



RESPIRABLE CRYSTALLINE SILICA: THE FACTS

- Facts and figures
- Find out more
- Free resources



WORKING TOGETHER TO BEAT OCCUPATIONAL CANCER

RESPIRABLE CRYSTALLINE SILICA

WHAT IS IT?

Crystalline silica is a natural substance found in stone, rocks, sand and clay, as well as products like bricks, tiles, concrete and some plastic composites. When these materials are worked on, for example by cutting or drilling, the crystalline silica is released as a very fine dust which can be breathed in. This dust is one of the oldest workplace hazards – and it still causes hundreds of thousands of deaths across the world every year.

The Ancient Greek physician Hippocrates described how miners became breathless as a result of inhaling dust and Bernardo Ramazzini described a similar disease in Italian Renaissance artisans. We now know this disease as 'silicosis'. Today, the main focus in workplaces in developed countries is on the risk of lung cancer from exposure to respirable crystalline silica, although silicosis and other lung diseases are also a concern where control measures are poor.

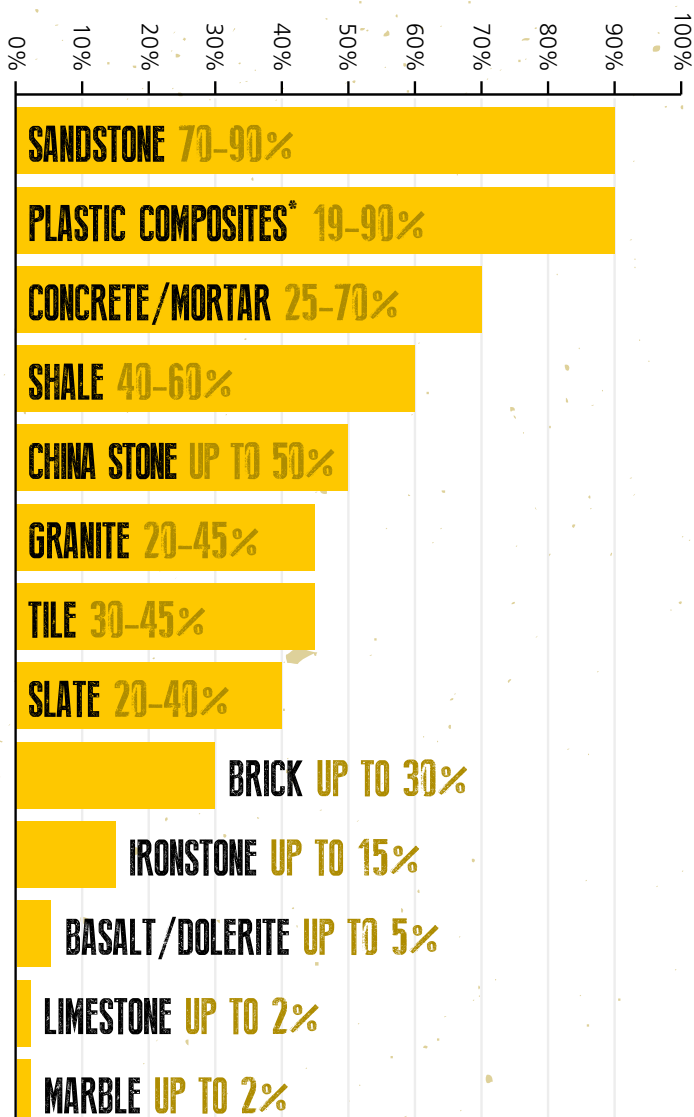
The minerals quartz, cristobalite and tridymite are crystalline forms of silicon dioxide that are found naturally around the world. Quartz is in most rocks, but most particularly in sandstone and granite – quartz is just yellow sand.

HARMFUL SILICA PARTICLES ARE MUCH SMALLER THAN A FINE GRAIN OF SAND

There are other forms of silicon dioxide that don't have a crystal structure and these are called 'amorphous silica', for example diatomaceous earth, silica gel, and synthetic amorphous silica (or SAS). Exposure to amorphous silica is much less hazardous than crystalline silica – it doesn't cause either silicosis or lung cancer.

Silica dust is only harmful when it's inhaled deep into your lungs, where oxygen is taken up into the blood. Sitting on a sandy beach won't cause any respiratory harm because any sand particles breathed in will generally be much too big to go beyond your nose or upper airways. But as a very fine airborne dust, silica can be dangerous. It's the respirable fraction that is hazardous. Respirable particles are typically less than around

HOW MUCH SILICA?



The approximate ranges for the amount of crystalline silica found in materials (based on Health and Safety Executive data)

*Silica is used in products like fillers or composite panels

5 micrometers in size. Compare this to the full stop at the end of the sentence, which is around 200–300 micrometers in diameter, and the finest sand on that beach, which is about 50–70 micrometers. Individual silica dust particles are so small that they are invisible to the naked eye in normal light – so you can have relatively high airborne concentrations without being aware that the dust is being inhaled.

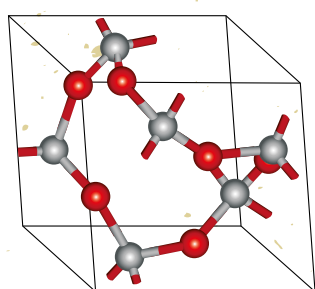
In 1996, the International Agency for Research on Cancer reviewed the scientific evidence and concluded that crystalline silica in the form of quartz or cristobalite dust is carcinogenic to humans. It is classified as a Group 1 carcinogen, meaning it is a definite cause of cancer in humans.

'SILICON DIOXIDE' EXPLAINED...

