



# Contaminant Focus

## Perchlorate

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## Environmental Occurrence

Perchlorate salts have been used in a wide variety of applications, including explosives, stick matches, highway safety flares, fireworks and other pyrotechnics; however, approximately 90 percent of the manufactured volume is currently used as a solid rocket fuel oxidizer. To a limited extent, perchlorate also occurs naturally in Chilean nitrate deposits and has been detected in fertilizer derived from those deposits.



Perchlorate manufacturing facilities and users have been identified in at least 44 states (1), and groundwater, surface water, and/or soil contamination has been reported in 35 states and Puerto Rico (2), with California having the greatest number of confirmed releases. The contamination is usually associated with rocket manufacturers or military facilities. One of the largest identified releases occurred at a former rocket fuel production facility in Henderson, NV that exploded in 1988. The resulting release contaminated the groundwater, which in turn flows into the Las Vegas Wash, nearby Lake Mead, and the Colorado River. Both of these surface waters are sources of public water supplies. Remediation efforts have focused on intercepting the groundwater plume.

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After a survey of drinking-water wells in western Texas showed perchlorate to be present in better than 80% of the wells tested over an area of 60,000 square miles, the Texas Commission on Environmental Quality turned to researchers at Texas Tech University for help to determine where the perchlorate was coming from. Most of the levels of perchlorate found were quite low, but ~25% were equal to or greater than 4 ppb. After the investigators determined that rocket fuel, flares, fireworks, explosives, and Chilean fertilizer were unlikely to have been potential sources in some areas of the region, they concluded that the evidence points to perchlorate sometimes being generated naturally in the atmosphere or by surface oxidation. (3,4).

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Sources:

1. Logan, Bruce E. "[Assessing the outlook for perchlorate remediation.](#)" *Environmental Science and Technology* 35 (2001): 482A - 487A.
2. U.S. EPA. [Known Perchlorate Releases in the U.S. - December 10, 2004.](#)
3. Erickson, Britt A. [Tracing the origin of perchlorate.](#) *Analytical Chemistry*, 388A-389A, 1 Nov 2004. 
4. Jackson, W.A., et al. [Distribution and Potential Sources of Perchlorate in the High Plains Region of Texas.](#) Texas Tech University Water Resources Center, 186 pp, 2004. 

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**Maps**

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**[California Perchlorate Study Discovery Areas, 2004](#)**

Contact: Kevin Mayer, [mayer.kevin@epa.gov](mailto:mayer.kevin@epa.gov)



**[Greater Los Angeles Basin Area, 2004](#)**

Contact: Kevin Mayer, [mayer.kevin@epa.gov](mailto:mayer.kevin@epa.gov)



**[Perchlorate Manufacturers and Users as of April, 2003](#)**



**[Perchlorate Occurrence in Nevada](#)** (slide presentation)

Brenda L. Pohlmann



Division of Environmental Protection  
State of Nevada Department of Conservation and Natural Resources

### [National Perchlorate Detections as of September 2004](#)

#### [Perchlorate Occurrence Mapping](#)

Phillip Brandhuber and Sarah Clark.  
American Water Works Association, 38 pp, Jan 2005



The national occurrence of perchlorate in drinking water was analyzed and geographically mapped by compiling data from existing perchlorate occurrence surveys made by U.S. EPA and the states of Arizona, California, Massachusetts, and Texas. Perchlorate occurrence was found to be national in scope, with detections reported in 35 states and Puerto Rico. Geographically, the highest density of perchlorate detection was found in southern California, west central Texas, along the east coast between New Jersey and Long Island, and in Massachusetts. The compound was often detected in drinking water in areas for which there was no documented environmental release of perchlorate.

### [For Further Information](#)

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#### [Aberdeen Proving Ground Detects Perchlorate in Aberdeen](#)

U.S. Army, 2002  
Contact: DOIM Hotline, [hotline@apg.army.mil](mailto:hotline@apg.army.mil)

#### [Alternative Causes of Widespread, Low Concentration Perchlorate Impacts to Groundwater](#)

Strategic Environmental Research and Development Program, Arlington, VA.  
54 pp, 2005.



This review focuses on five major perchlorate-containing products for which significant quantity and use information is available: Chilean nitrate fertilizers, fireworks, safety flares, blasting explosives, and electrochemically-prepared chlorine products.

#### [Atmospheric Processes May Create Perchlorate](#)

Rebecca Renner.  
Environmental Science & Technology, 2 Feb 2005

#### [Chlorite and Chlorate in Drinking-Water: Background Document for Development of WHO 'Guidelines for Drinking-Water Quality'](#)

World Health Organization, WHO/SDE/WSH/05.08/86, 31 pp, 2005.



Some drinking water treatment systems use a chlorine dioxide generating process that if imperfectly configured or operated may produce chlorite and other undesirable byproducts, such as chlorate, hydrogen peroxide, and perchlorate, which could affect the drinking water supply.

