Association of State and Territorial
ASTSWMO
Solid Waste Management Officials

PERCHLORATE POLICY UPDATE

FINAL

APRIL 2011

Federal Facilities Research Center
Emerging Issues Focus Group

ASTSWMO
444 North Capitol Street, N.W., Suite 315
Washington, D.C. 20001
Tel: (202) 624-5828 Fax: (202) 624-7875
www.astswmo.org

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1.0 INTRODUCTION

In April, 2004, the Association of State and Territorial Solid Waste Management Officials (ASTSWMO) Emerging Issues Focus Group (formerly the Policy & Technology Focus Group) began researching perchlorate issues, standards promulgation, and the inherent challenges and impacts of perchlorate assessment and remediation on State and Territorial (States) programs. In July 2005, the Focus Group published the "Perchlorate Issues Document," which provided a compilation of State- and Federal-specific policy and technical resources regarding this emerging contaminant. This document provides State and Federal policy updates and serves as a supplement to ASTSWMO's 2005 Document.

In the past few years, Federal agencies and several States have developed new policies and promulgated drinking water and/or cleanup standards for perchlorate. This report provides readers with updated information on State and Federal policies, guidance, and resources specific to assessing and remediating perchlorate while performing environmental cleanups. It is intended to serve as a source of information to assist States as they prepare to deal with the environmental assessment and cleanup at sites potentially or currently contaminated with perchlorate, and to assist States and Federal Agencies that may be considering regulatory or policy development for this constituent of concern. While this report does not provide details on technical developments such as sampling and analysis processes, and remedial technologies, references to additional information about technical developments and strategies are provided throughout this document.

PERCHLORATE QUICK FACTS[1]

What is perchlorate?
Perchlorate (or perchlorates) (ClO_4^-), is a "catchall" term for the solid salts of ammonium, lithium, magnesium, potassium and sodium perchlorate. Percholorates are colorless and odorless, are naturally occurring and man-made, and can occur either as a solid or dissolved in water.

What is the problem with perchlorate?
Perchlorate is highly stable, soluble in water, and very mobile in soils. These characteristics can result in leaching from soil to groundwater. Once dissolved in water, perchlorate is difficult to remove and can persist in the environment for several years.

How is perchlorate used?
Large-scale production of perchlorates began in the 1940's during World War II for use as an oxidant in rocket and missile propellants. Currently, perchlorate is also used in the production of blasting agents, fireworks, road flares, textile bleaching agents, fertilizers, matches, ammunitions, airbags, and chrome plating, among other uses. Perchlorates were once used to treat thyroid disorders.

How does exposure to perchlorate affect human health?
Perchlorate interferes with the uptake of iodide by the thyroid gland. Iodide is an essential component of thyroid hormones needed to support and regulator normal body functions and development. It is assumed that humans exposed to excessive amounts of perchlorate over a long time period may develop a decreased production of thyroid hormones, which leads to a condition known as hypothyroidism..

[1]Agency for Toxic Substances and Disease Registry (ATSDR), *ToxFAQs™ for Perchlorates,* September 2008. http://www.atsdr.cdc.gov/toxfaqs/tf.asp?id=893&tid=181

2.0 THE PERCHLORATE DILEMMA

As of October 2009, perchlorate has been detected at private and federal facilities in 45 States, three territories, and the District of Columbia (Figure 1).[1]

