16.7	-	109.0	-

Summary of results:

The measured respirable dust concentrations ranged from 1.14 to 3.53 $mg.m^{-3}$ and the calculated 8hr TWA respirable dust exposures ranged from 1.06 to 3.31 $mg.m^{-3}$.

The respirable crystalline silica content measured concentrations ranged from <0.02 to 0.26 $mg.m^{-3}$ and the 8hr TWA exposures ranged from < 0.02 to 0.24 $mg.m^{-3}$. It should be noted that 5 out of the 7 personal measurements exceeded 0.1 $mg.m^{-3}$ and another was relatively close.

The highest RCS exposure result came from the operative that was undertaking angle device attendant duties, who was also exposed to the highest concentration of respirable dust.

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	Control	
B6	E		7	2	0	5	0.24	0	3.31	3	2	Clay, Hoffman kilns

Activity: A: Extruded clay brick production, B: Hand made bricks, C: Concrete bricks, D: Clay & terracotta products, E: Fletton process / London bricks, F: Soft clay brick production

Control strategy: Silica Essentials Control approaches: W = Water suppression, LEV = Local exhaust ventilation.

Site 7

Description of Facility / Operations

The site produces facing bricks using the extrusion and soft mud processes with firing of products done in kilns. Additionally hand-thrown bricks are produced, however these are in much smaller quantities. Clay is taken from the quarry adjacent to the site.

Operatives work 44 hours each week when on day shifts from 07.00 – 18.00hrs with one 30-minute lunch and one 30-minute break taken during the morning. Typical actual working time (exposure duration) is approximately ten hours.

Material

The raw material for the brick production is locally-occurring clay that is quarried from the site. Bricks are coated with mixtures of sand and pigments to produce different finishes when bricks were fired.

Control Measures

Local exhaust ventilation (LEV) systems are present on the dehacker lines however the capture hoods for these systems did not appear to be well designed.

The site has a 'Gotland' multi-point vacuum cleaning system for housekeeping purposes.

On the setter line and in the clay prep areas operatives wore disposable respirators with P3 grade particulate filtration. Disposable respirators are also made available to any staff that may wish to use them during cleaning operations. Whilst no face-fit testing has been undertaken to date the equipment required for this has been purchased and a system will be set up shortly.

Health surveillance (lung function testing) is conducted on all manufacturing employees on an annual basis.

Operatives take tea breaks and lunch in a rest area / canteen located in a separate area of the building.

Control competency rating (0 - 5)	**3** – See Appendix IV for descriptors
RPE competency rating (0 – 5)	**3*** – See Appendix IV for descriptors

Note:

Control The group H & S manager was on site on the day of the survey. The plant supervisor stated that air sampling for RCS has been conducted in-house and incidences of high exposure were dealt with as priority cases. Standard operating procedures, control measures and risk assessments were reviewed in order to identify cause of exposure and the remedial action required.

The LEV had been checked by an independent consultant and was on an annual testing schedule.

***** Rating of 4 was not awarded in this instance due to the result of the exposure monitoring which indicated occasional over-exposure and the issues identified relating to potential improvement of control measures.

RPE: Face fit testing not yet conducted although equipment and schedule for testing have been established. 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	PH – Clay Prep operative / Finger car driver*	344	0.077	0.096	0.735	0.919
2	PL	NF – Kiln burner	353	0.066	0.082	0.356	0.445
3	PL	RC – Sand mixer	380	0.065	0.081	0.811	1.013
4	PL	MW – Finger car driver	345	0.044	0.055	0.279	0.349
5	PL	GW – Make operative (De Boer)	361	0.098	0.123	0.797	0.996
6	PL	JD – Fitter (various areas)	335	0.044	0.055	0.422	0.528
7	PL	MY – Setter operator	345	0.066	0.082	0.387	0.484
8	PL	RW – Setter (pit work)	304	0.211	0.264	0.896	1.120
9	PL	GG - Dehacker No.1	331	0.187	0.234	0.570	0.712

