Health effects of silica dust

An overview for occupational health in the UK

April 2025

What is silica?

- Silica is a naturally occurring material in most rocks, sand and clay and in bricks and concrete
- Stone contains varying quantities of silica (see table)
- Cutting, sanding, grinding or polishing silica releases tiny particles into the air, called respirable crystalline silica or RCS
- RCS is 100 times smaller than a grain of sand and is not visible to naked eye
- Inhaling RCS causes significant risk to health

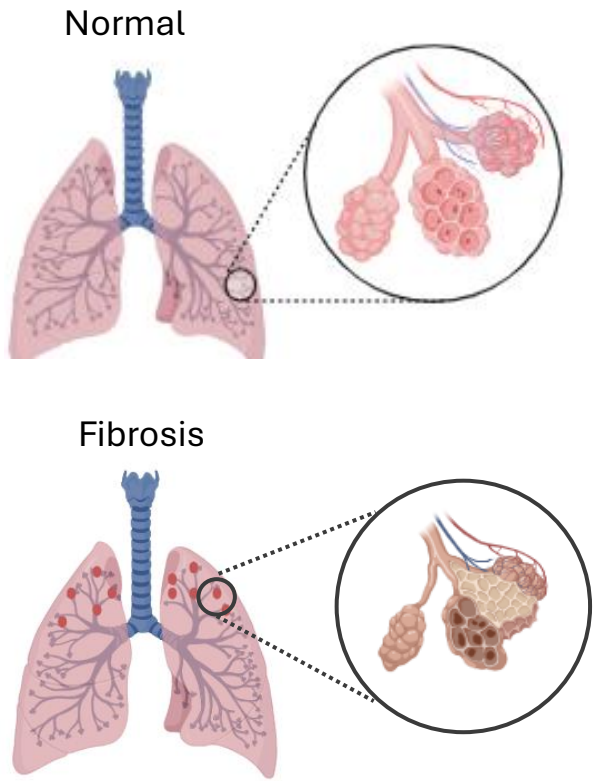
Stone	silica content
engineered stone	up to 95%
sandstone, gritstone, quartzite	>70%
concrete, mortar	25 to 70%
shale	40 to 60%
china stone	up to 50%
slate	up to 40%
granite, brick	30%
ironstone	up to 15%
basalt, dolerite	<5%
limestone, chalk, marble	<2%

https://www.hse.gov.uk/lung-disease/silicosis.htm

What are the health effects of RCS (1)?

Silicosis

- irreversible lung disease
- lungs become hard and stiffened or develop ‘fibrosis’
- the higher the exposure the greater the risk
- silica cannot be removed once it enters the lungs
- symptoms can progress even if stop working
- main symptom is breathlessness
- diagnosed on chest x-ray or CT scan



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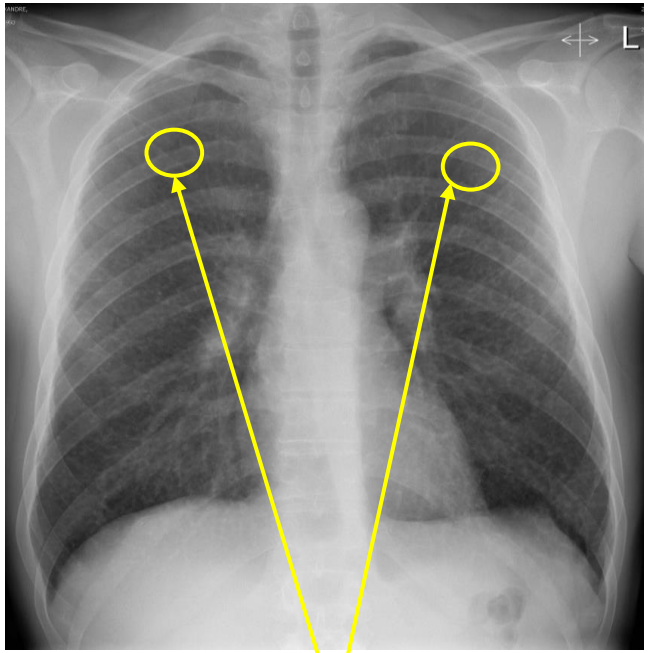
Silicosis is categorised according to x-ray appearances and duration of exposure