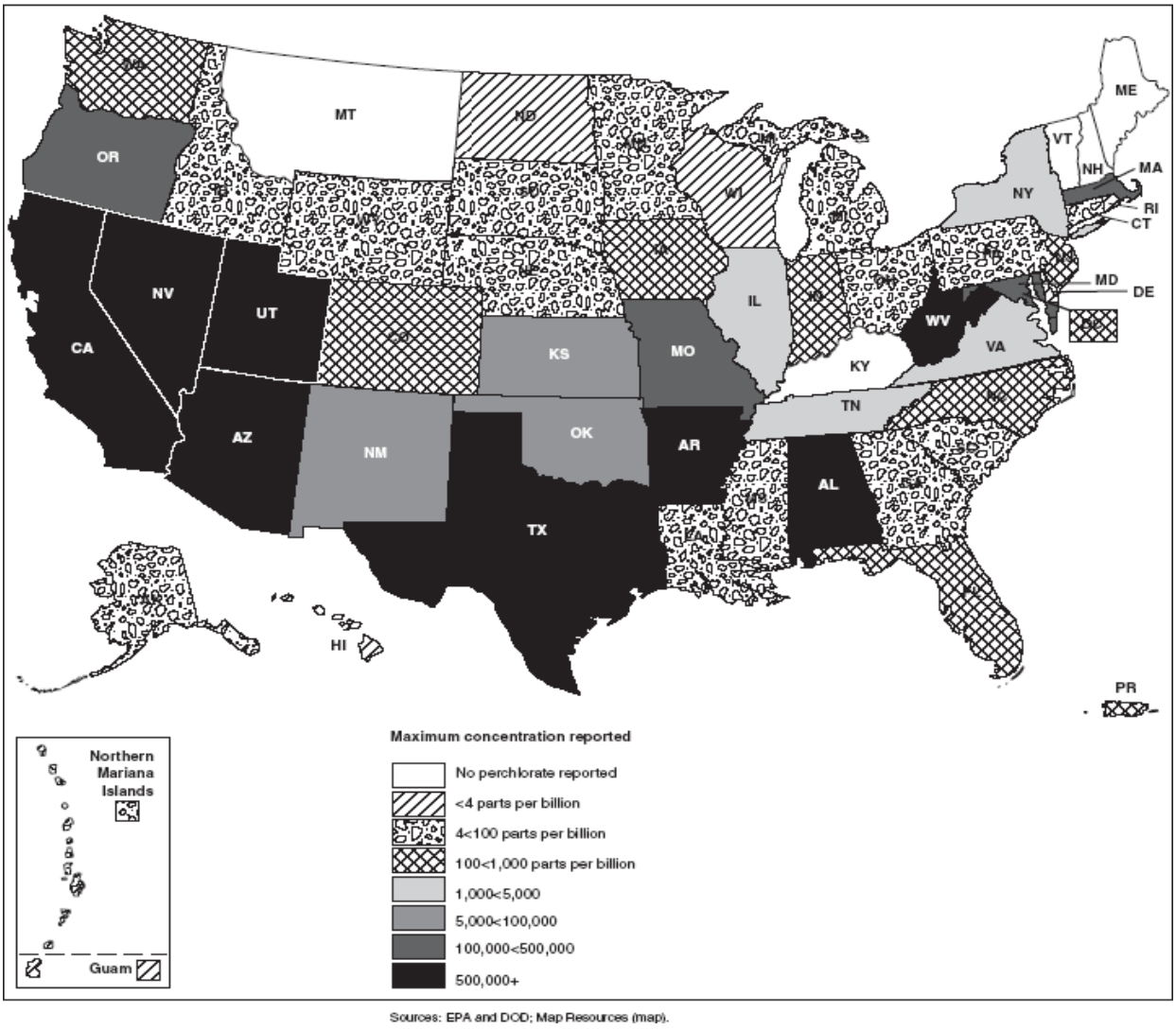

Figure 1: Perchlorate Occurances as of October 2009 (GAO-10-769)

In 2010, the General Accountability Office (GAO) provided a summary of perchlorate detections at various types of facilities based on information gathered by U.S. Environmental Protection Agency (EPA), Department of Defense (DoD), National Aeronautics and Space Administration (NASA), and Department of Energy (DOE):

[1] Government Accounting Office. "PERCHLORATE: Occurrence Is Widespread But At Varying Levels; Federal Agencies have Taken Some Actions to Respond to and Lessen Releases" GAO-10-769, August 12, 2010, www.gao.gov/new.item/d10769.pdf

- **U.S. EPA, Unregulated Contaminant Monitoring Regulation (UCMR) Data, 2001 – 2005.**[2]
    - 3,865 public drinking water systems sampled.
    - Minimum detection level (MDL) of 4 parts per billion (ppb).
    - Perchlorate detected at or above 4 ppb at 4.1% of tested systems, ranging from 4 ppb to 160 ppb.

