Chromium

What is Chromium and how is it used?

Chromium is a metal found in natural deposits as ores containing other elements. The greatest use of chromium is 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. Its soluble forms are used in wood preservatives.

Why is Chromium being regulated?

In 1974, Congress passed the Safe Drinking Water Act. This law requires EPA to determine safe levels of chemicals in drinking water, which do or may cause health problems. These non-enforceable levels, based solely on possible health risks and exposure, are called Maximum Contaminant Level Goals.

The MCLG for chromium has been set at 0.1 parts per million (ppm) because EPA believes this level of protection would not cause any of the potential health problems described below.

Based on this MCLG, EPA has set an enforceable standard called a Maximum Contaminant Level (MCL). MCLs are set as close to the MCLGs as possible, considering the ability of public water systems to detect and remove contaminants using suitable treatment technologies.

The MCL has also been set at 0.1 ppm because EPA believes, given present technology and resources, this is the lowest level to which water systems can reasonably be required to remove this contaminant should it occur in drinking water.

These drinking water standards and the regulations for ensuring these standards are met, are called National Primary Drinking Water Regulations. All public water supplies must abide by these regulations.

What are the health effects?

Short-term: EPA has found chromium to potentially cause the following health effects when people are exposed to it at levels above the MCL for relatively short periods of time: skin irritation or ulceration.

Long-term: Chromium has the potential to cause the following effects from a lifetime exposure at levels above the MCL: damage to liver, kidney circulatory and nerve tissues; skin irritation.

The health effects resulting from exposure to chromium(III) and chromium(VI) are fairly well described in the literature. In general, chromium(VI) is more toxic than chromium(III). Breathing in high levels (greater than 2 µg/m3) chromium(VI), such as in a compound known as chromic acid or chromium(VI) trioxide, can cause irritation to the
nose, such as runny nose, sneezing, itching, nosebleeds, ulcers, and holes in the nasal septum. These effects have primarily occurred in factory workers who make or use chromium(VI) for several months to many years. Long-term exposure to chromium has been associated with lung cancer in workers exposed to levels in air that were 100 to 1,000 times higher than those found in the natural environment. Lung cancer may occur long after exposure to chromium has ended. Chromium(VI) is believed to be primarily responsible for the increased lung cancer rates observed in workers who were exposed to high levels of chromium in workroom air. Breathing in small amounts of chromium(VI) for short or long periods does not cause a problem in most people. However, high levels of chromium in the workplace have caused asthma attacks in people who are allergic to chromium. Breathing in chromium(III) does not cause irritation to the nose or mouth in most people. In the same way, small amounts of chromium(VI) that you swallow will not hurt you; however, accidental or intentional swallowing of larger amounts has caused stomach upsets and ulcers, convulsions, kidney and liver damage, and even death. The levels of chromium(VI) that caused these effects were far greater than those that you might be exposed to in food or water. Although chromium(III) in small amounts is a nutrient needed by the body, swallowing large amounts of chromium(III) may cause health problems. Workers handling liquids or solids that have chromium(VI) in them have developed skin ulcers. Some people have been found to be extremely sensitive to chromium(VI) or chromium(III). Allergic reactions consisting of severe redness and swelling of the skin have been noted. Exposure to chromium(III) is less likely than exposure to chromium(VI) to cause skin rashes in chromium-sensitive people. The metal, chromium(0), is less common and does not occur naturally. We do not know much about how it affects your health, but chromium(0) is not currently believed to cause a serious health risk. We have no reliable information that any form of chromium has harmful effects on reproduction or causes birth defects in humans, though it does not seem likely that the amount of chromium that most people are exposed to will result in reproductive or developmental effects.

Because some chromium(VI) compounds have been associated with lung cancer in workers and caused cancer in animals, the Department of Health and Human Services has determined that certain chromium(VI) compounds (calcium chromate, chromium trioxide, lead chromate, strontium chromate, and zinc chromate) are known human carcinogens. The International Agency for Research on Cancer (IARC) has determined that chromium(VI) is carcinogenic to humans, based on sufficient evidence in humans for the carcinogenicity of chromium(VI) compounds as found in chromate production, chromate pigment production, and chromium plating industries. IARC's determination is also based on sufficient evidence in experimental animals for the carcinogenicity of calcium chromate, zinc chromate, strontium chromate, and lead chromate; and limited evidence in experimental animals for the carcinogenicity of chromium trioxide (chromic acid) and sodium dichromate. IARC has also determined that chromium(0) and chromium(III) compounds are not classifiable as to their carcinogenicity to humans. The EPA has determined that chromium(VI) in air is a human carcinogen. The EPA has also determined that there is insufficient information to determine whether chromium(VI) in water or food and chromium(III) are human carcinogens.

