

## Sulphuric acid and sulphur oxides

### Definition of causal agent

Sulphuric acid ( $\text{H}_2\text{SO}_4$ ) is a colourless or slightly brown, hygroscopic, oily liquid. Vaporization can begin from  $30^\circ\text{C}$ . Sulphur trioxide is emitted when heated.

Fuming sulphuric acid (synonym: oleum), a solution of sulphur trioxide in concentrated sulphuric acid, produces thick white fumes in the air.

Sulphur dioxide ( $\text{SO}_2$ ) is a colourless pungent gas, heavier than air. It converts to sulphurous acid ( $\text{H}_2\text{SO}_3$ ) in water.

Sulphur trioxide ( $\text{SO}_3$ ) (synonym: sulphuric acid anhydride) is a solid crystalline substance which develops pungent-smelling fumes in the air and converts under thermic reaction with water to sulphuric acid ( $\text{H}_2\text{SO}_4$ ).

### *Main occupational uses and sources of exposure:*

Sulphuric acid is used as battery acid in accumulators, electroplating and in the production of fertilizer as well as in laboratories.

Sulphur dioxide occurs when sulphur is burnt (combustion of fossil fuel) and in the smelting process of metal ore. It is used as a coolant (in liquid form), for vulcanization of rubber, as a bleaching agent or for obtaining sulphuric acid.

Sulphur trioxide is an intermediate product in the manufacture of sulphuric acid and oleum and is used for sulphonation of organic acids.

### Toxic effects

#### *1. Acute, local effects*

#### Irritant and corrosive effects

$\text{SO}_2$  is converted to sulphurous acid by moisture on sweating skin or on mucous membranes.  $\text{H}_2\text{SO}_4$  is harmful not only as a liquid but also as acidic vapour and, because it has a great affinity for water, it corrodes the skin and the underlying tissue.

Although the following effects apply for both substances,  $\text{SO}_2$  mainly produces irritant effects and  $\text{H}_2\text{SO}_4$  produces the caustic effects.

These substances are highly irritant for the skin (burns), the eyes (possibility of keratoconjunctivitis, deep corneal ulcerations, eyelid lesions) and the respiratory tract (in severe cases: bronchoconstriction, laryngospasm, pulmonary oedema, with a latent period of variable length). Acute exposures to high concentrations of sulphur dioxide may cause bronchial hyper

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responsiveness (Irritant Induced Asthma or Reactive Airways Dysfunction Syndrome) that may persist for several years.

***Exposure criteria:***

*Minimum intensity of exposure*

- Occupational exposure confirmed, if possible assessed by history and study of exposure conditions providing evidence of skin contact or inhalation;
- And if available:  
Workplace air monitoring:  
Guide values:
  - > 2.7 mg/m<sup>3</sup> (1 ppm) SO<sub>2</sub> (SCOEL 1998 STEL 15 min): irritation symptoms,
  - > 1040 mg/m<sup>3</sup> (400 ppm) SO<sub>2</sub>: death in a few minutes

*Minimum duration of exposure:* seconds to minutes depending on the intensity of the exposure

*Maximum latent period:* The first manifestations should appear during exposure or within a few hours.

***Chronic effects***

Chronic irritation leads to drying and ulcerations of the skin (particularly the hands), chronic paronychia and perionychia, reddened glossy tongue and taste disturbances.

Chronic irritation of the respiratory tract can cause ulcerations of the nasal septum, nose-bleeding and possibly atrophic rhinitis and chronic obstructive ventilation disturbance.

See section on ***Occupationally caused irritation of the skin and mucous membranes*** in Annex I entry nr. 202.

**☐ Damage to dental enamel**

The compounds affect particularly the incisors: loss of lustre, streaks, decalcification, yellow or brown flecks, increased sensitivity to temperature changes.

***Exposure criteria:***

*Minimum intensity of exposure:* Occupational exposure confirmed, if possible assessed by:

- History and analysis of the working conditions showing evidence of prolonged/repeated exposure to these substances.

*Minimum duration of exposure:* A few months.

*Maximum latent period:* The first manifestations should appear during exposure

**Laryngeal cancer**

An increased risk of laryngeal cancer has been found after chronic exposure to strong-inorganic-acid mists containing sulphuric acid. There is little evidence in support of a causal relationship between mist containing sulphuric acid and lung cancer. However, there is sufficient evidence for classifying strong-inorganic-acid mists containing sulphuric acid as carcinogenic (IARC group 1).

***Exposure criteria***

*Minimum intensity of exposure:* Occupational exposure confirmed, if possible assessed by:

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- History and study of the working conditions showing evidence of significant prolonged exposure of sulphuric acid containing mist

*Minimum duration of exposure: 5 years*

*Minimum induction period: 10-20 years*