- **U.S. EPA, National Priorities List Data as of June 2010.**
    - Perchlorate detected at 40 NPL sites: 25 federal facilities, and 15 private facilities.
    - For private sites, detections ranged from 13 to 682,000 ppb.

- **DoD, 1997 – 2009.**
    - 407 DoD installations sampled.
    - MDL of less than 1 ppb.
    - Perchlorate detected at or above MDL at 70% of tested installations, ranging from MDL to 2.6 million ppb.
    - Perchlorate detected at or above 15 ppb, DoD's current screening level, in approximately 20% of tested installations.

- **NASA, 1997 – 2009.**
    - Seven NASA facilities sampled.
    - Perchlorate detected at four facilities, with three facilities detecting at or below 4.4 ppb, 3.7, and 2.6 ppb, respectively, and one facility detecting at 13,300 ppb.

- **DOE, 1998 – 2009.**
    - Five DOE facilities sampled.
    - Perchlorate detected at all five facilities, ranging from less than 1 ppb to 3,090 ppb.

According to GAO, perchlorate occurrences at DoD, NASA, and DOE facilities were due to rocket, munitions, and other explosives testing, past waste disposal practices. Releases are found primarily at explosives testing sites, maintenance facilities, and waste disposal areas.

[2] http://water.epa.gov/lawsregs/rulesregs/sdwa/ucmr/data.cfm

3.0 REGULATORY AND GUIDANCE UPDATES

3.1 U.S. Environmental Protection Agency

Regulatory Developments

For a number of years there has been debate within the U.S. EPA as to whether to regulate perchlorate. EPA has included perchlorate on its three Contaminant Candidate Lists (CCLs) in 1998, 2005, and 2009, respectively. The CCL is required by the Safe Drinking Water Act (SDWA), and identifies and lists unregulated contaminants which may require drinking water regulations in the future.[3] Since ASTSWMO published its 2005 Perchlorate Issues Document, EPA has also sought input about perchlorate from stakeholders on multiple occasions, including:[4]

- 72 FR 24016. "Drinking Water: Regulatory Determinations Regarding Contaminants on the Second Drinking Water Contaminant Candidate List--Preliminary Determinations." May 1, 2007 [EPA-HQ-OW-2007-0068].

- 73 FR 60262. "Drinking Water: Preliminary Regulatory Determination on Perchlorate." October 10, 2008 [EPA-HQ-OW-2008-0692].

- 74 FR 41883. "Drinking Water: Perchlorate Supplemental Request for Comments." August 19, 2009 [EPA-HQ-OW-2009-0297].

The 2008 preliminary regulatory determination for perchlorate indicated "that perchlorate did not occur with frequency, and at levels of public health concern and the development of a regulation did not present a meaningful opportunity for health risk reduction for persons served by public water systems." EPA received over 39,000 public comments to their three requests for comments on regulatory determinations for perchlorate.[5] EPA published the Final Comment Response Document for the Regulatory Determination for Perchlorate, in January 2011, which is available at Regulations.gov, Docket and Document ID: EPA-HQ-OW-2009-0297-0681.

