

Technical Factsheet on: BARIUM

[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: 2 mg/l
MCL: 2 mg/l
HAL(child): none

Health Effects Summary

Acute: EPA has found barium to potentially cause gastrointestinal disturbances and muscular weakness resulting from acute exposures at levels above the MCL. No Health Advisories have been established for short-term exposures.

Chronic: Barium has the potential to cause hypertension resulting from long-term exposures at levels above the MCL.

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

Usage Patterns

The largest end use of barium metal is as a "getter" to remove the last traces of gases from vacuum and television picture tubes. It is also used to improve performance of lead alloy grids of acid batteries; as a component of grey and ductile irons; in the manufacture of steel, copper and other metals; as a loader for paper, soap, rubber and linoleum.

Barium peroxide is used as a bleach, in dyes, fireworks and tracer-bullets, in igniter and welding materials, and in manufacture of hydrogen peroxide and oxygen. The permanganate is used as a dry cell depolarizer and in disinfectants.

Barium nitrate is used in fireworks, ceramic glazes, electronics, tracer bullets, detonators, and neon sign lights. Barium cyanide is used in electroplating and metallurgy. Barium chlorate is used in fireworks, explosives, matches, and as a mordant in dyeing.

Barium carbonate is used as follows: 45 percent as ingredient in glass, 25 percent in brick and clay products, 7 percent as a raw material for barium ferrites, 4 percent in photographic paper coatings, 19 percent other.

Barium hydroxide is used in lubricating oils and greases and as a component of detergents in motor oils. It is also used in plastics stabilizers, papermaking additives, sealing compounds, vulcanization accelerators, pigment dispersants and self-extinguishing polyurethane foams and to protect limestone objects from deterioration.

Barium chloride is used in pigments, glass, dyeing, leather tanning, chlorine and sodium hydroxide manufacture and in water softening. Barium-based dyes are widely used in inks, paints, cosmetics and drugs.

Over 65% of barite produced was used as a weighting agent in oil and gas well drilling fluids, with a 50 percent decrease in demand for barite in 1986 due primarily to a severe downturn in oil and gas well drilling activity prompted by soft world oil prices. Barium sulfate is also used in photographic papers, pigments and as a filler for rubber & resins.

Release Patterns

Barium metal does not occur in nature. The most common ores are the sulfate, barite, found in AK, AR, CA, GA, KY, MO, NV, TN, and the carbonate, witherite, found in AR, CA, GA, KY, MO, NV. Barite was produced at 38 mines in the seven states in 1973, with Nevada supplying 50% of the tonnage. Missouri ranked second.

Barium is released to water and soil in the discharge and disposal of drilling wastes, from the smelting of copper, and the manufacture of motor vehicle parts and accessories.

Barium is emitted into the atmosphere mainly by the industrial processes involved in the mining, refining, and production of barium and barium-based chemicals, and as a result of combustion of coal and oil.

From 1987 to 1993, according to the Toxics Release Inventory barium compound releases to land and water totalled over 57 million lbs., of which about 99 percent was to land. These releases were primarily from copper smelting industries which use barium as a deoxidizer. The largest releases occurred in Arizona and Utah. The largest direct releases to water occurred in Texas.

Barium is found in waste streams from a large number of manufacturing plants in quantities that seldom exceed the normal levels found in soil. Background levels for soil range from 100-3000 ppm barium. Occurs naturally in almost all (99.4%) surface waters examined, in concentration of 2 to 340 ug/l, with an average of 43 ug/l. The drainage basins with low mean concentration of barium (15 ug/l) occur in the western Great Lakes, & the highest mean concentration of 90 ug/l is in the southwestern drainage basins of the lower Mississippi Valley. In stream water & most groundwater, only traces of the element are present.

There are limited survey data on the occurrence of barium in drinking water. Most supplies contain less than 200 ug/l of barium. The average concentration of barium in USA drinking water is 28.6 ug/l (1977 data). The drinking water of many communities in Illinois, Kentucky, Pennsylvania, & New Mexico contains concentrations of barium that may be 10 times higher than the drinking water standard. The source of these supplies is usually well water. Currently 60 ground water supplies and 1 surface water supply exceeds 1000 ug/l.

Environmental Fate

In water, the more toxic soluble barium salts are likely to precipitate out as the less toxic insoluble sulfate or carbonate. Barium is not very mobile in most soil systems. Adsorption of barium was measured in a sandy soil and a sandy loam soil at levels closely corresponding to those to be expected for field conditions. In general, sludge solutions appeared to increase the mobility of elements in a soil. This is due to a combination of complexation by dissolved organic compounds, high background concentration and high ionic strengths of the soil solution.

Marine animals concentrate the element 7-100 times, and marine plants 1000 times from seawater. Soybeans and tomatoes also accumulate soil barium 2-20 times.

Chemical/Physical Properties

CAS Number: 7440-39-3 (metal)

Color/ Form/Odor: Barium is a lustrous, machinable metal which exists in nature only in combined form.

Soil sorption coefficient: Koc N/A; high mobility

Bioconcentration Factor: BCFs of 7-100 for marine animals, 1000 for marine plants, 2-20 for some crops.

Common Ores: sulfate- Barite; carbonate- Witherite

Solubilities (water):

carbonate- 22 mg/L at 18 deg C
chloride- 310 g/L at 0 deg C
chromate- 3.4 mg/L at 16 deg C
cyanide 800 g/L at 14 deg C
hydroxide- sol. in dil. acid
nitrate- 87 g/L at 20 deg
permanganate- 625 g/L at 11 deg
peroxide- sol. in dil. acid
sulfate- 2.2 mg/L at 18 deg C

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 > 2 mg/L, sample quarterly.

Analysis

Reference Source

EPA 600/4-79-020
NTIS PB 91-231498
Standard Methods

Method Number

208.1; 208.2
200.7
3111D; 3113B

Treatment/Best Available Technologies: Ion Exchange, Reverse Osmosis, Lime Softening, Electrodialysis

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

| | Water | Land |
|------------------|----------------|-------------------|
| TOTALS | 928,448 | 57,063,031 |
| Top Ten States * | | |

| | | | |
|--------------------------|---------|------------|------------|
| AZ | 0 | 14,595,520 | |
| UT | 1,500 | 13,423,164 | |
| VA | 0 | 9,218,901 | |
| NM | 0 | 5,233,790 | |
| IL | 34,000 | 3,977,817 | |
| TN | 0 | 2,586,906 | |
| AL | 31,041 | 1,638,988 | |
| PA | 15,582 | 1,216,362 | |
| TX | 167,864 | 599,565 | |
| NJ | | 20,905 | 705,666 |
| Major Industries* | | | |
| Copper smelting | | 1,500 | 31,958,310 |
| Car parts, accessories | | 1,743 | 9,456,667 |
| Industrial organics | | 132,511 | 4,106,827 |
| Inorganic pigments | | 5,261 | 3,672,451 |
| Gray, ductile iron | | 0 | 1,556,681 |
| Steelworks, furnaces | | 256,582 | 679,999 |
| Electrometallurgy | | 1,599 | 633,876 |
| Paper mills | | 64,770 | 527,330 |

* Water/Land totals only include facilities with releases greater than a certain amount - usually 1000 to 10,000 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