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TECHNICAL BULLETIN

HEALTH EFFECTS INFORMATION

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CHROMIUM-Hexavalent

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SYNONYMS

Chrome 6, Chromium+6, Chromium-6, Chrome VI, Chromium VI, Cr (VI), Cr +6, Hex-chrome, Hexavalent Chromium

USES

Chromium is a naturally occurring metal found in soil, rocks, surface water and underground water. It is a component of steel products and is used in many industrial processes, products and consumer products. It is an important ingredient in many dyes, inks, pigments and some paint products. It is used in the tanning of leather, metal-works, wood preservatives and metal-finishing and plating processes.

CHEMICAL AND PHYSICAL PROPERTIES

The chemical symbol for chromium is Cr. Chromium does not exist as a pure metal in nature, but is always present as oxides or other combined forms. It is a natural ingredient in many soils and natural mineral formations. In its combined forms it can be found as chromium 1, 2, 3, 4, 5 and 6. These forms are referred to as oxidation states or valence numbers. Chromium in natural materials is usually either chrome-3 or chrome-6. Natural and man-made conditions can cause chromium to change from one oxidation state (valence) to another. Chromium 3 can convert to Chromium 6 in nature or when exposed to manmade conditions. Chromium 3 is commonly found in the environment and it serves as an essential nutrient for animals and humans. Hexavalent chromium is also found in nature but it is harmful to animals and humans when inhaled or ingested. When skin is exposed to hexavalent chromium it can causes rashes.

Low levels of chromium in drinking water are odorless, colorless and without taste. The only way to know if it is there is to test for it in a laboratory.

WHERE DOES IT COME FROM? HOW DOES IT ENTER THE ENVIRONMENT?

Since chromium is a natural earth metal, it is found in soils, rocks, dusts, surface water, ground water and seawater. Because of its natural presence it is found in plants, animals, food products and beverages. Manmade products that contain chromium and industrial processes that involve chromium can produce higher concentrations in some areas than would be found under natural conditions. Hexavalent chromium, the most hazardous form, can be found at higher than

natural levels in areas contaminated by industrial processes, industrial discharges or where chromium-containing products or wastes are found.

WHAT HAPPENS TO IT IN THE ENVIRONMENT?

Chromium found naturally or from manmade sources does not disappear or break down in the environment. It may change its valence state and may combine with other materials but it does not diminish or disappear unless it is physically removed by treatment processes.

HOW CAN CHROMIUM ENTER AND LEAVE MY BODY?

Everyone is exposed regularly to chromium in food, beverages, air and soil. Ingestion of chromium-3 is normal and it is an essential nutrient in quantities of 50 to 200 micrograms per day. Exposure to it in amounts greater than 200 micrograms per person per day may be harmful. It is excreted through urine, feces and through growing hair and nails. Hexavalent chromium, however, is hazardous even at very low exposure doses. It is also excreted but can produce lasting harm within the body before it is eliminated.

WHAT ARE ITS HARMFUL EFFECTS?

Inhaled chromium, especially hexavalent chromium causes nasal and respiratory irritation, perforation of the nasal septum and cancers of the nose, windpipe and lungs.

Skin exposure to hexavalent chromium can cause acute irritation, burning sensation and rashes. It may also lead to allergic dermatitis.

Oral exposure to excessive amounts of chromium via food, beverages, or drinking water can lead to stomach and digestive distress, ulcers and damage to kidneys and liver. Excessive exposure to hexavalent chromium can contribute to the above disorders and may lead to increased cancer risk, particularly cancers of the stomach and digestive tract.

DRINKING WATER STANDARDS

Hexavalent Chromium

The state of California has set a state standard of 0.010 mg/L (10 µg/L) for hexavalent chromium that became effective on July 1st, 2014. The USEPA is considering adoption of a maximum contaminant level for hexavalent chromium.

Total Chromium

The federal (USEPA) maximum contaminant limit for total chromium in finished drinking water is 0.1 mg/L or 100 micrograms per liter of water (100 µg/l). Oregon has adopted this standard. The State of California requires that total chromium in finished drinking water not exceed 50 micrograms per liter (50 µg/l). The State of Minnesota has adopted a maximum limit of 10 µg/l for total chromium in finished drinking water. The World Health Organization and the European Union require that total chromium in finished drinking water not exceed 50 µg/l.

HOW MUCH CHROMIUM IS GENERALLY FOUND IN OREGON DRINKING WATER?

Hexavalent Chromium

Oregon's public drinking water systems are not routinely required to test for hexavalent chromium. Oregon's public drinking water systems are required to test for total chromium on a routine basis. The USEPA recently published data from their Unregulated Contaminant Monitoring Rule 3 (UCMR 3), hexavalent chromium was one of the contaminants public water systems in Oregon monitored for. These data show that Oregon public water systems chrome six detections range from non-detect to 0.022 mg/L, (2.2 µg/L).

There is no way to know how much of total chromium in water is hexavalent without testing for it specifically. Hexavalent chromium has been found in water samples to range from 7% to 100% of the total chromium concentration.

Total Chromium

The Oregon Drinking Water Program requires public drinking water systems serving communities, schools, and business that use a surface water source to test for total chromium, after treatment, annually initially and can eventually be reduced to once every nine years if levels are below the MCL. Public drinking water systems that serve communities, schools, and businesses that use a groundwater source are required to test for total chromium every 3 years initially and can eventually be reduced to once every nine years if levels are below the MCL. Levels of total chromium found in Oregon drinking water systems have ranged from non-detectable (usually about 2 µg/l) to 133 µg/l. Only one finding for total chromium greater than the maximum contaminant level (100 µg/l) has been reported.

For more information about the Oregon Administrative Rules that regulate public drinking water, go to page 3 of the document at the following link:

<http://public.health.oregon.gov/HealthyEnvironments/DrinkingWater/Rules/Pages/r>

[ules.aspx#oars.](#)

CAN CHROMIUM BE REMOVED EFFECTIVELY FROM DRINKING WATER?

Various treatment methods may substantially reduce chromium levels in water. USEPA recommends coagulation/filtration, ion exchange filtration, reverse osmosis and lime softening. These techniques often also utilize chemical reduction of hexavalent chromium (chromium-6) to chromium-3 by applying iron chloride, iron sulfide, tin chloride or sodium bisulfate prior to filtration. If reducing hexavalent chromium to very low levels is essential, reverse osmosis may be the most effective treatment method.

If you own or operate a public water system in Oregon and are considering treating water for chromium removal, be sure to consult with the Oregon Drinking Water Program before purchasing or installing treatment equipment.

FOR MORE INFORMATION

The links below may have additional information to help you understand chromium-6 and drinking water standards.

The Agency for Toxic Substances and Disease Registry's information on health effects of chromium:

<http://www.atsdr.cdc.gov/substances/toxsubstance.asp?toxid=17>.

USEPA's drinking water standards:

<http://www.epa.gov/safewater/consumer/pdf/mcl.pdf>

USEPA's recommendations for voluntary hexavalent chromium monitoring in drinking water:

<http://water.epa.gov/drink/info/chromium/guidance.cfm>