



PERCHLORATE PAST & PRESENT

2020 UPDATE

This fact sheet provides information about the chemical perchlorate. It explains how NASA carefully controls the use of perchlorate today to be fully protective of human health and the environment. It also describes NASA's ongoing efforts to address perchlorate releases to the environment from past practices.

Production of man-made perchlorate first began in the United States in the mid-1940s, primarily for use in military applications. Today perchlorate is used by the military, NASA, and the commercial space industry in solid propellants and explosives. It is also a component of fireworks, road flares, blasting materials, airbags, matches, and other commercial products. Perchlorate also occurs naturally, particularly in arid areas such as the Southwest United States. Naturally formed perchlorate has been found in some agricultural fertilizers used in the US during the last century. Perchlorate is a salt that is highly soluble in water. Because it adheres poorly to mineral surfaces and organic material it can be very mobile in certain types of soils, and in surface and groundwater. Perchlorate has entered into the environment primarily from improper storage over the years as well as from past disposal practices.

Past and Current Use

Historically, NASA space programs have benefited from using perchlorate because its chemical properties make it an ideal oxidizer for stable and safe propellants. NASA's historical use of perchlorate has included large rocket motor propellants [see side bar]; and current use includes propellants in smaller solid motors used in applications unsuitable for liquid propellants; in small explosives used during launch; and in oxygen candles used in emergencies on the International Space Station.

Addressing Past Practices

All current use of perchlorate by NASA is carefully controlled to protect human health and the environment. Part of this commitment includes environmental monitoring. Shortly after perchlorate sampling protocols were improved in the late 1990s, NASA began to look for perchlorate at its Centers across the country.

Pathways for Human Exposure

Humans may be exposed to perchlorate primarily through drinking water and consuming food containing perchlorate. At high doses, perchlorate is known to interfere with iodide uptake into the thyroid gland, disrupting metabolism in adults, posing a potential risk to developing fetuses, and affecting development in some infants and young children.

Space Shuttle

The Space Shuttle was engineered to take advantage of perchlorate's oxidizing properties. Each launch required two reusable solid rocket boosters containing perchlorate-based propellant. These boosters provided most of the thrust needed to lift the Shuttle System from the launch pad through the upper atmosphere. Rapid combustion during the launch phase consumed virtually all of the perchlorate during the first two minutes of flight. After 25 years of Space Shuttle launches from Kennedy Space Center, environmental monitoring has detected no perchlorate in the environment around the launch pads or rocket assembling areas. Launches of the Space Shuttle ceased in 2011.

Sampling detected elevated perchlorate levels in soil or groundwater in four locations at or near NASA Centers. NASA takes responsibility for cleanup of perchlorate at NASA sites where there is a documented human exposure pathway. [See sidebar.]

Regulatory Status

In 2011, the United States Environmental Protection Agency (EPA) announced its decision to develop an enforceable federal drinking water standard called a Maximum Contaminant Level, or MCL. In accordance with the Safe Drinking Water Act, EPA reviewed monitoring data collected under the Unregulated Contaminant Monitoring Rule (UCMR1 2001-2005) and conducted peer reviews of the science on perchlorate occurrence and health effects in the process toward development of a proposed MCL. In 2019, EPA released a notice for public comment on the proposed options for regulating perchlorate in drinking water. Following review of public comments, EPA concluded that there is infrequent occurrence of perchlorate at the levels of public health concern and thus decided not to develop an MCL. For more information, visit https://www.epa.gov/sites/production/files/2020-05/documents/perchlorate_reductions_5.14.20.pdf.

According to EPA, perchlorate levels have decreased in water sources and drinking water due to a number of mitigation actions:

Two states with 60% of the perchlorate contamination reported in UCMR1, adopted a perchlorate MCL, enforceable at the state level, and detection of perchlorate has decreased. The Massachusetts MCL for perchlorate in drinking water is 2 parts per billion (ppb); California's MCL is 6 ppb.

Improved water system operations at the state and local level: some contaminated wells were closed, some new wells were drilled, and some local treatments were implemented.

Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), EPA has been overseeing some 60 Superfund sites conducting perchlorate remediation activities.

Addressing proper storage and handling of water disinfection products through limited storage time, adequate solution pH range, sunlight exposure avoidance, controlled storage temperature, and dilution.

NASA is addressing perchlorate in the environment from past practices by cleaning up groundwater at the Jet Propulsion Laboratory (JPL) in California under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). NASA has funded construction and operation of three groundwater treatment systems to remove unwanted chemicals including perchlorate. One system is located on the JPL facility to remove chemicals deep beneath the site near the former release, and two systems are located nearby treating water from drinking water production wells. Although there is not a federal drinking water standard, NASA is committed to meeting California's perchlorate MCL of 6 ppb as part of NASA's overall groundwater cleanup at JPL. For more information, visit <https://jplwater.nasa.gov>

NASA remains committed

to cleaning up perchlorate due to past practices and with any current and future perchlorate use.

NASA will continue to follow

proper handling, reuse, and disposal requirements to be fully protective of human health and the environment.

For more information contact

Merrilee Fellows

NASA Manager for Community Involvement | (818) 393-0754 | mfellows@nasa.gov