**[Comment on "Perchlorate Identification in Fertilizers"](#)**

Urbansky et al.  
Env. Sci & Tech. VOL. 34, NO. 20, 2000

**[Distribution and Potential Sources of Perchlorate in the High Plains Region of Texas](#)**

W.A. Jackson, K. Rainwater, T. Anderson, T. Lehman, R. Tock, S. Rajagopalan, and M. Ridley.  
Texas Tech University Water Resources Center, 186 pp, 2004.



- [Report appendices](#)

**[Ecological Impact/Transport and Transformation of Perchlorate](#) (slide presentation)**

Long, C., et al.  
U.S. Air Force and U. S. Environmental Protection Agency.  
Contact: Cornell Long, [cornell.long@brooks.af.mil](mailto:cornell.long@brooks.af.mil)

**[Exploratory Data on Perchlorate in Food](#)**

U.S. Food and Drug Administration, Center for Food Safety and Applied Nutrition.

**[Fact Sheet: Perchlorate](#)**

U.S. Army  
(Site sponsored by DoD/EPA/ State of Massachusetts. Fact sheet covers perchlorate in the groundwater at the Massachusetts Military Reserve.)

**[Known Perchlorate Releases in the U.S. - December 10, 2004](#)**

U.S. EPA, Office of Federal Facilities Restoration and Reuse.  
Contact: Kevin Mayer, [mayer.kevin@epa.gov](mailto:mayer.kevin@epa.gov)

**[Massachusetts Drinking Water Supply Information: Perchlorate](#)**

Bureau of Resource Protection  
Massachusetts Department of Environmental Protection

**[The Nature of Perchlorate \(General Background Information\) and the National Occurrence of Perchlorate](#)**

Mayer, K.  
U. S. Environmental Protection Agency, Region 9  
Contact: Kevin Mayer, [mayer.kevin@epa.gov](mailto:mayer.kevin@epa.gov)

**[Perchlorate as an environmental contaminant](#)**

Urbansky, E.  
Environmental Science & Pollution Research 9(3) pp. 187-192, 2002.



**[Perchlorate chemistry: Implications for analysis and remediation](#)**

Urbansky, E.  
CRC Press, 1998

**[Perchlorate: Draft Background Documents](#)**

California Department of Toxic Substances Control, 2005

[Sources of Perchlorate in the Environment \(11 pp\)](#)



[Perchlorate Containing Products \(18 pp\)](#)

[Manufacture and Distribution \(5 pp\)](#)

[Known Perchlorate Sites and Cleanup Operations \(36 pp\)](#)

Though the focus of this paper is concentrated primarily on sites in California, perchlorate cleanup operations at sites in Alabama, Maryland, Massachusetts, Nevada, and Texas are also discussed.

**[Perchlorate Environmental Contamination: Toxicological Review and Risk Characterization](#)**

U. S. Environmental Protection Agency, 2002  
Contact: Annie M Jarabek, [jarabek.annie@epa.gov](mailto:jarabek.annie@epa.gov)

**[Perchlorate in Arizona: Occurrence Study of 2004](#)**

Perchlorate Task Force [Arizona].  
Arizona Department of Environmental Quality, 83 pp., 2004.

**[Perchlorate in Pleistocene and Holocene Groundwater in North-Central New Mexico](#)**

Plummer, L. Niel  
Environmental Science & Technology 40(6) pp. 1757-1763, 2006

**[Perchlorate in the Lower Umatilla Basin Groundwater Management Area: Issues and Answers](#)**

Phil Richerson.  
Oregon Department of Environmental Quality. DEQ 04-ER-011a, 3 pp., 2004.  
Phil Richerson, [Richerson.Phil@deq.state.or.us](mailto:Richerson.Phil@deq.state.or.us)

**[Perchlorate levels in samples of sodium nitrate fertilizer derived from Chilean caliche](#)**

Urbansky et al.  
Environmental Pollution 112 (2001) 299-302



**[Perchlorate Occurrence](#)** (slide presentation)

Mayer, K.

U. S. Environmental Protection Agency, Region 9

Contact: Kevin Mayer, [mayer.kevin@epa.gov](mailto:mayer.kevin@epa.gov)**[Preliminary Analyses for Perchlorate in Selected Natural Materials and Their Derivative Products](#)**

G.J. Orris, G.J. Harvey, D.T. Tsui, and J.E. Eldrige

Open-File Report 03-314, United States Geological Survey, 2003

Contact: Greta J Orris, [greta@usgs.gov](mailto:greta@usgs.gov)**[Site-Specific Summaries of Perchlorate Sampling Results at DoD Sites](#)**

Department of Defense Perchlorate Work Group

**[Survey of Fertilizers and Related Materials for Perchlorate \(ClO<sub>4</sub><sup>-</sup>\): Final Report](#)**

E.T. Urbansky, T.W. Collette, W.P. Robarge, W.L. Hall, J.M. Skillen, P.F.

Kane.

EPA 600-R-01-047, 34 pp, 2001.

Contact: Tim Collette, [collette.tim@epa.gov](mailto:collette.tim@epa.gov)

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