



This Fact Sheet is part of a series of chemical fact sheets to address community concerns on public health and environmental issues associated with the Massachusetts Military Reservation (MMR).

Contributing Agencies

U. S. Environmental Protection Agency

Massachusetts Department of Environmental Protection

Air Force Center for Environmental Excellence

Massachusetts Department of Public Health

Army Environmental Center Impact Area Groundwater Study Program

Agency for Toxic Substances and Disease Registry

Where can I get more information about this chemical?

EPA perchlorate web site:
<http://www.epa.gov/ogwdw/ccl/perchlor/perchlo.html>

California Department of Health Services web site:
<http://www.dhs.ca.gov/ps/ddwem>

Call the Agency for Toxic Substance and Disease Registry 24-hour information service at (888) 42A-TSDR.

For more information on the occurrence of perchlorate at MMR, contact Kris Curley, Impact Area Groundwater Study Program: 508-968-5626

This fact sheet is specific to the perchlorate contamination situation at MMR

environmental MATTERS

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What is perchlorate?

Perchlorate is a compound consisting of one chlorine and four oxygen atoms. It is produced for industrial uses and is also present as part of certain rare geologic deposits. Perchlorate can exist as the solid salts of ammonium, potassium, or other metals. Approximately 90% of the perchlorate produced by U.S. manufacturers has been for use as an oxidizer in solid rocket fuel, and most of the remaining 10% is used in military and civilian explosives, munitions, and pyrotechnics, (which includes items such as flares and smoke grenades).

Why is perchlorate of concern?

- Perchlorate has potential adverse health effects
- Perchlorate may have an effect on ecosystems
- Perchlorate is difficult to remove with standard water-treatment processes
- Perchlorate salts readily dissolve in water and can persist for many decades under typical groundwater and surface water conditions

How might perchlorate affect one's health?

Perchlorate interferes with iodide uptake into the thyroid gland. Because iodide is an essential component of thyroid hormones, perchlorate disrupts how the thyroid functions. In adults, the thyroid helps to regulate metabolism. In children, the thyroid plays a major role in proper development, in addition to metabolism. Impairment of thyroid function in expectant mothers may impact the fetus and newborn, and result in effects including changes in behavior, delayed development and decreased learning capabilities. Changes in thyroid hormone levels also may result in thyroid gland tumors.

Where is perchlorate found at the Massachusetts Military Reservation (MMR)?

Several varieties of pyrotechnics, propellants and munitions formerly used at MMR contained perchlorate. Early sampling and analysis of groundwater monitoring wells at MMR have produced several detections of perchlorate. A majority of the detections, to date, have occurred in the vicinity of the Demolition Area 1 plume, in monitoring wells in the Southeast Ranges, in the Central Impact Area, and in one monitoring well near the Landfill-1 (LF-1) source area on MMR. In the fall of 2001, perchlorate was detected in wells on MMR situated close to the border with the neighboring town of Bourne. Following these detections, testing in this area was accelerated, including testing of the Bourne drinking-water supply wells. Testing in October 2001, January 2002, and February 2002 did not show detections of perchlorate in the Bourne water supply wells. In early 2002, perchlorate was detected in the Bourne Water District's early warning wells. These wells are designed to test the quality of water that will be approaching the water supply wells. In March and April 2002, perchlorate was detected in three water supply wells for the Bourne Water District. These wells were shut down prior to or immediately after the detections. Subsequent tests of the water distribution system showed that perchlorate was not present in the drinking-water supply system. The detections in the Bourne water-supply wells have been below 1 part per billion (ppb). This level is below both the current MMR relevant standard of 1.5 ppb being used by the Environmental Protection Agency (EPA) for MMR and the Massachusetts Department of Environmental Protection (MADEP) interim drinking water advice for Bourne of 1 ppb. However, most of the detections of perchlorate found on MMR do exceed the 1.5 ppb level. The Groundwater Study Program, together with EPA and MADEP, are working with the Bourne Water District to address these detections and to identify potential perchlorate source areas at MMR.

What standards exist to protect public health and the environment?

A federal or state regulatory level for perchlorate in drinking water has not yet been established. The first step in establishing a drinking water standard for a compound, like perchlorate, is to establish a reference dose (RfD). A reference dose is defined as the estimated dose to which a person could be exposed to daily over a long-term period of time without likely experiencing an appreciable risk of an adverse health effect. In the early 1990's, EPA released a provisional RfD for perchlorate, which is undergoing revision, in order to reflect the current state of scientific knowledge. EPA hopes to complete the revision process for perchlorate by 2003. EPA also is collecting information on the occurrence of perchlorate in public water supplies across the country, which will assist the agency in decisions regarding the need for future drinking water regulations. In the meantime, in July 2001, EPA New England established an MMR "relevant standard" of 1.5 ppb for perchlorate in groundwater for the Impact Area Groundwater Study Program. This standard is based on the provisional RfD. EPA New England has directed the Groundwater Study Program to use the 1.5 ppb number at MMR to make decisions regarding the effectiveness of remediation technologies for perchlorate in groundwater until a final RfD is made available, at which time EPA New England may revisit the 1.5 ppb value.

Laboratories used to evaluate samples taken from groundwater at MMR have the ability to detect perchlorate as low as 0.35 ppb, using some of the most sensitive detection procedures in the country. The effectiveness of technologies to be used in future cleanup activities will be evaluated by their ability to clean the groundwater of perchlorate to the 1.5 ppb target. This requirement will be reviewed when the EPA formally establishes a national regulatory level.

Based upon its interpretation of EPA's most recent draft toxicological evaluation, and its review of perchlorate detections in groundwater in Bourne, the Massachusetts Department of Environmental Protection has recently recommended to the Bourne Water District, as a precaution, that pregnant women, infants, children up to the age of 12, and individuals with hypothyroidism do not consume drinking water containing concentrations of perchlorate exceeding 1ppb. Potential skin and breathing exposures through showering and bathing are not seen as harmful, even above the 1 ppb value.

The Agency for Toxic Substances and Disease Registry (ATSDR) agrees that a 1 ppb guidance level is health protective. ATSDR is currently developing a Toxicological Profile and Minimal Risk Level (MRL) for perchlorate. This information is not yet available.

What methods are available for the treatment of perchlorate in water?

Since perchlorate was discovered in water supplies in California, Nevada, and Arizona, much progress has been made in developing removal/reduction treatment technologies. Most of the attention has been directed at two technologies: biological treatment and ion exchange. In the biological treatment process, microbes destroy perchlorate by converting it to water and chloride, a component of table salt. In ion exchange, the perchlorate ion is selectively removed and replaced by safe ions, usually chloride. In San Gabriel, CA, ion exchange is currently being utilized to remove perchlorate from the local drinking-water supply. The Groundwater Remediation Technologies Analysis Center in Pittsburgh, PA, (a joint EPA, Department of Defense and Department of Energy clearinghouse) is collecting data on perchlorate treatment studies to provide a stronger scientific understanding of the effectiveness of perchlorate treatment. A summary of 65 perchlorate treatment studies is available online at www.gwrtac.org. The Groundwater Study Program is currently researching treatment methods for perchlorate.

For more information contact:

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