On February 2, 2011, EPA announced that the agency would regulate perchlorate under the SDWA. Once EPA makes a final determination to regulate a contaminant in drinking water, SDWA requires that the Agency issue a proposed national primary drinking water regulation (NPDWR). The proposed NPDWR will be issued within 24 months of the February 2011 announcement, and a final NPDWR will be issued within 18 months of the proposal. The process will include receiving input from key stakeholders as well as submitting any formal rule to a public comment process.[6,7]

[3] http://water.epa.gov/scitech/drinkingwater/dws/ccl/index.cfm
[4] http://water.epa.gov/drink/contaminants/unregulated/perchlorate.cfm
[5] Id.
[6] Id.
[7] http://water.epa.gov/lawsregs/rulesregs/sdwa/index.cfm

EPA released a Federal Register notice on February 11, 2011, which provides their regulatory determination on perchlorate.[8] EPA's regulatory determination is based on its review of public comments and scientific research, and states [76 FR 7762]:

> EPA has found that perchlorate may have an adverse effect on the health of persons, that perchlorate occurs or there is a substantial likelihood that perchlorate will occur in public water systems with a frequency and at levels of public health concern, and that regulation of perchlorate in drinking water systems presents a meaningful opportunity for health risk reduction for persons served by public water systems.

Guidance

On January 26, 2006, EPA issued "Assessment Guidance for Perchlorate," which recommended that EPA Regions use a preliminary remediation goal (PRG) of 24.5 ppb for perchlorate at Superfund cleanups. The PRG was reviewed by the Academy of Sciences' National Research Center (NRC), and was based on a reference dose (RfD) of 0.0007 milligram/kilogram-day (mg/kg-day) for perchlorate.[9]

EPA issued "Revised Assessment Guidance for Perchlorate" and an "Interim Drinking Water Health Advisory" on January 8, 2009. The revised guidance and advisory lowered the PRG for perchlorate to 15 ppb, which is also based on NRC recommendations.[10,11]

For additional information on EPA regulatory developments for perchlorate, including background information, scientific research, and sampling data, visit:

- EPA's Perchlorate Website:
  http://water.epa.gov/drink/contaminants/unregulated/perchlorate.cfm

- Regulations.gov:
  - EPA-HQ-OW-2008-0692
  - EPA-HQ-OW-2009-0297

- EPA Federal Facilities Restoration and Reuse Office's Perchlorate Website:
  http://www.epa.gov/fedfac/documents/perchlorate.htm

[8] 76 FR 7762 [http://federalregister.gov/a/2011-2603].
[9] http://www.epa.gov/fedfac/pdf/perchlorate_guidance.pdf
[10] http://www.epa.gov/safewater/contaminants/unregulated/pdfs/healthadvisory_perchlorate_interim.pdf
[11] http://www.epa.gov/fedfac/documents/perchlorate_memo_01-08-09.pdf

3.2 Department of Defense

The DoD Environmental Data Quality Work Group (EDQW) includes representatives from DoD Service Components tasked with developing and recommending DoD policy relevant environmental sampling, laboratory testing operations, and data quality. In August 2007, the DoD EDQW released the "DoD Perchlorate Handbook" to help DoD facilities to comply with current DoD policy specific to perchlorate sampling and testing processes, and activities at environmental restoration, cleanup and compliance monitoring programs.[12] The Handbook is intended for use by DoD remedial program managers (RPMs), DoD contractors, and field sampling personnel, and replaced the February 2004, EDQW Interim Guidance and its supplemental guidance.

The DoD Perchlorate Handbook includes guidance on using conceptual site models (CSMs) for developing project quality objectives (PQOs), designing and implementing sampling strategies and techniques, selecting appropriate and qualified analytical laboratories, and documenting and complying with the Uniform Federal Policy for Quality Assurance Project Plans (UFP-QAPP). The Handbook also suggests that "projects teams should consult the appropriate Federal, State, and local regulations to determine the current requirements at the time site-specific studies are initiated."

On April 22, 2009, DoD released a "Perchlorate Release Management Policy"[13] for use by the DoD Components at DoD installations, which include operational ranges, government owned-contractor operated (GOCO) facilities, Base Realignment and Closure (BRAC) installations, and Formerly Used Defense Sites (FUDS). This policy outlines DoD's directive that perchlorate releases shall be handled just like any other CERCLA contaminants of concerns and adopts EPA's PRG for perchlorate of 15 ppb in water where (1) there is an actual or potential drinking water exposure pathway and (2) no legally applicable or relevant and appropriate requirements (ARARs) exist under Federal or State laws. This policy supersedes previous DoD and Component-specific policies.[14]

For additional information on DoD policies, research, and references specific to perchlorate, visit the EDQW Webpage at: http://www.denix.osd.mil/edqw/Perchlorate.cfm.

