

US EPA ARCHIVE DOCUMENT

Technical Factsheet on: SELENIUM

[List of Contaminants](#)

As part of the Drinking Water and Health pages, this fact sheet is part of a larger publication:
National Primary Drinking Water Regulations

Drinking Water Standards

MCLG: 0.05 mg/l
MCL: 0.05 mg/l
HAL(child): none

Health Effects Summary

Acute: Selenium is an essential nutrient at low levels. However, EPA has found it to potentially cause the following health effects from acute exposures at levels above the MCL: hair and fingernail changes; damage to the peripheral nervous system; fatigue and irritability.

No Health Advisories have been established for short-term exposures.

Chronic: Selenium has the potential to cause the following health effects from long-term exposures at levels above the MCL: hair and fingernail loss; damage to kidney and liver tissue, and the nervous and circulatory systems.

Cancer: There is no evidence that selenium has the potential to cause cancer from lifetime exposures in drinking water.

Usage Patterns

Selenium is used extensively in the manufacture and production of glass, pigments, rubber, metal alloys, textiles, petroleum, medical therapeutic agents, and photographic emulsions. Selenium dioxide is the most widely used selenium compound in industry. It is used as an oxidizing agent in drug and other chemical manufacture; a catalyst in organic syntheses; an antioxidant in lubricating oils.

Production in 1985 was reported to be 429,515 pounds, with demand for its various uses as follows: electronic and photocopier components, 35%; Glass manufacturing, 30%; Chemical and pigments, 25%; and Other, 10%.

Release Patterns

There are no true deposits of selenium anywhere and it cannot economically be recovered from the earth directly. It usually occurs in the sulfide ores of the heavy metals; this includes pyrite, clausthalite, naumannite, tienammite and in selenosulfur. Soils in the neighborhood of volcanoes tend to have enriched amounts of selenium. Selenium is the most strongly enriched element in coal, being present as an organoselenium compound, a chelated species, or as an adsorbed element.

Selenium compounds are released to the air during the combustion of coal and petroleum fuels, and during the smelting and refining of other metals.

From 1987 to 1993, according to the Toxics Release Inventory selenium releases to land and water totalled over 1 million lbs., of which about 99 percent was to land. These releases were primarily from

copper smelting industries. The largest releases occurred in Utah. The largest direct releases to water occurred in Indiana.

Selenium concentration in fresh water is usually around 0.02 ppm. The selenium content of surface water is greatly influenced by pH, being high in acidic (pH < 3.0) and in alkaline waters (pH > 7.5). Traces of selenium ranging from 0.0000-0.01 ppm are commonly found in community drinking water.

Environmental Fate

The toxicity of selenium depends on whether it is in the biologically active oxidized form. In alkaline soils and oxidizing conditions, selenium may be oxidized sufficiently to maintain the availability of its biologically active form, and cause plant uptake of the metal to be increased.

In acidic or neutral soils, it tends to remain relatively insoluble and the amount of biologically available selenium should steadily decrease. Selenium volatilizes from soils when converted to volatile selenium compounds (such as dimethyl selenide, dimethyl diselenide, and others) by microorganisms.

It is known that selenium accumulates in living tissues. For example, the selenium content of human blood is about 0.2 ppm. This value is about 1000 times greater than the selenium found in surface waters. It is clear that the human body does accumulate or concentrate selenium with respect to the environmental levels of selenium. Selenium has been found in marine fish meal at levels of about 2 ppm. This amount is around 50,000 times greater than the selenium found in seawater.

Selenium dioxide is the primary source of problems from industrial exposures since the dioxide forms selenious acid with water or sweat, and the acid is an irritant. Selenium compounds released during coal or petroleum combustion may be a significant source of exposure.

Chemical/Physical Properties

CAS Number: 7782-49-2

Color/ Form/Odor: Selenium is a metal which exists in nature only in the combined form.

Soil sorption coefficient: N/A

Bioconcentration Factor: BCF of 1000 in humans; 50,000 in marine fish

Solubilities:

dioxide- 384 g/L at 14 deg C
hydrogen- 3.8 L/L at 4 deg C
sodium- 850 g/L at 20 deg C
sulfide- insoluble

Common Ores: Usually found in the sulfide ores of the heavy metals, such as pyrite, clausthalite, naumannite, tiemannite. Also found in coal.

Other Regulatory Information

Monitoring:

-- For Ground Water Sources:

Initial Frequency-1 sample once every 3 years

Repeat Frequency-If no detections for 3 rounds, once every 9 years

-- For Surface Water Sources:

Initial Frequency-1 sample annually

Repeat Frequency-If no detections for 3 rounds, once every 9 years

-- Triggers - If detect at > 0.05 mg/L, sample quarterly.

Analysis

Reference Source

EPA 600/4-79-020
 ASTM Standards 1991
 Standard Methods (17th ed.)

Method Number

270.2
 D3859-84A; D3859-88
 3113B; 3114B

Treatment/Best Available Technologies: Activated Alumina, Coagulation/Filtration (SeVI only), Lime Softening, Reverse Osmosis, Electrodialysis

Toxic Release Inventory - Releases to Water and Land, 1987 to 1993 (in pounds):

| | Water | Land | |
|---------------------------|---------------|------------------|---------|
| TOTALS | 13,556 | 1,010,686 | |
| Top Five States* | | | |
| UT | 1,578 | 696,515 | |
| AZ | 0 | 260,632 | |
| WI | 0 | 45,000 | |
| IN | 5,300 | 0 | |
| TX | 359 | 4,920 | |
| Major Industries* | | | |
| Copper smelting, refining | | 1,500 | 962,067 |
| Metal coatings | | 0 | 45,000 |
| Petroleum refining | | 8,949 | 977 |

* Land totals only include facilities with releases greater than 1000 lbs.

For Additional Information:

EPA can provide further regulatory and other general information:
 EPA Safe Drinking Water Hotline - 800/426-4791

Other sources of toxicological and environmental fate data include:
 Toxic Substance Control Act Information Line - 202/554-1404
 Toxics Release Inventory, National Library of Medicine - 301/496-6531
 Agency for Toxic Substances and Disease Registry - 404/639-6000