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TECHNICAL BULLETIN

HEALTH EFFECTS INFORMATION

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NITRATE

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NITRATE

SYNONYMS: There are no synonyms for nitrate but there are a number of nitrogen compounds that are important in nitrate effects including nitrites, amines and nitrosamines. All may be present along with nitrates in the environment and in the human body.

WHAT IS NITRATE AND WHAT ARE ITS USES: Nitrate is a naturally occurring oxide of nitrogen. Nitrogen is always present in the air and it reacts with oxygen and ozone to produce nitrogen oxides of which nitrate is one. Nitrogen oxidation also occurs in growing and decomposing biological systems. Oxides of nitrogen are present in smoke in significant quantities. Nitrate is an essential component of living things and is a major component of animal manure, human sewage waste and commercial fertilizers. Nitrates and nitrites have been used for centuries as fertilizers, in explosives and as food preservatives, especially in cured red meats. There are many other uses of nitrates, and the presence of nitrates in the environment is normal and necessary.

HOW CAN I BE EXPOSED TO NITRATES: Everyone is exposed regularly to nitrates because of their presence in foods, in water and because they are formed during digestion and metabolism in our bodies. Nitrates are not harmful unless our exposure to them is excessive. Very young infants, persons taking nitrogen-containing medications, persons who work with nitrates occupationally, and persons with genetic susceptibility to nitrates are harmed at lower exposure levels than others; but nitrate exposures above the current MCL may be harmful to everyone.

OCCURRENCE AND SOURCES OF NITRATE IN WATER SUPPLIES

Naturally occurring levels of nitrate in surface and groundwater do not generally exceed 2 milligrams per liter (mg/l). Sources of nitrate in water include fertilizers, septic systems, animal feedlots, industrial wastes, and food processing waste. Nitrate is formed by microbes in some plants which remove nitrogen from air and oxidize it to nitrate. It can also be naturally occurring in certain geological settings, and can result from decaying organic matter. Elevated levels of nitrate found in well water usually indicate improper well construction or location, overuse of chemical fertilizers or improper disposal of human and animal waste in the vicinity of the well. Water with less than 10 mg/l nitrate as nitrogen ($\text{NO}_3\text{-N}$) is generally safe for all household activities including use in foods and beverages.

HEALTH EFFECTS OF DRINKING NITRATE CONTAMINATED WATER

The United States Environmental Protection Agency (USEPA) has set a maximum contaminant level (MCL) of 10 mg/l for nitrate ($\text{NO}_3\text{-N}$) in public water supplies. Nitrate levels above 10 mg/l may present a serious health concern for infants and pregnant or nursing women. Adults receive more nitrate exposure from food than from water. Infants, however, receive the greatest exposure from drinking water because most of their food is in liquid form. Nitrate can interfere with the ability of the blood to carry oxygen to vital tissues of the body in infants of six months old or younger. The resulting illness is called methemoglobinemia, or "blue baby syndrome".

Pregnant women may be less able to tolerate nitrate, and nitrate in the milk of nursing mothers may affect infants directly. These persons should not consume water containing more than 10 mg/l nitrate directly, added to food products, or beverages (especially in baby formula). Other domestic uses of affected water such as irrigation, washing and bathing do not result in nitrate absorption. The 10 mg/l standard for $\text{NO}_3\text{-N}$ in public drinking water supplies has been devised to protect a select group of sensitive persons (infants, and pregnant and nursing women).

It has been suggested in human studies that nitrate ingestion may be linked to gastric or bladder cancer. This link, however, has not been firmly established and current exposure levels do not appear to put the population at risk. There is also some evidence that areas having elevated nitrate in drinking water may have increased incidence of spontaneous abortion.

REMOVING NITRATE FROM DRINKING WATER

Heating or boiling water containing nitrate will not remove the nitrate, but may actually concentrate it. Options to consider if the water supply is contaminated with nitrate above the 10 mg/l level, include using bottled water for drinking, and for food and beverage preparation, or installing a home water treatment unit. Mechanical filters or chemical disinfection, such as chlorination, do not remove nitrate from water. Nitrate may successfully be removed from water using treatment processes such as ion exchange, distillation, and reverse osmosis. These treatment techniques require careful maintenance and sampling to achieve and confirm effective operation. If a treatment system is to be used, one with National Sanitation Foundation (NSF) certification should be selected. For additional information on these options, contact the Drinking Water Section of the Department of Human Services at (971) 673-0405.