Sample No	Sample type	Sample Position	Duration, Mins	Exposures, mg.m-3			
				RCS		Respirable dust	
				Task	8-hr TWA	Task	8-hr TWA
10	PL	MW – Dehacker No.2	334	0.286	0.357	0.670	0.838
11	PL	ME – Signode 2 operative (packaging)	323	0.033	0.041	0.193	0.241
12	SL	LK – Brick store yard FLT driver	316	0.011	-	0.333	-
13*	PL	JD – Hand throwing station	465	0.13	0.187	-	-

Note: Sample 13 was not taken during the HSL site visit. Sample was taken by the company management on 18/05/06 and then submitted to HSL for RCS analysis.

Summary of results:

The respirable dust concentrations ranged from 0.19 to 0.90 mg m^{-3} and the calculated respirable 8hr TWA exposures ranged from 0.24 to 1.12 mg m^{-3}. The respirable crystalline silica content measured concentrations ranged from 0.033 to 0.28 mg m-3 and the 8hr TWA exposures ranged from 0.041 to 0.36 mg m-3.

The highest RCS exposure result came from the operative that was undertaking Dehacker line attendant duties.

Site data transferred to summary:

Site	Activities	Control strategy	Samples collected		8-hr TWA Exposure measurements					Competency Descriptor Ratings		Material type
					RCS			Respirable Dust				
			Personal	Static	≥0.3 $mg.m^{-3}$	0.3>x≥0.1 $mg.m^{-3}$	Highest $mg.m^{-3}$	above 4 $mg.m^{-3}$	Highest $mg.m^{-3}$	Control	Control	
B7	F & A	LEV & W	11	1	1	3	0.357	0	1.12	3	3	"clay"

Activity: A: Extruded clay brick production, B: Hand made bricks, C: Concrete bricks, D: Clay & terracotta products, E: Fletton process / London bricks, F: Soft clay brick production

Control strategy: Silica Essentials Control approaches: W = Water suppression, LEV = Local exhaust ventilation,

Site 8

Description of Facility / Operations

Production facility manufacturing concrete facing bricks and "Ashler" building blocks. Production is undertaken in two main areas: the Brick plant and the Ashler process area.

The Ashler process uses silica sand as the main constituent together with local calcareous quarry waste and cement in the production of concrete blocks. Silica sand and other constituents are added by forklift truck to the Ashler plant which is located outside the main building. The concrete bricks are made from just quarry fines and cement with pigments as needed.

Both processes rely on pressing the damp mixtures to such an extent that they have enough strength to be handled. The bricks are mechanically placed on transport cars then moved into steam tunnels overnight which accelerates the curing so that they can be handled with no further risk of physical damage and sold earlier than would be the case without the extra heat and humidity. "Kiln car" loads of bricks are removed whole and transferred to pallets for wrapping and despatch. There is no "dehacking" or sorting after manufacture.

Operatives work twelve-hour shifts from 06.00 – 18.30hrs over four days. This includes two 45-minute lunch breaks, one taken at mid-morning and the other at lunch.

Materials

Calcareous fines (Waste from local quarries, i.e. calcium carbonate granules & powders),

Portland cement

Silica sand (Ashler products only)

Control Measures

No local exhaust ventilation (LEV) or similar engineering control systems are present in the production areas.

Health surveillance (lung function testing) is conducted on all manufacturing employees on an annual basis.

Disposable respirators (P2 rating filtration from Moldex) are available for use by staff and are generally used when staff are required to undertake routine cleaning. Whilst operatives were observed making use of their RPE, no face fit training or designated storage facilities had been provided.

Operatives are provided with orange coloured overalls to wear during their duties. It is unknown whether these overalls are low dust holding or whether they are laundered for the operatives. The operatives in the Ashler process area were both wearing their own clothes over the top of their overalls and this could lead to dust being carried on their clothing during the shift and also after they have left work.