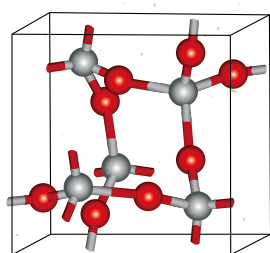
Often referred to as 'silica', silicon dioxide chemically comprises a silicon atom bonded with two oxygen atoms. It can exist either in the form of a crystal, where the atoms are arranged in a regular lattice structure, or in an unstructured amorphous form. The crystalline forms of silica are much more hazardous than the amorphous forms.

The way the atoms are arranged in the crystal structure determines the mineral properties. For example, the common form of quartz has a rhombohedral structure, whereas cristobalite commonly forms in a tetragonal structure.

The grey spheres are silicon atoms and the red are oxygen.



Quartz



Cristobalite

The different crystalline forms of silica are known as 'polymorphs'.

Crystalline silica is insoluble in water and doesn't evaporate. It melts at around 1,700°C. In some circumstances, heating amorphous silica above about 1,000°C can cause some of it to transform to a crystalline form, for example calcining diatomaceous earth. Burning agricultural waste or products such as rice hulls can turn amorphous silica into cristobalite.

Amethyst and citrine are two gem forms of quartz that get their colour from metal impurities in the crystal.

WHO IS AFFECTED?

Exposure to silica dust occurs in many industries. Common scenarios where people may be exposed include:

- breaking, crushing, grinding or milling silica-containing material such as concrete, aggregate or mortar
- drilling, cutting, chiselling or sanding silica-containing material
- dealing with cement
- moving earth, eg excavating, mining, quarrying or tunnelling
- abrasive blasting or sandblasting
- laying, maintaining or replacing ballast
- handling, mixing or shovelling dry materials that include silica
- using silica, sand or silica-containing products in the manufacturing process of glass and other non-metallic mineral products
- using sand as a moulding medium in foundries
- using silica flour (a finely ground form of crystalline silica)
- dry sweeping up after a task where silica dust has been created.

THINKING BEYOND THE TASK...

It's not just specific activities like drilling or cutting materials that contain crystalline silica that can leave people exposed to silica dust. As well as disturbing fine silica dust when someone cleans up after a task has been finished, the dust can also:

- stay in the air after a job's been done
- be released from clothes or surfaces
- get airborne again when disturbed by people or vehicles
- be released when equipment leaks or there's a spillage.

RESPIRABLE CRYSTALLINE SILICA

MAIN RISK EMPLOYMENT AREAS:

abrasive blasting, brick, concrete or tile manufacturing, bricklaying, cement finishing, ceramics manufacturing, coke and other fuel manufacturing, construction, cutting or grinding silica-containing material, demolition, drilling silica-containing material, electricity and gas supply, foundries, glass manufacturing, metals and machinery manufacturing, mineral product manufacturing, mining and quarrying, steel manufacturing, stonemasonry, trades that use or fit plastic composite products, tunnelling

PEOPLE WHO COULD BE AT RISK:

abrasive blasting workers, brick, concrete or tile manufacturing operatives, bricklayers, ceramics and pottery workers, coke and other fuel manufacturing operatives, concrete workers, construction labourers, crushing and grinding operators, demolition workers, digger drivers, foundry operatives, furnace workers, glass manufacturing workers, kiln operators, machinery manufacturing operatives, machinists, mineral product manufacturing operators, mining machine operators, moulding and casting operators, operatives working with or fitting plastic composite products, quarry workers, rock drillers, sandblasters, steelworkers, stonemasons, tunnel workers, utility employees involved in excavation work, welders, workers grinding, abrading, buffing or polishing

HOW?

Long-term exposure to silica dust – caused by tasks like cutting, drilling, grinding or polishing materials containing silica, or even just sweeping up after a task – can cause silicosis (an irreversible chronic respiratory illness), lung cancer and a number of other serious diseases, including a chronic obstructive pulmonary disease such as emphysema. Silica dust is one of the most significant causes of work-related disease around the world.

Exactly how silica dust causes lung cancer is unclear – the International Agency for Research on Cancer suggests the most likely cause is when the dust deposits in the lungs its toxicity makes it difficult for the body's natural defence cells to remove and so it stays there, causing persistent inflammation. This constant inflammation can damage the DNA in the lung cells and lead, in some people, to lung cancer.

Toxicology studies with crystalline silica have shown that the biological response is largely determined by the surface properties of the dust particles. Adding a chemical coating to the surface of a quartz particle in a cellular experiment dramatically reduces the inflammatory response. Similarly, quartz particles coated with clay or other materials show less toxicity than freshly crushed rock.

Some scientists have suggested that for there to be a risk for lung cancer it's first necessary to develop silicosis. But the evidence for this is weak, and research shows increased cancer risks among workers who don't have silicosis. Of course, decreasing exposure to silica will reduce the risk for both diseases.

**SILICA DUST IS ONE OF
THE WORLD'S MOST
SIGNIFICANT CAUSES OF
OCCUPATIONAL DISEASE**

**CONTROLLING SILICA DUST EXPOSURE CUTS THE
RISK OF BOTH SILICOSIS AND LUNG CANCER**

The human epidemiological evidence shows an increased risk of lung cancer in a wide range of occupations exposed to silica dust. Increased risks are seen at very low levels of exposure – at or below exposure for a working lifetime at the current limit in Britain of 0.1 mg/m^3 . This is reflected in reviews like the one recently published by the US's Occupational Safety and Health Administration. Many countries have moved to reduce the workplace exposure limit to 0.05 mg/m^3 or less – find out more in the 'Silica exposure limits around the world' box on page 05.

