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TECHNICAL BULLETIN

HEALTH EFFECTS INFORMATION

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ENVIRONMENTAL TOXICOLOGY SECTION

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PERCHLORATES

For More Information Contact:

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SYNONYMS

Perchlorate Ion, Perchlorate Salts, Perchloric Acid. Examples of perchlorate salts are Sodium Perchlorate, Ammonium Perchlorate, Potassium Perchlorate. Do not confuse with chlorates.

USES

Perchlorate ion and perchlorate salts are used extensively in industry in the production of military explosives, rocket and missile fuels, fireworks, flares, matches, dyes, lubricants, paints, rubber products and pharmaceuticals. Perchlorates are also used in leather tanning and in electroplating. Perchlorate ion, perchloric acid and perchlorate salts are strong oxidizers, but perchlorate ion has a very high activation temperature, so it can persist in products and in the environment for decades.

Perchlorates are natural ingredients in some natural soils and mineral formations. Perchlorate salts are present in some naturally mined nitrate and phosphate fertilizers, particularly rock fertilizers from Chile.

Historically perchlorate compounds have had some use as medications in treating persons with overly-active thyroid glands, but this use has been abandoned because of adverse effects and because better medications have been developed for that purpose.

WHAT HAPPENS TO PERCHLORATE IN THE ENVIRONMENT

Perchlorate compounds are very soluble in water. Sodium, potassium and ammonium perchlorate salts are solids when dry, and may exist as fine dusts which can be blown about by wind. When in contact with water, these compounds dissolve releasing perchlorate ion. Perchlorates will remain dissolved in the water and may stay in lakes and ponds, or they may be carried long distances by streams and rivers. Perchlorates in water may sink into the ground where perchlorate ion eventually reaches groundwater aquifers. Because environmental temperatures are generally too low to activate its oxidizing potential, perchlorate ion can persist unchanged in air, soil, surface water and groundwater for decades. Because of their high solubility, perchlorate compounds tend to be very mobile in the environment.

Many species of plants can absorb and accumulate perchlorate ion from soils they grow in and from water they absorb. There is some evidence that some plants may

degrade perchlorates to less hazardous compounds, but many plants appear to retain perchlorates unchanged in their tissues.

HOW CAN PERCHLORATES ENTER AND LEAVE MY BODY

Perchlorate salts and perchlorate ion can enter the human body by inhalation and swallowing of dusts containing the salts. These routes may be significant for persons who work with perchlorate compounds or materials with perchlorate contaminants. Perchlorates at levels found in drinking water do not have significant skin absorption potential.

Perchlorate salts and perchlorate ion may also enter the body as contaminants of food, drinking water or other beverages. Since some plants absorb and accumulate perchlorate salts in their tissue, contaminated vegetables, nuts and fruits along with contaminated drinking water are probably the most significant sources of exposure for most persons. Plants grown in soils containing perchlorate salts, plants fertilized with perchlorate containing fertilizers, or plants which are irrigated with contaminated water are potential exposure sources for humans and animals.

HOW ARE PERCHLORATES HARMFUL TO HEALTH

Perchlorate salts and perchlorate ion are absorbed by the thyroid gland, reducing the capacity of the gland to absorb iodine compounds that are essential for thyroid hormone production and other thyroid functions. Persons with regular excessive exposure to perchlorates often suffer from underactive or impaired thyroid function.

Pregnant women and developing fetuses are especially vulnerable to injury from perchlorate exposure, as are infants who are breast-fed. Perchlorates reduce the level of thyroid hormones transferred from the mother to the fetus or nursing infant, and they impair the function of the developing thyroid gland.

There is some evidence that perchlorates increase the likelihood of thyroid cancer.

DRINKING WATER STANDARDS

At the present time there is no enforceable national or Oregon state drinking water standard for perchlorates in drinking water. The US Environmental Protection Agency has not yet established a national maximum contaminant limit (MCL) for this contaminant. The most current recommendation from USEPA is that drinking water levels should be no greater than 4 micrograms per liter of water (4 ug/l, or 4

A number of individual western and southwestern states have found perchlorates in drinking water supplies and have adopted guidelines or enforceable maximum limits for perchlorates. These limits vary from 4 to 32 micrograms per liter of water.

It is believed that water having perchlorate concentrations of 4 micrograms per liter or lower can be used safely for all household uses and for drinking water as well as for irrigation of gardens and food crops. The Drinking Water Program recommends that water having perchlorate levels greater than 4 micrograms per liter not be used for drinking purposes or for food or beverage preparation.

CAN PERCHLORATES BE REMOVED FROM WATER

It would be extremely expensive and it may not be possible for individual households to treat water for removal of perchlorates. Larger systems with the technical expertise and resources to do so, may be able to successfully remove perchlorates from water by the use of selective ion exchange resins. Perchlorates cannot be filtered from water by mechanical means, and boiling of water is ineffective in treating water with perchlorate contamination. Boiling water will increase the concentration of perchlorates rather than lowering it.

Distillation and reverse osmosis processes can remove or lower the concentrations of perchlorates, but such processes are not selective and will also remove valuable minerals from the water.

All treatment systems require careful design, sampling and maintenance to ensure effectiveness. If a treatment system is considered, it should be certified by the National Sanitation Foundation (NSF) for removal of perchlorates.

For additional advice and information about drinking water treatment methods call the Drinking Water Section of the Department of Human Services, Public Health Systems. (See cover sheet for telephone numbers.)