Control competency rating (0 - 5)	**3** – See Appendix IV for descriptors
RPE competency rating (0 – 5)	**3*** – See Appendix IV for descriptors

Notes:

Control Competency:

Following discussions with the H & S manager at the site, inspection of COSHH risk assessment and previous monitoring report documents relating to RCS exposures it was deemed that management have undertaken suitable and sufficient assessment of the risks posed.

Observations of operations indicated that there continues to be scope for improvement of control of exposure to airborne dust. Many of the recommendations within the previous monitoring report remain valid particularly those relating to the dust generated from the feed conveyors and the manual addition of pigments in the upper levels of the brick plant.

RPE Competency:

* - Face fit testing not conducted. Regulation 7 (Para 149) of COSHH (fifth edition) 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.).

Results Table

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	CR – Ashler process operative	291	0.020	0.026	1.246	**1.64**
2	PL	DR – Ashler process, brick tray operative	288	0.07	0.092	1.302	**1.71**
3	PL	JS – Brick plant foreman	342	<0.01	<0.013	2.725	**3.58**
4	PL	MJ – Brick plant operative	309	<0.02	<0.026	3.150	**4.13**
5	PL	VA – Brick plant operative	390	<0.02	<0.026	3.002	**3.94**
6	PL	GW – Brick plant operative	388	<0.020	<0.026	2.104	**2.76**
7	PL	CG – Brick plant operative and external work (FLT)	297	<0.02	<0.026	3.786	**4.97**

Summary of results:

The measured respirable dust concentrations ranged from 1.2 to 3.8 mg.m^{-3} and the calculated respirable 8hr TWA exposures ranged from 1.6 to 4.97 mg m^{-3}.

The respirable crystalline silica content measured concentrations ranged from <0.01 to 0.07 mg.m^{-3} and the 8hr TWA exposures ranged from less than 0.013 to 0.092 mg m^{-3}.

The highest RCS exposure result came from operative undertaking brick tray operations in the Ashler process area

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	Control	
B8	C	N/A	7	0	0	0	0.092	2	4.97	3	3	Sand, silica sand

Activity: A: Extruded clay brick production, B: Hand made bricks, C: Concrete bricks, D: Clay & terracotta products, E: Fletton process / London bricks, F: Soft clay brick production

Control strategy: Silica Essentials Control approaches: W = Water suppression, LEV = Local exhaust ventilation,

Site 9

Description of Facility / Operations

The site is a handmade brick production facility with adjacent clay quarry.

Clay is granulated, mixed and then formed into lumps which then pass along the brick throwing line where two operatives manually pick up the clay and transfer them into brick moulds (brick throwing). At this stage sand is placed into the mould and onto the surfaces of the bricks. The moulds are then placed onto trays and stacked together onto pallets that are taken to a drying chamber by a forklift truck (FLT).

Once the bricks have been in the drying chamber for the required length of time they are then taken on FLTs to the Setting Area. Here two operatives place the bricks onto large trolleys that run on rails. Once the bricks are set the trolley can be moved into one of the kilns for firing.

The site has two kilns and this means bricks from one kiln area may be loaded / unloaded whilst the other area has the kiln in operation.

After the bricks have cooled some are placed on packing pallets on the trolley while others are taken outside for packaging. From here the pallets are wrapped in plastic and then held in the storage areas prior to dispatch for delivery to the customer.

On the day of this investigation air sampling was conducted in the Handmade Plant, the Setting area and the Packaging (drawing) area as these were deemed to be the areas where operations offered the greatest risk of exposure to significant levels of airborne RCS. A further sample was taken in an area where bricks are cut. On the day of the visit half bricks were being produced.

Operatives work 39 hours per week. On Monday to Thursday shifts are from 07:00 – 16.15hrs with two 20-minute breaks. On Fridays the shift is from 07:00-12:15 with one 20 minute break. The break times listed were the observed average and some employees took shorter breaks.