In some cases where people are exposed to crystalline silica, the risk of lung cancer is lower than typically found. It's likely that this is because of differences in the surface properties of the dust and its toxicity.

HOW MANY?

Research from Imperial College London suggests that around 900 new cases of lung cancer each year in Britain can be attributed to past exposure to silica dust in construction, granite and stone industries, and various industrial processes. Lung cancer is difficult to treat and most of those diagnosed with the disease will die within a few years – only one in 20 will live 10 or more years. It's estimated that nearly 800 people die a year from lung cancer caused by silica exposure at work.

There are about half a million people exposed to silica dust at work in the UK, and probably around 5 million in the European

Union. In Europe, the majority of these people are either employed in the construction sector (81 per cent) or in making products used in construction such as bricks, glass or cement (10 per cent). The people employed in these sectors are mostly in small companies – around 80 per cent are in organisations employing fewer than 10 people.

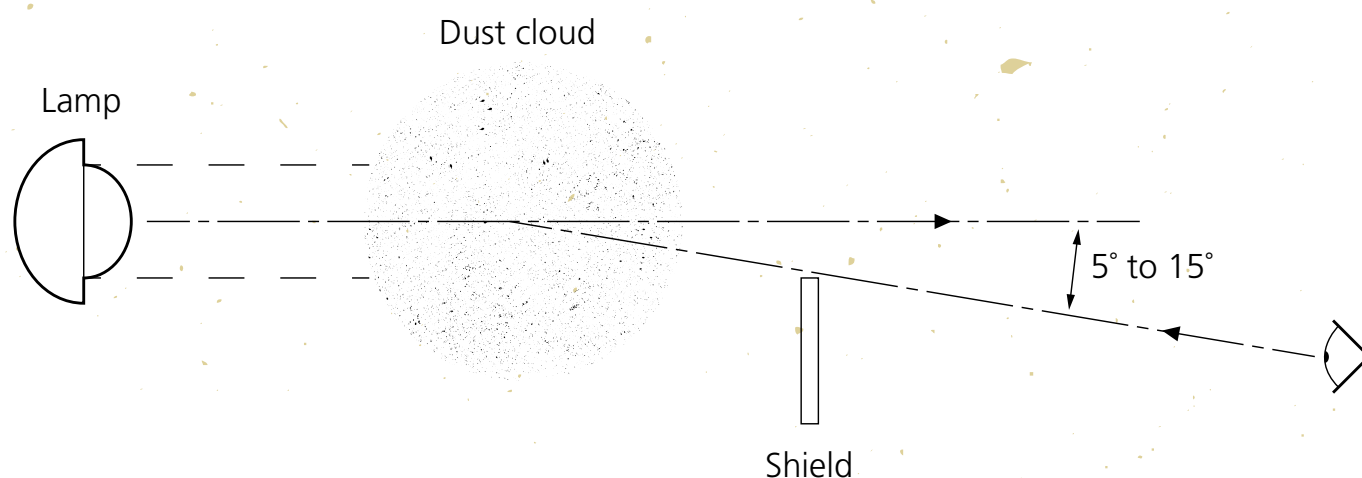
In the USA, two workers in every 100 could be exposed to silica dust – it's estimated that around 2.2 million workers are exposed, with 1.85 million of them in construction.

There are over 12,000 stone crusher mills in India alone, employing more than half a million workers. Across sectors, it's estimated that 10 million people could be exposed to silica dust at work in India. Studies have shown increased morbidity and mortality among silica-exposed workers from lung cancer, silicosis and other lung diseases.

Recent reports suggest that more than 23 million people in China have been occupationally exposed to silica dust. One study found an increased risk of lung cancer among non-smoking Chinese men exposed to silica dust, diesel exhaust and paint products at work. In a recent five-year period, China recorded more than 500,000 cases of silicosis, one of the serious diseases caused by silica dust exposure, with around 6,000 new cases and more than 24,000 deaths each year.

THE DUST LAMP

An easy, qualitative way of assessing the amount of airborne dust is using a dust lamp – sometimes called a 'Tyndall beam' – to illuminate the very fine dust that would otherwise be invisible to the naked eye. The process is simple – if you shine a bright light through the dust cloud while arranging a screen to obscure the direct light, then the light that is scattered by the dust can be seen as tiny spots of light.



This assessment technique works best indoors, when the background light levels are subdued.

MEASURING EXPOSURE TO SILICA DUST

We can measure exposure to silica using conventional occupational hygiene sampling gear.

To measure exposure an occupational hygienist uses equipment including a battery-operated sampling pump, polythene tubing, cyclone sampling head, pre-weighed PVC filters, a flowmeter to measure the amount of air flowing through the sampler, clips and belts.

The equipment is worn throughout the working shift with the sampling head close to the operative's nose/mouth. After the shift, the filter is sent to a specialist laboratory for analysis for crystalline silica.

The result is expressed as a concentration – milligrams of crystalline silica per cubic metre of air sampled (mg/m^3). You

can also ask the laboratory to reweigh the filter to give the respirable dust concentration and the percentage of silica on your sample.

Your data can then be compared with the occupational exposure limit. In Britain this is known as the workplace exposure limit (WEL) and the silica WEL is $0.1 \text{ mg}/\text{m}^3$, averaged over eight hours. It varies from country to country – look at the 'Silica exposure limits around the world' box.

This type of monitoring should be carried out by a professional with the right level of competence. In Britain, the British Occupational Hygiene Society has a directory of consultants who provide these services – find out more at www.bohs.org/OHServices-directory/a-z-search.

