United States Environmental Protection Agency | Office of Water 4601 | EPA 811-F-95-002k- T October 1995

National Primary Drinking Water Regulations

Beryllium

Chemical/ Physical Properties

CAS Number: 7440-41-7

Color/ Form/Odor: Beryllium is a grayish metal which exists in nature only in combined forms, and in some precious stones *such as emeralds, aquamarine.*

Soil sorption coefficient: N/A

Bioconcentration Factor: Nitrate BCF = 100 under constant exposure; not expected to bioaccumulate.

Solubilities:

chloride	very soluble
fluoride	very soluble
hydroxide	slightly sol. in dil. alkali
oxide	insoluble
phosphate	poorly soluble
sulfate-	insol. in cold water

Common Ores: Major commercial ore is bertrandite; oxide-bromellite; others: phenacite, pegmatite bodies.

Drinking Water Standards

MCLG: 0.004 mg/l

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HAL(child): 1- to 10-day: 30 mg/L

Longer-term: 4 mg/L

Health Effects Summary

Acute: EPA has found beryllium to potentially cause the following health effects from acute exposures at levels above the MCL: inhalation may cause acute chemical pneumonitis; less toxic via oral exposure.

Short-term exposures in drinking water considered "safe" for a 10-kg (22 lb.) child consuming one liter of water per day: up to a ten-day exposure to 30 mg/L; a longer-term exposure (upto 7 years) to 4 mg/L.

Chronic: Beryllium has the potential to cause the following health effects from long-term exposures at levels above the MCL: damage to bones and lungs.

Cancer: There is limited evidence that beryllium may cause cancer from lifetime exposures at levels above the MCL.

Usage Patterns

Production of beryllium metal increased during the 1980s: from almost 300,000 lbs. in 1982 to 490,000 lbs in 1986. In 1986, it was estimated that the greatest use of beryllium is as an alloy and metal in nuclear reactors and aerospace applications, which consumed 40% of all production in 1986. Consumption for other uses: as an alloy and oxide in electrical equipment, 35%; as an alloy and oxide in electronic components, 17%; and as compounds and metal in other applications, 8%.

Beryllium metal is used as a hardener in alloys; in space vehicles, navigation and optical equipment, and missile fuel. The chloride is used as a catalyst and intermediate in chemical manufacture. The oxide is used in glass/ceramics; as a component of nuclear fuels and moderators, electric heat sinks; electrical insulators; microwave oven components; gyroscopes; military vehicle armor; rocket nozzles; crucibles; thermocouple tubing; laser structural components.

Toxic Release Inventory - Releases to Water and Land: 1987 to 1993

	Water	Land
TOTALS (in pounds)	1,314	341,721
***Top Five States** *		
PA	653	174,250
OH	490	166,292
MI	5	1,000
TX	0	174
MN	142	0
Major Industries*		
Copper rolling, drawing	405	180,502
Nonferrous metal smelting	481	151,790
Nonferrous rolling, drawing	4	8,000
Aluminum foundries	5	1,000
Blast furnaces, steelworks	250	250
Petroleum refining	142	174

Release Patterns

Beryllium is concentrated in silicate minerals relative to sulfides and in feldspar minerals relative to ferromagnesium minerals. The greatest known naturally occurring concentrations of beryllium are found in certain pegmatite bodies. Certain fossil fuels contain beryllium compounds, perhaps accounting for its presence in some community air samples. Beryllium is not likely to be found in natural water above trace levels due to the insolubility of oxides and hydroxides at the normal pH range. It has been reported to occur in US drinking water at 0.01 to 0.7 ug/L.

Beryllium enters the environment principally from coal combustion. Beryllium content of the ashes and wastewater from a power plant suggest that secondary long term beryllium pollution emerges from the slag and ash dumps. It is also found in discharges from other industrial and municipal operations. Rocket exhaust products also consist of its compounds, principally the oxide, fluoride and chloride.

From 1987 to 1993, according to the Toxics Release Inventory beryllium releases to land and water totalled over 340,000 lbs., of which most was to land. These releases were primarily from copper rolling and drawing industries which use it as a hardener in alloys. The largest releases occurred in Pennsylvania and Ohio.

Environmental Fate

There is little information available on the environmental fate of beryllium and its compounds. Beryllium compounds of very low water solubility appear to predominate in soils. Leaching and transport through soils to ground water appears unlikely to be of concern. Erosion and bulk transport of soil may bring beryllium to surface waters, but most likely in particulate rather than dissolved form.

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 > 0.004 mg/L, sample quarterly.

Analysis:

Reference Source	Method Numbers
EPA 600/4-79-020	210.2
NTIS PB 91-231498	200.7; 200.8; 200.9
ASTM	D3645-84B
Standard Methods	3113; 3120

Treatment

Best Available Technologies

Activated Alumina; Coagulation/filtration; Ion Exchange, Lime Softening, Reverse Osmosis

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