	Duration of exposure	Symptoms	Spirometry	Chest x-ray
Simple chronic silicosis	Typically 10-20+ years	None	Normal	Tiny nodules or 'spots'; but may be normal in 50%
Complicated chronic silicosis or 'Progressive Massive Fibrosis (PMF)'	Typically 10-20+ years	Cough, breathlessness	Reduced FEV1 and FVC	Larger nodules or 'mass' at least 1cm in diameter; usually at top of lungs
Accelerated silicosis	3-10 years	Cough, breathlessness, weight loss	Reduced FEV1 and FVC	Nodules and signs of inflammation; often throughout the lungs
Acute silicosis	Less than 3 years	Cough, breathlessness, weight loss	Reduced FEV1 and FVC	Inflammation throughout the lungs

FEV1: forced expiratory volume in one-second
FVC: forced vital capacity

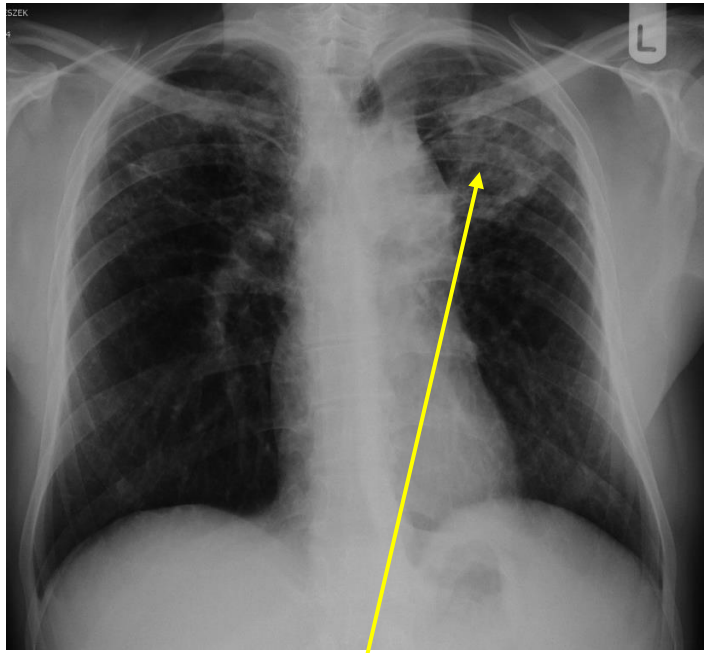
Chest x-ray changes

Simple chronic silicosis



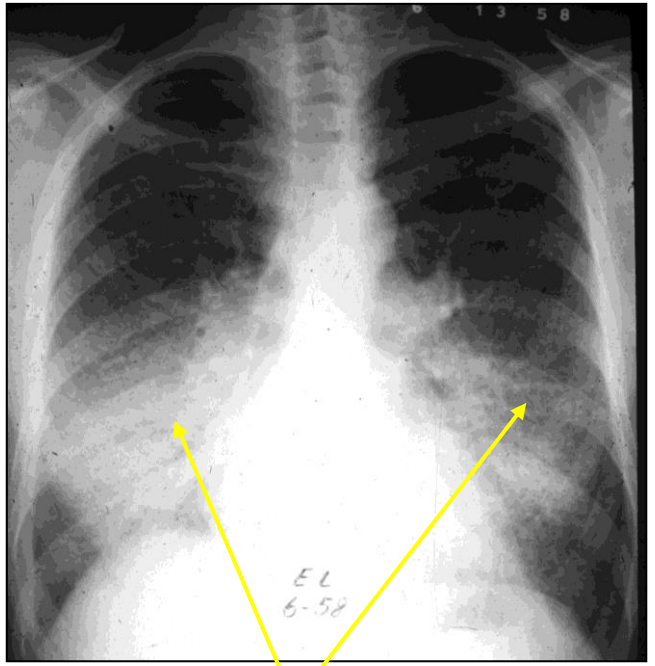
tiny nodules <1cm in
upper zones of lungs

Complicated chronic silicosis (PMF)



large mass in
upper zone of left lung

Acute silicosis

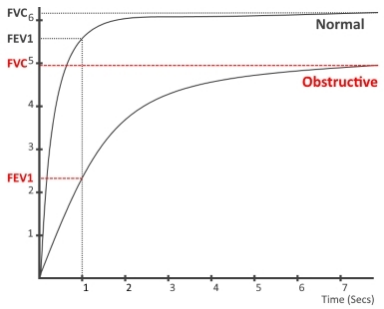


inflammation in
lower zones

What are the health effects of RCS (2)?