Construction industry data from the UK's Health and Safety Executive in the late 1990s showed that 30 per cent of general construction workers were exposed to more than $0.3 \text{ mg}/\text{m}^3$ respirable crystalline silica and 65 per cent were exposed above $0.1 \text{ mg}/\text{m}^3$ (eight-hour average). Exposures typically decrease over time so these data are probably not representative of current conditions – levels are likely to have gone down 2.5–10 per cent a year due to improvements in technology.

A large scientific study carried out in Europe and Canada suggests that typical daily average silica dust exposures for those in relevant jobs in the UK are now probably less than $0.1 \text{ mg}/\text{m}^3$ averaged over a working day, but there is still a substantial number of people in construction with high exposure, for example working as bricklayers, stonecutters, monumental stonemasons and demolition workers. The study showed that exposure in the UK is higher than elsewhere in Europe. The research confirmed the steady decline in exposure levels with time (6 per cent a year) because of improved technology.

Stonemasonry can cause high airborne dust levels. Research carried out in Ireland has shown the importance of the type of stone being used. Work involving limestone generated average levels less than $0.01 \text{ mg}/\text{m}^3$ and granite less than $0.06 \text{ mg}/\text{m}^3$, but work with sandstone produced levels up to $0.7 \text{ mg}/\text{m}^3$ (grinding and cutting).

Exposure to silica dust during unconventional oil or gas extraction using hydraulic fracturing, known as 'fracking', has recently emerged as an area of concern. Silica sand (about 5 per cent) is mixed with large volumes of water and pumped into oil-bearing strata. The surface handling and processing of the sand can create average levels around $0.1 \text{ mg}/\text{m}^3$ for most workers, but up to $0.4 \text{ mg}/\text{m}^3$, on average over a day, for sand movers.

LUNG CANCER IS A RISK EVEN FOR LOW LEVELS OF SILICA DUST EXPOSURE

**23 MILLION
WORKERS IN CHINA
COULD BE EXPOSED
TO SILICA DUST**

SILICA EXPOSURE LIMITS AROUND THE WORLD

Legal exposure limits are the maximum allowable concentration in workplace air, averaged over a day. It's worth remembering that some tasks don't last long but have very high exposure peaks.

The limit for silica differs from one country to another, but it is generally expressed as an average value over an eight-hour working day. For example:

- in British Columbia and some other states in Canada – 0.025 mg/m^3
- in Ireland, Italy, Finland and Portugal – 0.05 mg/m^3
- in the Netherlands – 0.075 mg/m^3
- in Britain – 0.1 mg/m^3
- in Poland – 0.3 mg/m^3 .

There is a trend to reduce exposure limits in many countries. In the USA, the American Conference of Governmental Industrial Hygienists has recommended a limit of 0.025 mg/m^3 and the government's Occupational Safety and Health Administration has proposed cutting the limit to 0.05 mg/m^3 .

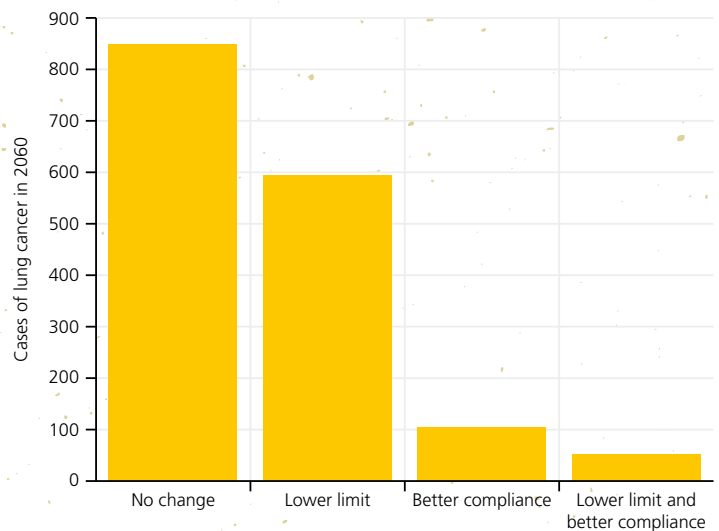
You'll find a list of limit values in Europe at www.nepsi.eu/media/2307/oel_table_dustqct_may_2010_jan09.pdf.

A POWERFUL CASE FOR ACTION

The effect of improving compliance with existing silica limits, and/or reducing the limits, can help identify the best way of preventing future cancers. In one modelling study, we see projected lung cancer cases in Britain in 2060 under four different scenarios:

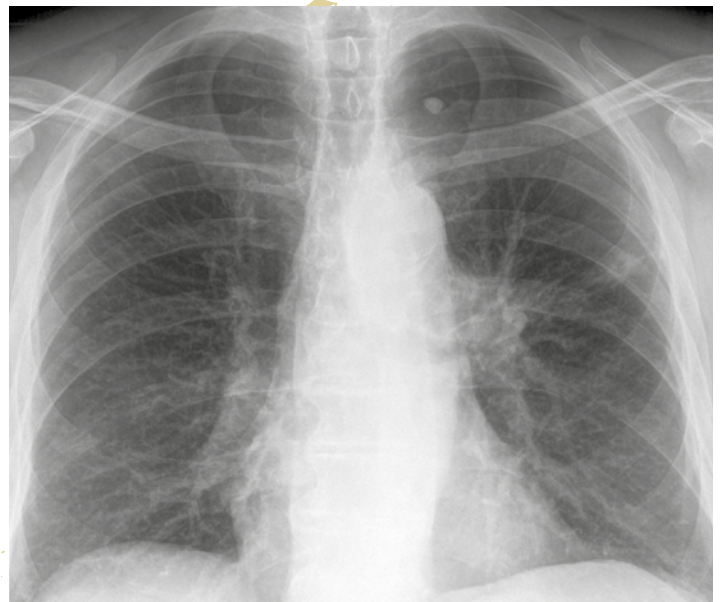
- no change from our current situation
- introducing a lower limit (0.05 mg/m^3) but with no improvement in compliance levels
- improving compliance with the current limit (0.1 mg/m^3) from a third of workplaces to 90 per cent
- reducing the limit and improving compliance.

