SELENIUM SULFIDE
CAS No. 7446-34-6
First Listed in the *Third Annual Report on Carcinogens*

CARCINOGENICITY

Selenium sulfide is *reasonably anticipated to be a human carcinogen* based on sufficient evidence of carcinogenicity in experimental animals (NCI 1980a). When administered by oral gavage, selenium sulfide induced hepatocellular carcinomas in rats of both sexes and female mice, and alveolar/bronchiolar carcinomas and adenomas in female mice. When applied topically, selenium sulfide and Selsun®, an antidandruff shampoo containing 2.5% selenium sulfide, exhibited no carcinogenic effects in mice; however, these studies were not conclusive because the length of study was limited to 88 weeks by the relatively short lifespan of the strain of mouse (NCI 1980b,c). An IARC Working Group considered that there were insufficient data available to evaluate the carcinogenicity of selenium compounds in animals (IARC 1975). When applied topically in long-term studies, Selsun® did not induce tumors in mice or rabbits (Stenbäck 1977). In view of a NCI/OTA correlative interpretation, the evidence (based on the NCI studies) may be regarded as sufficient (Griesemer and Cueto 1980, OTA 1981).

No adequate human studies of the relationship between exposure to selenium sulfide and human cancer were found.

PROPERTIES

Selenium sulfide exists as an odorless, orange-yellow powder or tablet that is practically insoluble in water and organic solvents. It is soluble in carbon disulfide. It decomposes in alcohol and at temperatures >118°C (ATSDR 1996, HSDB 2001). It can ignite when ground with silver oxide. When heated to decomposition, it emits toxic fumes of sulfur oxides and selenium (HSDB 2001).

USE

Selenium sulfide is used as an antifungal and antiseborrheic agent. It is used in combination with a detergent in dandruff shampoos and in an ointment to treat seborrheic dermatitis or fungal infections of the eyelids and skin (NTP 2001). Prescription strength and nonprescription strength medications contain 2.5% and 1% selenium sulfide, respectively (Medlineplus 2001). Approximately 440 lb of selenium sulfide were consumed for pharmaceutical and cosmetic products in the early 1970s (IARC 1975). Additionally, selenium sulfide is used topically in veterinary medicine for eczemas and dermatomycoses (NTP 2001).

PRODUCTION

Selenium was first isolated from pyrite in 1817; however, almost all selenium is currently obtained as a byproduct from copper refining (IARC 1975). Five electrolytic copper refineries generated selenium in the U.S. in 2000; however, only one of these recovered commercial grade selenium. The other four refineries exported semi-refined selenium or selenium-containing

slimes for further processing. Domestic production of selenium increased from 1999 to 2000 (Brown 2000). Specific production information for selenium sulfide was not found.

Two U.S. suppliers of selenium sulfide were identified in 1990, but none were currently listed (Chem Sources 1991, 2001). Approximately 1,800 lb of selenium sulfide were imported by U.S. companies in 1979 (TSCA 1979). No recent import or export data were found.

EXPOSURE

Selenium is widely distributed throughout the environment, occurring in ground water, surface water, rocks, soil, and food (ATSDR 1996). No data on the environmental occurrence of selenium sulfide were located.

The primary routes of potential human exposure to selenium sulfide are dermal contact and inhalation. Shampoos containing 1% selenium sulfide are available without prescription and are recommended for use at least twice a week. Shampoos or lotions containing 2.5% selenium sulfide are available by prescription, with a recommended treatment for dandruff or seborrheic dermatitis of twice a week for the first two weeks and once per week or less thereafter. The 2.5% lotion may be used to treat once a day for seven days to treat tinea versicolor (a type of skin fungus) (Medlineplus 2001). Residues of selenium sulfide may remain on the scalp after rinsing, although 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 that used selenium shampoos had a level of selenium sulfide as high as 32 μg/ml in her urine (NCI 1980a).

Workers are potentially exposed to airborne selenium sulfide dust during production, formulation, and packaging of consumer products. The National Occupational Hazard Survey, conducted by NIOSH from 1972 to 1974, estimated that 8,500 workers were possibly exposed to selenium sulfide in the workplace in 1970 (NIOSH 1976). The National Occupational Exposure Survey (1981-1983) indicated that 2,965 total workers, including 2,490 women, potentially were exposed to selenium sulfide in the workplace (NIOSH 1984).

REGULATIONS

EPA regulates selenium sulfide under the Resource Conservation and Recovery Act (RCRA) as a hazardous constituent of waste. Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), EPA has established a reportable quantity (RQ) for selenium sulfide of 10 lb. The Superfund Amendments and Reauthorization Act (SARA) identifies selenium as a toxic chemical and subjects it to reporting requirements.

ACGIH recommends a threshold limit value (TLV) of 0.2 mg/m^3 for selenium sulfide. NIOSH has established a recommended exposure level (REL) of 0.2 mg/m^3 as a 10-hr time-weighted average (TWA). OSHA adopted a permissible exposure limit (PEL) of 0.2 mg/m^3 as an 8-hr TWA for selenium compounds. OSHA regulates selenium sulfide under the Hazard Communication Standard and as a chemical hazard in laboratories. Regulations are summarized in Volume II, Table 160.

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