

Perchlorate Fact Sheet

What is Perchlorate?

Ammonium perchlorate (NH_4ClO_4) is an inorganic chemical widely used as an oxidizer in solid propellants for rockets, missiles, fireworks and explosives. Perchlorate may thus be found in surface and ground waters around military operations, defense contracting, manufacturing facilities, and areas where blasting agents have been used. Perchlorate may also be generated in small amounts within existing water treatment processes. Perchlorate has also been found at low levels in some groundwaters where no anthropogenic source is apparent. Perchlorate is highly mobile in water and can persist for many decades under typical ground and surface water conditions.

How Might I be Exposed to Perchlorate?

Human exposure to perchlorate can occur if contaminated water is consumed directly, is used to make beverages such as tea, coffee or formula, or is used to cook foods that absorb a significant amount of water. Perchlorate has also been detected in several types of foods and beverages (e.g. some lettuces and milk, depending on where they are from), possibly from use of perchlorate contaminated irrigation water or feeds. Infants can be exposed to perchlorate through breast milk, depending on their mother's exposure. Absorption of perchlorate as a result of skin contact during showering and bathing is not a concern because perchlorate is completely ionized in water. However, children may be incidentally exposed by ingesting water during bathing. Showering only becomes of concern, due to the possible inhalation of aerosolized particles in the air, when perchlorate concentrations in water reach many hundreds of parts per billion.

What Are The Health Effects Of Perchlorate?

At sufficient doses, perchlorate disrupts normal function of the thyroid gland. It interferes with iodide transport into the thyroid gland, decreasing the availability of iodide needed for the synthesis of thyroid hormones, which are essential for metabolism and normal growth and development. The impacts of disrupting thyroid hormone synthesis are greatest on pregnant women and their developing fetuses, infants, children, and individuals who have low levels of thyroid hormones.

Adverse health effects associated with perchlorate exposure at sufficient doses are expected to be similar to those caused by iodine deficiency in humans. In areas of inadequate iodine intake, thyroid hormone synthesis and secretion decline, and the effects manifested in such iodine-deficient individuals, depending on the severity of the iodine deficiency, include: impairment in physical development, behavior, movement, speech, hearing, vision, and intelligence. Other effects of iodine deficiency also include signs and symptoms of hypothyroidism and enlargement of the thyroid gland. Impaired brain development and lower IQ were observed in children born to even mildly or moderately iodine deficient mothers.

Why Did MassDEP Choose To Address Perchlorate Risk?

In April 2002, the Bourne Water District (BWD) asked MassDEP for guidance on perchlorate, after the compound was detected in their wells. At that time, no drinking water standard had been set by either the U.S. Environmental Protection Agency (USEPA) or the state. Given the seriousness of the potential adverse effects associated with perchlorate and the fact that children were at risk, combined with uncertainty over the schedule of federal efforts to establish a drinking water standard for perchlorate, MassDEP provided interim guidance to the BWD and initiated the standard setting process.

Why Is It Necessary For MassDEP To Set Perchlorate Standards?

MassDEP is establishing perchlorate standards to ensure that public health is protected and to facilitate the cleanup of perchlorate sources.

What Perchlorate Standards Are Being Set By MassDEP?

MassDEP is promulgating a drinking water standard or Maximum Contaminant Level (MCL) of 2 ppb. This is the first drinking water standard for perchlorate in the nation. Perchlorate soil and groundwater standards for hazardous waste site cleanup under the Massachusetts Contingency Plan or MCP (MGL Chapter 21E) are also being established, along with the adoption of a reference dose (RfD) of 7×10^{-5} mg/kg-day to be used for site-specific risk assessments.

Will MassDEP Update its Perchlorate Standards as New Information Becomes Available in the Future?

MassDEP is committed to reviewing the MCL every 6 years and will revise it as appropriate.

Why is MassDEP's Drinking Water Standard Lower than EPA's Drinking Water Equivalent Level of 24.5 ppb?

It is important to note that the US EPA has not yet set a standard for perchlorate and will likely not do so for several years. US EPA's 24.5 ppb Drinking Water Equivalent Level (DWEL) value is not a final standard but is an intermediate value used to set a final standard. It does not account for any other source of exposure. Final drinking water standards, including our own, consider other sources of exposure, including those from foods, which have been documented to occur. Because MassDEP considered other exposures, our MCL is lower than US EPA's DWEL value.

Why Did MassDEP Select a Lower Reference Dose for Perchlorate than US EPA?

The reference dose is the total daily dose of a chemical, from all sources, that is anticipated to be without risk of adverse effect. The US EPA adopted the reference dose value cited in the NAS perchlorate report that was supported by the majority of the NAS committee. It is important to note that the NAS committee was not unanimous in their views on this matter. One member concluded that perchlorate exposures should be lower than the majority recommended because of uncertainties in the science. This dissenting view would lead to a drinking water limit of about 2 ppb using MassDEP's established protocol. Although MassDEP scientists agreed with many of the findings in the NAS Perchlorate report, important new data became available after the NAS committee completed their assessment. This new data demonstrated that perchlorate is found in breast milk at significant levels, likely attributable to perchlorate in drinking water and foods, and supported MassDEP's conclusion that a lower exposure limit was needed in order to protect nursing newborn babies.

What is the Basis of MassDEP's Perchlorate Standards?

MassDEP's perchlorate MCL is based on an assessment of the health risks of perchlorate using a thorough analysis of perchlorate's toxicity, including review of the NAS perchlorate report, by MassDEP toxicologists with extensive input from a science advisory committee comprised of academic scientists and public health professionals from other agencies. Other factors were then taken into account in selecting the final drinking water standard. These included the scope of the problem; the availability and feasibility of testing and treatment technologies; and data that demonstrated that perchlorate can be introduced into drinking water when certain disinfection chemicals are used. This latter issue was of particular concern. Disinfection of drinking water has been called one of the most important public health accomplishments of the past century. To ensure that this benefit is not compromised due to the possible introduction of perchlorate from the use of disinfection chemicals, MassDEP has chosen to set the MCL at a level that does not create any disincentive on the part of public water systems to continue or, when necessary, introduce disinfection to counter microbial contamination and associated risks to public health. The selected MCL of 2.0 ppb was determined to provide the best overall protection of public health, considering the benefits of disinfection, while retaining a margin of safety to account for uncertainties in the available data

Is it Feasible to Meet the Standard of 2 ppb?

Statewide occurrence monitoring conducted in 2004, using then newly improved analytical techniques, identified relatively few contaminated water supplies, suggesting a manageable aggregate cost for clean-ups. Treatment technologies have also been demonstrated to be capable of removing perchlorate in drinking water to low levels.