The projection to 2060 is made because of the long latency for lung cancer.



Just lowering the limit would cut estimated cases from over 800 to around 600 a year. But increasing compliance and reducing the limit would cut the estimated number of lung cancers caused by silica to about 50 a year.

SILICA LUNG CANCER CASES IN BRITAIN COULD DROP TO 100 A YEAR IF WE IMPROVE LEGAL COMPLIANCE



WHAT YOU NEED TO DO

- The main aim should be to stop silica dust getting into the air in the first place. You may be able to select a process that avoids or cuts down the dust being released, for example, taking into account silica dust control at the design stage of a construction project by planning buildings with pre-built recesses for plumbing, gas and electric wiring so there's less need to cut or drill masonry and concrete, or getting materials cut to size off-site in a facility where it's easier to control dust exposure.
- Try to remove or substitute materials containing crystalline silica from the work process – it may be possible to use a different material, for example substituting olivine or another safer material for silica sand in abrasive blasting.
- If it's not possible to protect operatives from silica dust at the design stage or by changing processes or materials, then your first step is to monitor or assess the exposure and identify the jobs and tasks that need better controls. A survey by the UK's Health and Safety Laboratory shows that when employers do this they are more likely to put in appropriate controls.
- Select from a range of options available to control exposure to silica dust at work:
 - In a factory or workshop environment, the best strategy is to use engineering controls like enclosures or hoods and local exhaust ventilation to extract the contaminated air at the point it's produced, or to use water suppression on fixed machinery.
 - Where work with hand-held power tools generates dust, for example on construction sites, the best strategies are to use localised ventilation on the tool or suppress the dust using water spray systems.

When you buy or rent new equipment, make sure the controls are appropriate. High-value plant and equipment, for example the rock-drilling machines used in tunnelling or the crushing equipment operating at recycling plants, are now likely to have dust suppression integrated into the design. Small items may not have these controls as standard, although you can often buy an add-on control sleeve to extract the dust.

LOOK AT MATERIALS AND METHODS

When you assess exposures, remember that as well as considering the materials involved in a task, the way materials are worked on will affect the amount of dust produced.

For example, working on concrete or granite with cut-off saws, grinders, chasers or grit blasting will always produce very high levels. And jobs like pneumatic drilling or coring, internal structural demolition or dry sweeping indoors can create high levels too. Working inside with poor ventilation will increase exposure levels, compared to outdoor work.

**TWO WORKERS IN
EVERY 100 COULD BE
EXPOSED TO SILICA
DUST IN THE USA**



A LITTLE KNOWLEDGE IS A DANGEROUS THING

Are you 'competent' to manage this area? Assessing and managing exposure to harmful substances are specialist areas and if you don't have the right training, knowledge and experience then you could make a fatal mistake. Know your own limits and get expert advice if you need to

- In all situations, if it's not possible to adequately control airborne silica dust using engineering solutions, and air sampling data shows that there is still an unacceptable level of dust, then operatives should use personal respiratory protection.
- As well as getting all the relevant controls in place, and checking that they're working properly in practice, you should give people who could be at risk from silica dust exposure information about the possible risks and how exposure can be cut down. And you need to instruct or train affected employees too, including on how to use the control measures in place to protect them.
- Where there is a reasonable chance that workers may develop silicosis you should consider introducing health surveillance (legally required in Britain). This may be as simple as the health professional asking an individual about symptoms and making a record of the job and the exposure they receive. In some cases it may be appropriate for the employee to have a chest x-ray and lung function tests, which could help detect chronic obstructive pulmonary disease or silicosis. There is no effective way of detecting lung cancer as part of a surveillance procedure, which underlines the importance of stringently controlling exposure to silica dust to minimise risk.

Respiratory protection is generally considered the 'last resort', and health and safety legislation in countries such as Britain positions it in that way. But the reality is that respirators are often necessary to achieve adequate control, either because of the difficulty of controlling exposure using another method, or because it would be impractical and costly to use engineering controls in some circumstances. In addition, respirators are often a very effective way of reducing exposure. For high-risk tasks, you shouldn't rely on respiratory protection alone – it may not give enough protection, it only protects the person wearing it, and people make mistakes with masks, for example wearing them at the wrong time or for too long.

GETTING IT RIGHT IN PRACTICE

Make sure that your work teams understand when and how to use the control measures you've set up. If operatives don't know when to use a particular exposure control method, or how to use equipment properly, they will have a 'false sense of security' and may not be protected. For example, if a fine mist spray is used during a kerb-cutting operation, then it's not likely to damp down dust enough, or if a pile of track ballast is just wetted down at the start of a task, the water will soon evaporate and leave employees exposed to the dust released as they work with the material.



**IN THE EU 7,000 CASES OF
LUNG CANCER A YEAR ARE
DOWN TO SILICA DUST**

RESPIRATORY PROTECTION — CHOOSING THE RIGHT TYPE

Respirators are designed to cover the nose and mouth, and filter the air to remove specific contaminants before they can enter the lungs.