Material

The raw material for the handmade brick production is locally occurring clay taken from the adjacent quarry. Bricks are coated with mixtures of sand and pigments to produce different finishes when bricks were fired.

Control Measures

There are no dust suppression system or local exhaust ventilation (LEV) systems in use at the site within the hand making, setting or packaging (drawing) areas.

There was LEV on the sand drying machine where the dried sand fell out into a wheelbarrow. This partially enclosed the end of the dryer with a hood and flap system. The capture was adequate visually, and as tested with smoke. The measured capture velocities were between 0.6 & 1.0 m/sec. The flaps that made up the enclosure were in poor condition.

The dust at the brick-cutting machine was suppressed using a wet cutting technique that appeared to be effective.

Moldex 2485 FFP2D respirators were available for use by those who wanted them.

Various gloves were supplied to those you wanted to use them. Types observed included marigold-type gloves and heavier rubber gloves. Some operatives chose not to wear gloves in the hand making area.

General clothing was prevalent with most employees wearing T-shirts. A few of the brick makers wore aprons.

Control competency rating (0 - 5)	**3** – See Appendix IV for descriptors
RPE competency rating (NR, 1 – 5)	**2*** – See Appendix IV for descriptors
Note: Control competency rating 3 generally applies to operations where there is 'Occasional over-exposure'; the results from this investigation indicate that this is unlikely to be the case at this site. Rating 3 awarded as it was felt that current Controls did not merit rating 4. RPE – Operatives are not provided with RPE.	

Results Table

Sample No	Sample type	Sample Position	Duration, Mins	Exposures, $mg.m^{-3}$			
				RCS		Respirable dust	
				Task	8-hr TWA	Task	8-hr TWA
02061/06	PL	JM Clay preparation and sand drying.	312	0.04	0.04	0.26	0.26
02062/06	PL	GC Supervisor/Team leader. Repairing Bury machine.	276	<0.02	<0.02	0.09	0.09
02063/06	PL	SP Hand making bricks using soft sand.	292	0.05	0.05	0.39	0.39
02064/06	PL	MJ Hand making bricks.	287	0.09	0.09	0.36	0.36
02065/06	PL	JR Hand making bricks.	284	0.07	0.07	0.43	0.43
02066/06	PL	RB Hand making bricks	331	0.08	0.08	0.75	0.75
02067/06	PL	AW Setting bricks	273	0.03	0.03	0.3	0.3
02068/06	PL	CG Loading pallets (drawing). Inside and outside.	267	0.05	0.05	0.27	0.27
02069/06	PL	HB Loading pallets (drawing). Inside only.	291	0.04	0.04	0.36	0.36
02070/06	PL	MB Loading pallets (drawing). Outside only.	274	0.03	0.03	0.11	0.11
02071/06	SL	Static in sand drying area.	288	0.26		0.08	
02072/06	SL	Static between throwing and setting areas.	283	0.09		0.09	
02073/06	SL	Static in drawing area.	281	0.39		ND	
02074/06	SL	Static in brick cutting area.	194	0.36		0.08	

Summary of results:

The respirable dust concentrations ranged from 0.11 to 0.75 $mg.m^{-3}$ and as an average 8-hour day is worked the 8hr TWA exposures are the same.

The respirable crystalline silica content measured concentrations ranged from <0.02 to 0.09 $mg.m^{-3}$ and as an average 8-hour day is worked the 8hr TWA exposures are the same.

The highest RCS exposure result came from one of the operatives undertaking hand made brick production operations.

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	Control	
B9	B		10	4	0	0	0.09	0	0.75	3	2	

Activity: A: Extruded clay brick production, B: Hand made bricks, C: Concrete bricks, D: Clay & terracotta products, E: Fletton process / London bricks, F: Soft clay brick production

Control strategy: Silica Essentials Control approaches: W = Water suppression, LEV = Local exhaust ventilation

Site 10

A sampling visit was planned to a site where water mist dust suppression had been installed as part of the SBS. However due to commissioning difficulties the site management were reluctant to let the site be included in the project until the system was working satisfactorily. Unfortunately this meant that the site visit was postponed and could not be rescheduled within the time frame of the project.

