

## Selenium Sulfide

### CAS No. 7446-34-6

Reasonably anticipated to be a human carcinogen

First listed in the *Third Annual Report on Carcinogens* (1983)

Se = S

### Carcinogenicity

Selenium sulfide is *reasonably anticipated to be a human carcinogen* based on sufficient evidence of carcinogenicity from studies in experimental animals.

#### Cancer Studies in Experimental Animals

Oral exposure to selenium sulfide caused tumors in two rodent species and at two different tissue sites. Administration of selenium sulfide by stomach tube caused liver cancer (hepatocellular carcinoma) in rats of both sexes and in female mice. In female mice, it also increased the combined incidence of benign and malignant lung tumors (alveolar/bronchiolar adenoma and carcinoma) (NCI 1980b). When applied topically, selenium sulfide and Selsun, an antidandruff shampoo containing 2.5% selenium sulfide, did not cause tumors in mice; however, these studies were considered inconclusive, because the study length was limited to 88 weeks by the animals' early deaths resulting from amyloidosis (NCI 1980a,c).

#### Cancer Studies in Humans

The data available from epidemiological studies are inadequate to evaluate the relationship between human cancer and exposure specifically to selenium sulfide.

### Properties

Selenium sulfide is a selenium salt that exists as a yellow-orange to bright-orange tablet or powder at room temperature. It is insoluble in water or ether and soluble in carbon disulfide. Selenium sulfide has a molecular weight of 111.0 and a specific gravity of 3.056 at 0°C (HSDB 2009).

### Use

Selenium sulfide is used as an active ingredient in anti-dandruff shampoos and as a constituent of fungicides (ATSDR 2003).

### Production

No data were found on selenium sulfide production volume. In the early 1970s, about 440 lb of selenium sulfide was consumed for pharmaceutical and cosmetic products (NCI 1980b). In 2009, selenium sulfide was produced by seven manufacturers worldwide, including one in the United States (SRI 2010), and was available from 17 suppliers, including 10 U.S. suppliers (ChemSources 2009). Four products containing selenium sulfide as an active ingredient are approved by the U.S. Food and Drug Administration (FDA 2009). No recent data on U.S. imports or exports of selenium sulfide were found.

### Exposure

The routes of potential human exposure to selenium sulfide are dermal contact, inhalation, and occasional accidental ingestion. Prescription and nonprescription shampoos or lotions for treatment of dandruff or seborrheic dermatitis contain 2.5% and 1% selenium sulfide, respectively. Shampoos containing 1% selenium sulfide are recommended for use at least twice a week. Shampoos containing 2.5% selenium sulfide are recommended for use twice a week for the first two weeks and once a week or less thereafter. The 2.5% lotion may

be used once a day for seven days to treat tinea versicolor (a fungal infection of the of skin) (MedlinePlus 2009). Although residues of selenium sulfide may remain on the scalp after rinsing, there is no substantial absorption through intact skin. Absorption has been reported in patients with open lesions on the scalp or in patients using a 1% cream on the back (NCI 1980c). A patient with scalp lesions who used selenium shampoos had levels of selenium sulfide as high as 32 µg/mL in her urine (NCI 1980b).

No data on the environmental occurrence of selenium sulfide were located. Selenium is a naturally occurring element that is widely distributed throughout the environment, occurring in groundwater, surface water, rocks, soil, and food (ATSDR 2003).

Workers potentially are exposed to airborne selenium sulfide dust during production, formulation, and packaging of consumer products. The National Occupational Exposure Survey (conducted from 1981 to 1983) estimated that 2,965 workers, including 2,491 women, potentially were exposed to selenium sulfide (NIOSH 1990).

## Regulations

#### Department of Transportation (DOT)

Selenium compounds are considered hazardous materials, and special requirements have been set for marking, labeling, and transporting these materials.

#### Environmental Protection Agency (EPA)

##### Clean Air Act

*National Emission Standards for Hazardous Air Pollutants:* Selenium compounds are listed as hazardous air pollutants.

##### Clean Water Act

*Biosolids Rule:* Limits have been established for selenium in biosolids (sewage sludge) when used or disposed of via land application.

*Effluent Guidelines:* Selenium compounds are listed as toxic pollutants.

*Water Quality Criteria:* Based on fish or shellfish and water consumption = 170 µg/L for selenium; based on fish or shellfish consumption only = 4,200 µg/L for selenium.

##### Emergency Planning and Community Right-To-Know Act

*Toxics Release Inventory:* Selenium compounds are listed substances subject to reporting requirements.

##### Resource Conservation and Recovery Act

*Listed Hazardous Waste:* Waste code for which the listing is based wholly or partly on the presence of selenium sulfide = U205.

Selenium compounds are listed as a hazardous constituent of waste.

##### Safe Drinking Water Act

Maximum contaminant level (MCL) = 0.05 mg/L for selenium.

##### Food and Drug Administration (FDA)

Selenium sulfide is permitted in antidandruff shampoos and for the control of seborrheic dermatitis at concentrations not to exceed 1% for selenium sulfide or 0.6% for micronized selenium sulfide.

Maximum permissible level in bottled water = 0.05 mg/L for selenium.

Selenium is regulated as a prescription drug subject to labeling and other requirements.

##### Occupational Safety and Health Administration (OSHA)

While this section accurately identifies OSHA's legally enforceable PELs for this substance in 2010, specific PELs may not reflect the more current studies and may not adequately protect workers. Permissible exposure limit (PEL) = 0.2 mg/m<sup>3</sup> (as Se) for selenium compounds except selenium hexafluoride.

## Guidelines

#### American Conference of Governmental Industrial Hygienists (ACGIH)

Threshold limit value – time-weighted average (TLV-TWA) = 0.2 mg/m<sup>3</sup> for selenium and compounds.

#### National Institute for Occupational Safety and Health (NIOSH)

Immediately dangerous to life and health (IDLH) limit = 1 mg/m<sup>3</sup> (as Se).

Recommended exposure limit (REL) = 0.2 mg/m<sup>3</sup> (as Se) for selenium compounds, except selenium hexafluoride.

A comprehensive set of guidelines has been established to prevent occupational exposures to hazardous drugs in health-care settings.

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### References

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