

Silicosis and Silicosis combined with pulmonary tuberculosis

Definition of causal agent

Silica is silicon dioxide. Free silica is the most important component of the earth's crust and exists in crystalline, micro-crystalline and non-crystalline (amorphous) forms:

1. the main types of crystalline silica are quartz, trydimite and cristobalite. The last two are more fibrogenic to the lungs than quartz.
2. micro-crystalline (crypto-crystalline) silicas include flint, chalcedony and chert.

Diatomite is the most important form of amorphous silica. It is composed of the skeletons of microscopic marine animals and is not fibrogenic. When heated it forms cristobalite or trydimite.

Main occupational uses and sources of exposure:

Mining (of almost any material) and other underground working such as tunnelling: quarrying of sand, sandstone, slate and other silica-containing rocks: masonry and sculpture: foundry work and the repair or demolition of blast furnaces: sand crushing and blasting: sandstone milling and grinding: manufacture and use of abrasives including carborundum: glassmaking: ceramic manufacture: vitreous enamelling: the use of silica as a filler in the paint, rubber, plastics and woodworking industries.

Toxic effects

4. *Pneumoconiosis ('silicosis')*

- Ordinary ('nodular', 'chronic', 'classical') silicosis, occurring after long exposures to silica. The disease may be 'simple' or 'complicated', depending on its radiographic appearance and extent. In some cases there is rapid progression ('accelerated' silicosis). Ordinary silicosis predisposes to pulmonary tuberculosis.

Diagnostic features:

Symptoms: few, if any, unless extensive disease when cough and breathlessness are common.

Radiology: bilateral, multiple, discreet rounded opacities and reticulation usually in the upper zones. In advanced disease the size and number of opacities increases and they may conglomerate ('complicated' silicosis). Rheumatoid nodules may be present. High resolution CT scanning is more sensitive than plain chest radiography. *Lung function:* mixed restrictive/obstructive pattern in advanced disease.

Minimum intensity of exposure: usually above $50\mu\text{g}\cdot\text{m}^{-3}$ crystalline free silica.

Minimum duration of exposure: five years (two years in accelerated disease)

Maximum latent period: none

- Acute silicosis (alveolar proteinosis) can develop after relatively short exposures to very high concentrations of crystalline silica of small particle size. Acute silicosis predisposes to pulmonary tuberculosis.

Diagnostic features:

Symptoms: rapidly developing cough, breathlessness and loss of weight.

Radiology: bilateral alveolar filling pattern.

Lung function: restriction with loss of gas transfer.

Minimum intensity of exposure: well above $50\mu\text{g.m}^{-3}$ crystalline free silica

Minimum duration of exposure: three months

Maximum latent period: one year

- Diatomite pneumoconiosis is a rare outcome of exposure to diatomite amorphous silica.

Minimum intensity of exposure: above $50\mu\text{g.m}^{-3}$ crystalline free silica

Minimum duration of exposure: five years

Maximum latent period: none

Note: the following are not ‘silicosis’ as prescribed in Annex 1. The evidence that either is attributable to silica is not as strong as it is for silicosis.

5. *Chronic obstructive pulmonary disease (COPD)*

- Chronic bronchitis and airflow obstruction are common among workers exposed for long periods to silica; in most cases the degree of obstruction that is attributable to silica exposure is small. COPD may occur in the absence or presence of silicosis.

Minimum intensity of exposure: unknown but may be below the intensity required to induce silicosis.

Minimum duration of exposure: five years

Maximum latent period: none

6. *Lung cancer*

- Crystalline silica is probably a bronchial carcinogen. The evidence is stronger in the presence of silicosis; the risk is higher in smokers and among those working in manufacturing industries (rather than primary mining) where silica is used.

Minimum intensity of exposure: above $50\mu\text{g.m}^{-3}$ crystalline free silica.

Minimum duration of exposure: five years

Maximum latent period: none

7. Autoimmune disease/nephropathy

Any relationship between silica exposure and autoimmune diseases or nephropathy has not been firmly established. Cases of these diseases in silica-exposed workers require specific evaluation before reaching any conclusion on a causal association.