Site 11

This site was visited prior to the commencement of the SBS in 2002 as part of an investigation by HSE FOD into reported cases of respiratory illness from workers at the facility.

Samples of worker exposures to respirable dust and RCS were taken over a three-day period by scientists from HSL. A total of 27 personal samples were taken from workers doing a variety of operations including the shift manager, sandman, pan room operator, extruder / auger operator, setting machine operator, kiln car repair man, kiln operator, fitter, two specials operatives and two packers.

Description of Facility / Operations

The facility was built in 1966 to manufacture extruded wire-cut facing bricks and replaced the existing brickworks that had been in production since the turn of the century.

Simplified, the bricks start from an argillaceous rock consisting of clay, shale and slate. The rock is crushed into a powder, mixed with water into a plastic consistency that can then be moulded into the required shape. The brick is then dried to prevent distortion of shape then fired in a kiln. ~~back to a rock~~.

The company employs just over 60 people on the site. Two shifts of 30 employees work 11 ¼ hours Monday to Friday (6 am to 5.15 pm) and 11 hours Saturday and Sunday (6 am to 5 pm). The shifts work four days in work then four days off and so on. The night shifts consist of one burner and one cleaner with the kilns and dryers only in operation. No production takes place during the night shifts.

Material

The raw materials are extracted using an open cast mining system where materials are selected and blended from the general rock mass. They consist of clay, shale (of the Devonian period) and slate.

Control Measures

The operator in the sand house wore a 3M Dustmaster DM10 with visor and cape at all times when working inside the sand house. Three batteries were stored in the locker room which are charged and used alternately. The filter is changed weekly. The locker room area is also where the sand house operator changes before and after shifts, leaving his dusty overalls on site and changing into fresh clothes at the end of every shift.

All other operatives on site were given the choice of wearing a Respair FFP1 mask if they felt it was necessary. The three individuals working in the specials room were wearing the masks on days when extruding or sanding was taking place, but not during other activities. None of the individuals wore the masks correctly as they had not been trained how to do so.

Most of the operatives working in the monorail packing area wore the FFP1 mask by choice, the masks were handed out without training being administered. A range of LEV systems are present in a number of the production areas. Inspection of the LEV systems indicated that they were not offering a satisfactory level of control of dust. The Visit report makes reference to the need to improve cleaning procedures.

Results Table

Sample type	**Sample Position**	**8-hr TWA Exposures, mg.m^{-3}**					
		RCS			**Respirable dust**		
		Day 1	**Day 2**	**Day 3**	**Day 1**	**Day 2**	**Day 3**
PL	Augur Operator	0.05	0.05	0.06	0.27	0.30	0.58
PL	Shift manager	0.05	0.04	0.06	0.26	0.25	0.68
PL	Sandman	**0.45**	**0.72**	**0.79**	**8.31**	**11.06**	**6.14**
PL	Fitter	0.06	0.05	0.04	0.16	0.22	0.18
PL	Pan Room operator	**0.15**	**0.10**	**0.14**	0.77	0.83	0.93
PL	Setting machine operator	0.04	0.04	0.04	0.31	0.24	0.40
PL	Kiln Operator	<0.03	<0.03	<0.03	0.10	0.16	0.09
PL	Kiln car repairs	0.04	0.04	0.03	0.25	0.29	0.28
PL	Packer	<0.03	<0.03	<0.03	0.15	0.16	0.18
PL	Packer	<0.03	<0.03	<0.03	0.12	0.18	0.15
PL	Specials operative	**0.37**	0.07	<0.03	2.46	0.42	0.17
PL	Specials operative	**0.17**	**0.11**	0.04	1.11	0.80	0.36

Summary of results:

8-hr TWA concentrations of respirable dust ranged from 0.09 mg.m^{-3} to 11.06 mg.m^{-3} and RCS exposures ranged from <lld to 0.79 mg.m^{-3}. The sand man's exposure was always above the WEL and the pan room operator's exposure was above the Medical Surveillance Threshold, as were the Specials operatives (3 out of the 6 man-days.)