There are several different designs of respirator, from a half-mask that just covers the nose and mouth, through to full-face respirators. Many half-masks are now designed to be disposable – they are often referred to as ‘filtering facepiece respirators’ because they are designed so that the whole of the mask is made from the filter material.

When selecting a respirator, make sure it provides sufficient reduction in exposure to protect the worker’s health and also that it’s right for the wearer, for example in terms of fit to the face. All classes of respirator are given an ‘assigned protection factor’ (APF), a rating that indicates the minimum reduction in exposure that should be achieved. There are three types of filtering facepiece respirator in the EN 149 standard:

- FFP1 – the simplest device, APF 4 (cuts the wearer’s exposure to airborne particles by a factor of 4)
- FFP2 – this design offers more protection, APF 10 (cuts exposure by a factor of 10)
- FFP3 – these devices offer a greater level of protection, APF 20 (cuts exposure by a factor of 20).

For certain activities, it will be more appropriate to choose a different type of respiratory equipment, for example a powered mask if a high level of protection is needed, and it will be worn for lengthy periods of time.

It’s important to make sure that the equipment you use fits the task. A free online tool at www.healthyworkinglives.com/advice/work-equipment/rpe is designed to help choose the right type of respiratory protective equipment.

RESPIRATORY PROTECTIVE EQUIPMENT — MATCHING THE TYPE TO THE TASK

Here are some examples of the respiratory equipment recommended by the UK’s Health and Safety Executive where air sampling has shown that additional controls are needed:

- kerb-cutting – mask with an assigned protection factor of 20, eg an FFP3 disposable mask or half mask with a P3 filter
- hand-held rotary tools used for cutting and polishing – respiratory protective equipment with an APF of at least 40 (a full face mask with a particle filter if worn for less than an hour, or a powered mask or powered hood/helmet if worn for more than an hour).

The HSE’s ‘Respiratory protective equipment at work’ gives more information and details – download it at www.hse.gov.uk/pUbns/priced/hsg53.pdf.

Anyone who wears respiratory protective equipment in your workplace should have a ‘fit test’ to make sure the device they are being asked to wear is suitable and that it will protect them.

FACE FIT AND FACIAL HAIR

Recent research from the HSE, looking at how stubble growth affects the protection given by FFP3 filtering facepieces and half masks, found that protection could be significantly reduced as facial hair grows. Following the study, the enforcer continues to recommend that people who wear this sort of respiratory protection should be clean shaven in the area of the mask seal.



GOOD PRACTICE IN ACTION

When cutting kerbstones and paving, it's now recommended that the work is done using water suppression with a hose directly attached to the tool delivering at least 0.5 litres of water per minute. For this type of work it's also necessary for employees involved to wear a respirator, a disposable mask certified to FFP3 or similar. Have a look at the HSE guide and film highlighting the correct methods for cutting kerbstones – at www.hse.gov.uk/pubns/indg461.pdf and www.hse.gov.uk/construction/cleartheair.

Research on Irish stonemasons showed that wet-cutting resulted in exposure to silica dust 35 times lower than during dry-cutting, demonstrating the potential impact of relatively simple changes to working methods.

Research in the USA has shown that using water in grinding may have a similar effect on worker exposure, with the water reducing exposure on average between seven and 50 times, depending on the grinding equipment used. The study also found the use of local on-tool ventilation was more effective, cutting average exposures by between 50 and 150 times.

**10 MILLION PEOPLE
COULD BE EXPOSED
TO SILICA DUST AT
WORK IN INDIA**

THE LAW

In many countries workplace exposure to silica is covered by legislation.

In Britain, the Control of Substances Hazardous to Health Regulations are the most relevant. In other European countries, as in Britain, the Chemical Agents Directive is the main source of legal requirements. Silica is not classified as a carcinogenic substance under Europe's Carcinogens and Mutagens Directive, because the legislation mainly focuses on supplied chemicals, not process-generated contaminants. Crystalline silica may be included as a specific carcinogenic agent when the EU next updates the Carcinogens and Mutagens Directive.

In countries such as Britain, employers have a legal responsibility to carry out risk assessments in situations where there is exposure to silica and, where the risks are not adequately controlled, to instigate effective control measures. There are also obligations to check and maintain control measures. Employees need to get the right training, instruction and information so that they can do their job safely. In some circumstances it will be appropriate to monitor exposure and carry out health checks – this is legally required in Britain.

Find more information about the relevant legislation in Britain at www.hse.gov.uk/coshh.

