Technical Factsheet on: CHROMIUM

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: 0.1 mg/l
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HAL(child): 1- to 10-day: 1 mg/L; Longer-term: 0.2 mg/L
Note: These standards are based on the total concentration of the trivalent and hexavalent forms of dissolved chromium (Cr3+ and Cr 6+).

Health Effects Summary

Acute: EPA has found chromium to potentially cause the following health effects from acute exposures at levels above the MCL: skin irritation or ulceration.

Drinking water levels which are considered "safe" for short-term exposures: For a 10-kg (22 lb.) child consuming 1 liter of water per day, a one- to ten-day exposure to 1 mg/L; a longer-term (7 years) exposure to 0.2 mg/L.

Chronic: Chromium has the potential to cause the following health effects from long-term exposures at levels above the MCL: damage to liver, kidney circulatory and nerve tissues; dermatitis.

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

Usage Patterns

Chromium and its compounds are used in metal alloys such as stainless steel; protective coatings on metal; magnetic tapes; and pigments for paints, cement, paper, rubber, composition floor covering and other materials. Other uses include: chemical intermediate for wood preservatives, organic chemical synthesis, photochemical processing and industrial water treatment. In medicine, chromium compounds are used in astringents and antiseptics. They also are used in cooling waters, and in the leather tanning industry, in catalytic manufacture, and in fungicides; as an algaecide against slime forming bacteria and yeasts in brewery processing water and brewery warmer water.

Chromic acid consumption patterns in 1988: wood preserving, 63%; metal finishing, 22%; other, including water treatment, magnetic particles and catalysts, 7%; exports, 8%. Demand: 1987: 57,500 tons; 1988: 62,500 tons; 1992 (projected): 78,800 tons.

Sodium Bichromate consumption patterns in 1988: chromic acid, 54%; leather tanning, 9%; chromium oxide, 9%; pigments, 8%; wood preservation, 5%; other, including drilling muds, catalysts, water treatment, metal finishing, 5%; exports, 10%. Demand: 1987: 150,000 tons; 1988: 164,000 tons; 1992 (projected): 180,000 tons

Release Patterns

Chromium occurs in nature mostly as chrome iron ore, or chromite. Though widely distributed in soils and plants, it is rare in natural waters. The two largest sources of chromium emission in the atmosphere are from the chemical manufacturing industry and combustion of natural gas, oil, and coal.

Other sources include wind transport from road dust, cement producing plants because cement contains chromium, the wearing down of asbestos brake linings from automobiles or similar sources of wind carried asbestos since asbestos contains chromium, incineration of municipal refuse and sewage sludge, exhaust emission from automotive catalytic converters, emissions from cooling towers that use chromium compounds as rust inhibitors, waste waters from electroplating, leather tanning, and textile industries when discharged into surface waters, and solid wastes from chemical manufacture.

From 1987 to 1993, according to the Toxics Release Inventory, chromium compound releases to land and water totalled nearly 200 million pounds, of which about 99 percent was to land. These releases were primarily from industrial organic chemical industries which use chromium as an intermediate. The largest releases occurred in Texas and North Carolina. The largest direct releases to water occurred in Georgia and Pennsylvania.

Background levels in water average 1 ug/L while municipal drinking water contain 0.1-35 ug/L. The higher values of chromium can be related to sources of anthropogenic pollution. In ocean water, the mean chromium concentration is lower than in river water, and its value is 0.3 ug/l, with a range of 0.2 to 50 ug/l.

A survey of 3834 tap waters reported the concentrations of chromium to range from 0.4 to 8.0 ug/l. The reported chromium concentrations in this study may be a little higher than the actual values due to inadequate flushing of tap water before collection of samples. This indicates that the concentration of chromium in household tap water may increase due to plumbing materials.

Environmental Fate

Chromium is not likely to migrate to ground water. A field trial on the application of wastewater treatment sludge to soils found movement of heavy metals, including chromium, from the soil surface to a depth of 10 cm, but most of the metal (mean 87%) remained in the upper 5 cm of soil. Uptake by plants is generally low; it was found to be greater from ultrabasic soils by a factor of 5-40 than on calcareous or silica-based soils.

Chromium compounds are very persistent in water. Most of the chromium in surface waters may be present in particulate form as sediment. Some of the particulate chromium would remain as suspended matter and ultimately be deposited in sediments.

The exact chemical forms of chromium in surface waters are not well defined. Although most of the soluble chromium in surface waters may be present as Cr(VI), a small amount may be present as Cr(III) organic complexes. Hexavalent chromium is the major stable form of chromium in seawater; however, Cr(VI) may be reduced to Cr(III) by organic matter present in water, and may eventually deposit in sediments.

Though little data is available, there is a high potential for bioconcentration of chromium in aquatic organisms. Snails showed an accumulation factor of 1x10+6.

Chemical/Physical Properties

CAS Number: 7440-47-3

Color/ Form/Odor: Chromium is metal found in nature only in the combined state.

Soil sorption coefficient: N/A; Low mobility

Bioconcentration Factor: BCF in plants, 1000; in snails, 1,000,000; expected to accumulate in aquatic organisms.

Common Ores: oxide- Iron chromite

Solubilities:

chloride- soluble in cold water
chromate- 0.2 mg/L (lead salt)
chromate- 873 g/L at 30 deg C (sodium salt)
chromate oxide- insoluble
dichromate- 2380 g/L at 0 deg C (sodium salt)
dioxide- insoluble
oxide- insoluble
sulfate- insoluble
trioxide- 617 g/L at 0 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 > 0.1 mg/L, sample quarterly.

Analysis

Reference Source	Method Number
EPA 600/4-79-020	218.2
NTIS PB 91-231498	200.7
Standard Methods	3113B; 3120

Treatment/Best Available Technologies: Coagulation/Filtration; Ion Exchange, Reverse Osmosis, Lime Softening (for CrIII only)

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

	Water	Land
TOTALS	**2,876,055**	**196,880,624**
Top Ten States *		
TX	102,079	64,301,920
NC	43,522	55,217,044

IN	85,570	15,955,895		
OH	51,830	8,319,600		
UT	1,750	5,817,015		
AR	2,300	3,532,000		
KY	255	2,491,519		
PA	110,149	2,337,905		
GA	679,721	1,404,698		
ID	91,750	1,404,870		
Major Industries*				
Indust. organics			3,272	120,707,814
Steelworks, Blast furn.			609,174	16,638,880
Electrometallurgy			33,269	10,796,928
Copper smelting, refining			1,750	5,817,015
Nonferrous smelting			2,300	3,532,000
Inorganic pigments			88,721	1,375,700
Pulp mills			985,800	224,198

* State/Industry 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