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Projet d'augmentation de la capacité d'entreposage des résidus miniers et des stériles à la mine de fer du lac Bloom

6211-08-019

ToxGuide™ for Silica SiO_2

(Numerous CAS#s)

January 2020

General Populations

- Silica is found throughout the environment and is used in some commercial products. The general population is exposed to silica through air, indoor dust, food, water, soil, and various consumer products.
- The levels of exposure to silica in the environment are very low. The general population is highly unlikely to receive high exposures to silica.

Occupational Populations

- Workers in crystalline and amorphous silica industries are exposed to much higher levels of silica than the general population.
- Workers are exposed through breathing air containing silica dust. This is a particular concern for workers in occupations involving crystalline silica, such as mining, sandblasting, and porcelain manufacturing.

Toxicokinetics

- Most studies on the toxicokinetics of silica compounds have looked at crystalline silica.
- For inhaled crystalline silica, studies in silica workers and in animals show that:
  - Silica can be retained in the lungs for several years, even after exposure has stopped.
  - Some of the inhaled crystalline silica is absorbed into the body and is found in the kidneys, lymph nodes, blood, liver, and spleen.
  - In workers, silica has been found in the urine.
- For ingested crystalline silica, animal studies show that very little silica is absorbed into the body.
- No studies looking at the absorption of silica compounds through the skin were identified. However, it is expected that very little silica would be absorbed through the skin.
- Silica compounds are not metabolized.

Normal Human Levels

- No data available.

Biomarkers

- No biomarkers for crystalline or amorphous silica have been identified.
- Prolonged inhalation exposure (typically years) to crystalline silica can cause silicosis in workers exposed to high levels for long periods of time (years). Silicosis is a unique lung disease that does not result from inhalation of any other substance, including amorphous silica.

Environmental Levels

- Air (range):
  - Crystalline silica: 0.25-2.87 $\mu g/m^3$
  - Amorphous silica: <0.2-135 $\mu g/m^3$
- Soil (range):
  - Crystalline silica: trace to up to 95% of soil
  - Amorphous silica: 3.9-5.3 mg/g soil
- Water (range for total dissolved silica):
  - Surface water: 0.12-6 mg/L
  - Drinking water: 3.3-7.1 mg/L

Reference

Agency for Toxic Substances and Disease Registry (ATSDR). 2019. Toxicological Profile for Silica. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Services.

SiO_2

U.S. Department of Health and Human Services
Public Health Service
Agency for Toxic Substances and Disease Registry
www.atsdr.cdc.gov

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

Chemical and Physical Information

Silica is a Naturally Occurring Substance

- Silica is composed of silicon and oxygen. All silica forms are identical in chemical composition but have different structures.
- Silica is divided into two groups, crystalline silica and amorphous silica (non-crystalline silica). Each silica group has several different compounds. Quartz is one type of crystalline silica.

Crystalline silica

- Crystalline silica naturally enters the environment through the weathering of rocks and minerals. Industrial activities (industrial quarrying and mining, metallurgic manufacturing) release crystalline silica into air in workplace settings.
- The predominant commercial products for crystalline silica are sand, gravel, and quartz crystal.

Amorphous silica

- Natural forms of amorphous silica contain various amounts of crystalline silica. Synthetic forms are not contaminated with crystalline silica.
- Amorphous silica is used in a wide variety of industrial processes and consumer products (filtration systems, pesticides, food additives, food wrappings, pharmaceuticals, cleaning products, cosmetic and personal hygiene products).

Routes of Exposure

- Inhalation – Most likely route of exposure for general population and occupational exposure
- Oral – A route of exposure but is a less important than inhalation.
- Dermal – Potential route of exposure

Silica in the Environment

- Silica compounds are found in the air, water and soil.
- Silica particles may be transported in the environment by wind or water currents.
- Silica compounds are poorly soluble in water and are chemically unreactive in the environment.
- The most common form of crystalline silica is quartz. This is found in sand, soils and rocks.
- Amorphous silica occurs naturally from living matter, such as plants and certain microscopic organisms.

Relevance to Public Health (Health Effects)

Health effects are determined by the dose (how much), the duration (how long), and the route of exposure.

Minimal Risk Levels (MRLs)

Inhalation

- No acute-, intermediate- or chronic duration inhalation MRLs were derived for crystalline silica or amorphous silica.

Oral

- No acute-, intermediate- or chronic duration inhalation MRLs were derived for crystalline silica or amorphous silica.

Health Effects

In the general population, no health effects are associated with exposure to crystalline or amorphous silica at the low levels found in the environment.

Crystalline Silica

- The primary target of crystalline silica exposure is the respiratory tract. Respiratory effects in workers exposed to inhaled crystalline silica include silicosis, decreased lung function, and chronic obstructive pulmonary disease (COPD). Silicosis is a potentially fatal lung disease that is only found in workers exposed to crystalline silica for a long time (years).

Health Effects

- Several types of kidney disorders have been seen in workers, but these effects are less common than lung effects.
- In crystalline silica workers, autoimmune disorders (e.g., rheumatoid arthritis, systemic lupus erythematosus) have been observed. These effects are less common than lung effects.
- Some studies have found lung cancer in crystalline silica workers. The Department of Health and Human Services and the International Agency for Research on Cancer consider silica to be carcinogenic to humans.

Amorphous Silica

- Damage to the lungs has been reported in a-silica workers, but some workers were also exposed to crystalline silica at the same time. Lung damage (inflammation and reversible fibrosis) has been observed in lab animals exposed to inhaled amorphous silica, but silicosis is not observed.

Children's Health

- Health effects of silica only occur in workers who breathe high levels of silica dust for many years. It is highly unlikely that children would be exposed under these conditions.