MORE INFO

Guidance and advice

- The UK's HSE has a range of guidance and resources on silica dust and its health risks:
 - find a general guide at www.hse.gov.uk/aboutus/occupational-disease/cancer/silica.htm and task-specific information at www.hse.gov.uk/pubns/silicaindex.htm
 - download a guide for employees at www.hse.gov.uk/pubns/indg463.pdf
 - find details of a technical sampling method for airborne respirable crystalline silica at www.hse.gov.uk/pubns/mdhs/pdfs/mdhs101.pdf and information on using a dustlamp at www.hse.gov.uk/pubns/mdhs/pdfs/mdhs82-2.pdf
 - see the 'Time to clear the air!' film at www.hse.gov.uk/construction/cleartheair/index.htm for advice on using cut-off saws for cutting kerbs and flag paving. A guide covers protecting your lungs when using cut-off saws – download it at www.hseni.gov.uk/time_to_clear_the_air.pdf
 - find guidance on respiratory protection at www.hse.gov.uk/respiratory-protectiveequipment/index.htm and at www.hse.gov.uk/pubns/priced/hsg53.pdf
 - get respirator fit-testing basics at www.hse.gov.uk/respiratory-protective-equipment/fittesting-basics.htm
 - get online information on construction dust at www.hse.gov.uk/construction/healthrisks/hazardous-substances/constructiondust.htm, a guide to construction dust at www.hse.gov.uk/pubns/cis36.pdf, a guide to controlling construction dust with on-tool extraction at www.hse.gov.uk/pubns/cis69.pdf, general information to help employers control dust exposure at www.hse.gov.uk/dust/index.htm?ebul=hsegen&cr=5/06-jul-15 and an FAQ section for employees exposed to construction dust at www.hse.gov.uk/construction/faq-dust.htm
 - find specific information and guidance for silica dust in construction at www.hse.gov.uk/construction/healthrisks/cancer-and-construction/silica-dust.htm
 - go to www.hse.gov.uk/construction/healthrisks/hazardous-substances/constructiondust-specific-tasks.htm to access detailed guidance and short films on high-risk tasks relevant beyond the construction sector, including:
 - cutting paving blocks, kerbs and flags
 - chasing concrete and raking mortar
 - cutting roofing tiles
 - scabbling or grinding
 - soft strip demolition
 - dry sweeping
 - get a guide to health surveillance for those exposed to silica at www.hse.gov.uk/pubns/priced/healthsurveillance.pdf
 - go to the HSE's 'Dust hub' for information to help control exposure to dust at www.hse.gov.uk/dust
- The HSE also has guidance on controlling silica through its COSHH Essentials initiative – access the resource sheets and COSHH e-tool at www.hse.gov.uk/coshh/essentials

- The HSE's Paving, Road and Highways Supply Chain web community shares guidance and good practice in managing health issues in the sector. Find out more and join the hub at webcommunities.hse.gov.uk/connect.ti/kerbcutting-community/groupHome
- The Unite union offers a guide to controlling silica dust at [www.unitetheunion.org/uploaded/documents/Silica%20Dust%20\(Unite%20guide\)11-5188.pdf](http://www.unitetheunion.org/uploaded/documents/Silica%20Dust%20(Unite%20guide)11-5188.pdf)
- The Occupational Safety and Health Administration in the USA has a guide on controlling silica dust exposures in construction at www.osha.gov/Publications/3362silica-exposures.pdf

Information

- The Construction Dust Partnership, at www.citb.co.uk/cdp, gives information on managing exposure to all construction dusts
- Find a comparison of exposure levels at workplaces across Europe at www.dguv.de/medien/ifa/de/pub/grl/pdf/2014_136.pdf
- The European Industrial Minerals Association hosts a website with information about the health hazards of silica and preventive measures, including labelling silica-containing products – find out more at www.crystallinesilica.eu
- Find out about the glass industry's position at www.glassallianceeurope.eu/images/cont/glassalliance-europe-statement-on-respirable-crystalline-silica_file.pdf
- The British Safety Industry Federation's 'Clean air? Take care!' initiative focuses on breathing hazards at work and respiratory protection – find out more at www.bsif.co.uk/clean-air-take-care-

Research and reports

- Get the findings of a survey of attitudes to dust exposure in the UK construction industry at www.iosh.co.uk/~media/Documents/Networks/Group/Construction/MEM1871%20Dust%20survey.pdf. The report is published by IOSH in conjunction with the Construction Dust Partnership
- Read about the HSE's research into the effects of stubble growth on respiratory protective equipment at www.hse.gov.uk/research/rrhtm/rr1052.htm
- The USA's National Institute of Environmental Health Sciences has a report on the carcinogenic effects of silica dust at ntp.niehs.nih.gov/ntp/roc/content/profiles/silica.pdf
- CAREX Canada, an evidence-based carcinogen surveillance programme, offers a general profile of silica at [www.carexcanada.ca/en/silica_\(crystalline\)](http://www.carexcanada.ca/en/silica_(crystalline))
- Find summaries of silica hazards and risks in these scientific papers:
 - Silica exposure, smoking, silicosis and lung cancer: complex interactions, Occupational Medicine, at occmed.oxfordjournals.org/content/59/2/89.full
 - Silica: a lung carcinogen, CA: A Cancer Journal for Clinicians, at onlinelibrary.wiley.com/doi/10.3322/caac.21214/full

- Read studies into different silica dust controls in these papers:
 - Engineering controls for selected silica and dust exposures in the construction industry – a review, Applied Occupational and Environmental Hygiene, at www.tandfonline.com/doi/abs/10.1080/10473220301406
 - Dust control measures in the construction industry, The Annals of Occupational Hygiene, at annhyg.oxfordjournals.org/content/47/3/211.short
 - Silica dust exposures during selected construction activities, AIHA Journal, at www.tandfonline.com/doi/abs/10.1080/15428110308984823
 - Crystalline silica dust and respirable particulate matter during indoor concrete grinding – wet grinding and ventilated grinding compared with uncontrolled conventional grinding, Journal of Occupational and Environmental Hygiene, at www.tandfonline.com/doi/abs/10.1080/15459620701569708
 - Effectiveness of dust control methods for crystalline silica and respirable suspended particulate matter exposure during manual concrete surface grinding, Journal of Occupational and Environmental Hygiene, at www.tandfonline.com/doi/abs/10.1080/15459624.2010.527552
- Access a collection of academic articles on respiratory hazards in construction in the British Occupational Hygiene Society's journal at www.oxfordjournals.org/our_journals/annhyg/respiratory_diseases.html