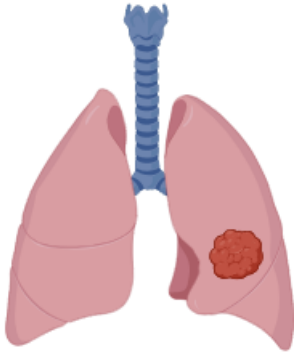
COPD (or chronic obstructive pulmonary disease)

- most commonly caused by smoking but also by RCS exposure
- causes progressive breathlessness and cough
- diagnosed using spirometry which shows airflow obstruction



Lung cancer

- symptoms include cough, weight loss, haemoptysis (coughing blood), breathlessness
- the higher the exposure to silica, the greater the risk
- risk much greater in smokers



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What are the health effects of RCS (3)?

Tuberculosis (TB)

- silica exposure increases risk of TB infection
- screening for TB (e.g. sputum analysis) should be done if productive cough, weight loss, night sweats

Autoimmune disease

- much less well-known association with different autoimmune diseases like rheumatoid arthritis and kidney disease
- joint pain, stiffness and swelling; dry eyes and mouth, hair loss, Raynaud's phenomenon (colour changes and pain in hands/feet in cold weather)
- blood in urine
- can occur without any evidence of respiratory disease

Images created in https://BioRender.com

Why is engineered stone causing an issue?

- Engineered or artificial stone or ‘quartz’ is formed of crushed rocks bonded together with resins and pigments
- Increasing popularity over the last 20 years to use for kitchen and bathroom worktops
- Emerging cases of silicosis from artificial stone around the world since 2010
- Often causes accelerated and acute disease and so affects young people and has high mortality
- Severe disease likely from combination of
  - high silica content of material
  - dry processing (without water suppression)
  - inadequate control of exposure
  - other unknown factors
- Australia banned the product in 2024 but no plans as yet to ban in UK

What about in the UK?

- In mid-2024, the first 8 cases of silicosis from artificial stone from the UK were reported [1]
- Numbers are now over 30 and rising
- Size of workforce and scale of the issue is unknown but more cases are expected
- As seen elsewhere, those affected are young (average age in early 30s), often migrant workers, employed by small companies and have relatively short duration of exposure (average 12 years).

[1] Feary et al Thorax 2024

What is the HSE guidance on health surveillance?

- In the UK, health surveillance is a legal requirement for workers:
  - in high-risk occupations where they are regularly exposed to RCS
  - with a reasonable likelihood that silicosis may develop
  - in companies where cases have been detected

- Current guidance:

	Baseline	Annually
Respiratory questionnaire	X	X
Spirometry	X	X
Chest x-ray	consider	every three years after 15 years of exposure

- Updated in 2024:
  - If there is risk of accelerated silicosis, the timing and performance of health surveillance should be adapted and chest x-rays should be performed within suitable timescales, and well before the 15 years described

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

Key challenges of current surveillance programme

- Chest x-rays will miss around 50% of cases of early silicosis [(2)]
- No guidance around timing of chest x-rays in those at risk of accelerated silicosis
- Current UK Workplace Exposure Limit (WEL) is 0.1mg/m3 over 8 hours – double that of Australia and USA – so even if exposures are below the WEL, workers still exposed to higher levels than elsewhere

[(2)] Hoy et al Respirology 2024

Suggested approaches

New national/ international guideline development is underway and should be available by early 2026

In the meantime....

- Recommend CT scan for anyone
  - at high risk (dry processing of engineered stone)
  - where there are other cases in the workplace
  - with reasonable concerns

- Spirometry can detect COPD, but less useful for silicosis
  - Consider doing spirometry less frequently e.g. alternate years

- Carry out workplace visit where artificial stone being fabricated

- Get expert help if uncertain

Finally, primary prevention is key; control of exposure should be part of any assessment of workplaces where RCS exposure occurs

Resources

HSE guidance on silicosis: https://www.hse.gov.uk/pubns/priced/healthsurveillance.pdf

BOHS education video for workers: https://live.sixtylearn.com/v/website-naMB

BOHS slides on exposure control: PowerPoint Presentation

NEBOSH training courses: https://www.nebosh.org.uk/

LUNGS AT WORK
www.lungsatwork.org.uk