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	Control	
B11	A		27	25	4	5	0.79	3	11.06	N/A	N/A	Clay, shale

Activity: A: Extruded clay brick production, B: Hand made bricks, C: Concrete bricks, D: Clay & terracotta products, E: Fletton process / London bricks, F: Soft clay brick production

Control strategy: Silica Essentials Control approaches: W = Water suppression, LEV = Local exhaust ventilation, LEV = Local exhaust ventilation

APPENDIX C: CONTROL COMPETENCE SURVEY TABLES

Control competency descriptors

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

<table>
<tr><th>Control Rating</th><th>Description</th></tr>
<tr><td>4

The COSHH Essentials Standard</td><td>Adoption of good control practice consistent with risk. Reasonable awareness of hazard and risk and knowledge to implement effective strategies. Typically:

• Comprehensive COSHH assessment
• Aware of literature and information sources
• Application of appropriate, effective, well maintained controls at process
• Management and operator understanding of exposures
• Well trained operators
• Designated areas and use of RPE when appropriate
• Well informed management
• Competent supervision
• Evidence of coordinated approach to control – skills and knowledge available</td></tr>
<tr><td>5</td><td>Exemplary control consistent with risk. Typically:

• Comprehensive COSHH assessment
• Literature and guidance to hand
• Competent well-trained staff at all levels
• Documented procedures
• Exposure and risk understood at process
• No evidence of over-exposure
• Evidence of engagement of all stakeholders
• All aspects of process considered</td></tr>
</table>

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: • Limited evidence of selection process and face fit testing. • Equipment normally available but anticipated problems with use • Poor storage • No evidence of adequate training programme • 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: • Face fit testing • Equipment readily available and used • Appropriate storage facilities • Adequate initial training • Operator can answer questions about use of RPE • 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: • 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
5	RPE used to achieve adequate control. Evidence of exemplary RPE programme with only minor deviations from agreed practices and policies. • Verifiable policy on RPE linked to COSHH assessment. • Face fit testing programme • Wide range of appropriate equipment available for all users • Appropriate storage facilities and procedures to allow audit • Initial training and routine refresher training • Operators understand role of RPE in controlling risk • Everyone understands roles and responsibilities

APPENDIX D: BRICKMAKING: STANDARD INDUSTRIAL CLASSIFICATION (SIC)

For the purposes of statistical analysis data was obtained from the Office of National Statistics (ONS.) Businesses that are considered Brickmaking type activities by ONS are designated the Standard Industrial Classification (SIC) code 26.40 - Manufacture of bricks, tiles and construction products, in baked clay and 26.61 - Manufacture of concrete products for construction purposes.

26.40 Manufacture of bricks, tiles and construction products, in baked clay

This class includes:

– manufacture of non-refractory structural clay building materials:

(manufacture of ceramic bricks, roofing tiles, chimney pots, pipes, conduits, etc.)

This class also includes:

– manufacture of flooring blocks in baked clay

This class excludes:

– manufacture of structural refractory ceramic products cf. 26.26

– manufacture of ceramic flags and paving cf. 26.30

26.6 Manufacture of articles of concrete, plaster and cement

26.61 Manufacture of concrete products for construction purposes

This class includes:

– manufacture of precast concrete, cement or artificial stone articles for use in construction:

(tiles, flagstones, bricks, boards, sheets, panels, pipes, posts, etc.)

– manufacture of prefabricated structural components for building or civil engineering of cement, concrete or artificial stone

7 REFERENCES

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Silica baseline survey

Annex 1 Brickmaking 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 brickmaking sector.

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