Tools, resources and case studies

- Healthy Working Lives has information and a respiratory protective equipment selection tool at www.healthyworkinglives.com/advice/work-equipment/rpe
- The British Safety Industry Federation runs a fit-testing accreditation service known as Fit2Fit – find out more at www.fit2fit.org
- The Safe Quarry website at www.safequarry.com is a hub for guidance and resources on health and safety in the mineral products sector, and includes materials on silica dust
- Canada's WorkSafeBC website has information and resources on silica dust, including sample exposure control plans, at www2.worksafebc.com/i/posters/2009/WS%2009_04.html. The WorkSafeBC film at www2.worksafebc.com/Publications/Multimedia/Videos.asp?ReportID=36018 explains how silica dust damages the lungs
- Find more information and practical resources, including an online planning tool, from the Work Safely with Silica website, run by the USA's Center for Construction Research and Training at www.silicasafe.org
- The European Network for Silica has good practice sheets at www.nepsi.eu
- Download a case study outlining how Crossrail managed dust control in its tunnelling work at www.breathefreely.org.uk/assets/case-study---crossrail.pdf
- Watch a case study on how a stone-cutting facility introduced and managed a new respiratory protective equipment programme at www.youtube.com/watch?v=By1LWWnG_70
- Get free tools and resources to help tackle occupational lung disease in construction from the BOHS's Breathe Freely site at www.breathefreely.org.uk

**800 PEOPLE DIE A YEAR
FROM LUNG CANCER
CAUSED BY SILICA DUST
AT WORK IN BRITAIN**



Download IOSH's free pack on silica dust at www.notimetolose.org.uk. In the pack you'll find:



a leaflet for employees, covering the risks and protection measures (available as a DL leaflet)



a pocket card for operatives to remind them of risks and controls (available as a credit card-sized 'z' card)



an employee engagement discussion pack to raise awareness of silica risks and controls



a link to our online mythbuster quiz



a range of workplace posters (available as hard copies)



a signpost document giving links to a range of other free tools and resources



a briefing sheet to support a presentation or briefing session



a range of 'fast facts' infographics



visual standards – a selection of photography showing control measures and equipment



a collateral portfolio, offering you digital files to integrate in your own materials



a range of case studies sharing good practice tips and experiences

Contact campaigns@iosh.co.uk to find out about free hard copies.

Sources: Cancer Research UK, Health and Safety Executive, Imperial College London, Institute of Occupational Medicine, International Agency for Research on Cancer, Occupational Health and Safety Administration, Occupational Knowledge International, World Health Organization

Technical content from Professor John Cherrie, Heriot-Watt University and Institute of Occupational Medicine

Reviewed by Dr Frank de Vocht, University of Bristol

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DUST: UNDER CONTROL?

For years we haven't taken the health risks from silica dust seriously enough. In the UK, for example, there has been widespread non-compliance with the WEL of 0.1 mg/m^3 . HSE research shows that employers have underestimated exposure and not prioritised risk control. Typically, engineering controls like local ventilation are not as widely used as they should be and, where they do exist, they are often not effective or properly maintained. Employers don't always implement respiratory protection measures in a reliable way.

Is construction dust a priority?

The challenges have been highlighted in a survey of UK construction professionals by IOSH and the Construction Dust Partnership in 2012. Only 12 per cent felt the sector treated dust risks as a priority health issue – nearly 45 per cent said the industry gave it little or no priority. Attitudes vary, with larger companies generally promoting higher standards of dust prevention and protection.

The survey findings paint a negative picture, revealing:

- a lack of priority given by companies
- poor awareness of the risks among workers
- little attempt to design-out dust risks
- poor understanding and use of on-tool extraction
- over-reliance on respiratory protective equipment as the main form of control
- a lack of awareness about face-fit testing
- inadequate management arrangements to control dust
- poor worker compliance with the arrangements that are in place
- a lack of worker consultation.

But the survey also suggested:

- water suppression has helped with general control – although there are many practical challenges
- better compliance among those who are more informed about the risks and the controls needed.

A major challenge: changing awareness and perceptions

Poor awareness has a detrimental effect on control, provision and use. Forty-two per cent of respondents said that workers appreciated that dust could be a health issue but had no idea of the significance. Only 16 per cent believed workers are aware, or know the risks, of breathing in construction dust.

Dust causes less concern than other dangers. One commented: "Dust, like noise, affects people when they're older so [employees] don't see it as a significant immediate risk, unlike falls or equipment risks." And many accept dust as a normal part of construction: "A little bit of dust doesn't hurt anybody." There is also a general tolerance of short term exposure, even where it can still be high risk. Cost plays a part too, with dust control perceived as labour-intensive, expensive and time-consuming.

Cost savings and the benefits of engagement

Some cost savings from control measures were highlighted, such as where simpler block paving layout designs save time as well as excessive cutting, and where water suppression reduces wear to consumables, resulting in improved equipment maintenance and lifespan.

There are other benefits associated with getting basics like safe systems of work or face-fit testing right – one commented that after face-fit testing, operatives were "astounded at the level of protection they get when these are properly fitted... [and] are more likely to comply if they are told why." Involving operatives in equipment trials or choosing respiratory equipment meant they were more likely to use it properly too.

- www.iosh.co.uk/~media/Documents/Networks/Group/Construction/MEM1871%20Dust%20survey.pdf



**ONLY 16 PER CENT OF UK
CONSTRUCTION PROFESSIONALS
BELIEVE WORKERS KNOW THE
RISKS OF BREATHING IN DUST**

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IOSH

The Grange
Highfield Drive
Wigston
Leicestershire
LE18 1NN
UK

t +44 (0)116 257 3100

f +44 (0)116 257 3101

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