**How much Chromium is produced and released to the Environment?**
Production of the most water soluble forms of chromium, the chromate and dichromates, was in the range of 250,000 tons in 1992. Though chromium occurs in nature mostly as chrome iron ore and is widely found 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.

From 1987 to 1993, according to the Toxics Release Inventory, chromium compound releases to land and water totaled nearly 200 million pounds. These releases were primarily from industrial organic chemical industries. The largest releases occurred in Texas and North Carolina. The largest direct releases to water occurred in Georgia and Pennsylvania.

**What happens to Chromium when it is released to the environment?**

When released to land, chromium compounds bind to soil are not likely to migrate to ground water. They are very persistent in water as sediments. There is a high potential for accumulation of chromium in aquatic life.

**Is there a medical test to determine whether I have been exposed to chromium?**

Chromium can be measured in the hair, urine, serum, red blood cells, and whole blood. However, since chromium(III) is an essential nutrient, low levels of chromium are normally found in body tissues and urine. Tests for chromium exposure are most useful for people exposed to high levels. These tests cannot determine the exact levels of chromium you may have been exposed to or predict whether or not health effects will occur. High chromium levels in the urine and red blood cells indicate exposure to chromium(VI) or chromium(III) compounds. Since the body changes chromium(VI) to chromium(III), the form of chromium that you were exposed to cannot be determined from levels in the urine. Much more chromium(VI) can enter red blood cells than chromium(III), but chromium(VI) can be changed to chromium(III) within these cells. Therefore, chromium levels in the red blood cells indicate exposure to chromium(VI). Because red blood cells last about 120 days before they are replaced by newly made red blood cells, the presence of chromium in red blood cells can show whether a person was exposed to chromium 120 days prior to testing but not if exposure occurred longer than 120 days before testing. Skin patch tests may indicate whether a person is allergic to some chromium salts.

**How can families reduce their risk of exposure to chromium?**

If your doctor finds that you have been exposed to significant amounts of chromium, ask whether your children might also be exposed. Your doctor might need to ask your state health department to investigate.

Children living near chromium waste sites are likely to be exposed to higher environmental levels of chromium through breathing, touching soil, and eating contaminated soil. Some children eat a lot of dirt. You should discourage your children from eating dirt. Make sure they wash their hands frequently and before eating. Discourage your children from putting their hands in their mouths or hand-to-mouth
activity. Although chromium(III) is an essential nutrient that helps the body use sugar, protein, and fat, you should avoid excessive use of dietary supplements containing chromium such as chromium picolinate. You should only use the recommended amount if you choose to use these products and store these products out of children’s reach in order to avoid accidental poisonings.

**How will Chromium be detected in and removed from my drinking water?**

The regulation for chromium became effective in 1992. Between 1993 and 1995, EPA required your water supplier to collect water samples once and analyze them to find out if chromium is present above 0.1 ppm. If it is present above this level, the system must continue to monitor this contaminant every 3 months.

If contaminant levels are found to be consistently above the MCL, your water supplier must take steps to reduce the amount of chromium so that it is consistently below that level. EPA has approved the following treatment methods for removing chromium: Coagulation/Filtration, Ion Exchange, Reverse Osmosis, Lime Softening.

**How will I know if Chromium is in my drinking water?**

If the levels of chromium exceed the MCL, the system must notify the public via newspapers, radio, TV and other means. Additional actions, such as providing alternative drinking water supplies, may be required to prevent serious risks to public health.

This is a factsheet about a chemical that may be found in some public or private drinking water supplies. It may cause health problems if found in amounts greater than the health standard set by the United States Environmental Protection Agency (EPA).

**Drinking Water Standards:**

MCLG: 0.1 ppm

MCL: 0.1 ppm

*This factsheet was adapted from U.S. EPA.*

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