3.3 States

Several States have developed regulatory and/or guidance advisory and maximum cleanup levels (MCLs) or perchlorate due to lack of national regulatory standards. States have developed levels for drinking water, groundwater, soils, and/or sediments. In 2009-2010, the Emerging Issues Focus Group requested information from States in order to document current State regulations and guidance for perchlorate, and to gather and compile State resources that may assist other States that may soon develop their own. According to information provided

[12] http://www.denix.osd.mil/edqw/upload/DODPerchlorateHandbookR1C1.pdf
[13] www.denix.osd.mil/cmrmd/upload/dod_perchlorate_policy_04_20_09.pdf
[14] http://www.p2sustainabilitylibrary.mil/p2_documents/dod_perchlorate_policy042009.pdf

by States and additional research conducted by the Focus Group, 24 States have guidance and/or regulatory cleanup levels for perchlorate. A summary of information collected is provided below in Table 1.

State associations have also developed guidance and policy on perchlorate. The Environmental Council of States (ECOS) / DoD Sustainability Work Group formed the Emerging Contaminants Task Force in 2004. The Task Force focuses on studying and developing approaches to all emerging contaminants, including perchlorate, and its participants include States, DoD, and EPA. Since 2004, the Task Force has hosted forums and developed multiple policy documents and resolutions specific to addressing challenges associated with emerging contaminants. Documents include a 2007 State survey on emerging contaminants, a 2007 Issues Paper on Risk Communication Principles, and the 2008 "Resource Triggers Paper." A compilation of their work and other resources are available on the ECOS/DoD Sustainability Work Group webpage and ECOS Emerging Contaminants Task Force webpage.

- http://www.ecos.org/section/committees/cross_media/ecos_dod_sustainability_work_group/

- http://www.ecos.org/section/committees/cross_media/ecos_dod_sustainability_work_group/emerging_contaminants_task_group/

The Interstate Technology and Regulatory Council (ITRC) formed the Perchlorate Team in 2004 to address technical issues associated with perchlorate remediation. The Team reviews perchlorate remediation technologies to evaluate their effectiveness, and works with States, Federal agencies, industry, and other parties. In September 2005, ITRC published "Perchlorate: Overview of Issues, Status, and Remedial Options," which summarizes available and emerging technologies for perchlorate remediation, and provides much information on perchlorate sources, uses, sampling and analysis, fate and transport, and toxicity. In March 2008, ITRC released "Remediation Technologies for Perchlorate Contamination in Water and Soil," to serve as a technical and regulatory reference for State and Federal regulators, consultants, project managers, and others during selection of a cleanup technology for perchlorate. The goal of the document is to help streamline the review and approval process for selecting and implementing perchlorate treatment technologies. Additional information about the ITRC Perchlorate Team and copies of these documents and other training materials are available at: http://www.itrcweb.org/teampublic_Perchlorate.asp.

Table 1: STATE-SPECIFIC PERCHLORATE ADVISORY LEVELS AND RESOURCE INFORMATION

STATE	ADVISORY LEVELS/MCLs		GUIDANCE AND POLICIES	ADDITIONAL INFORMATION AND RESOURCES
	GW/DW (ppb)	Soil (mg/kg)		
Alabama	24.5	7.8 (res.) 100 (non-res.)	Alabama Risk-Based Corrective Action Manual, April 2008 – Revision 2	
Alaska	26	DC: 96 (arctic zone) 71 (under 40") 58 (over 40") Mitigation to GW: 0.067	18 AAC 75, Oil and Other Hazardous Substances Pollution Control	Perchlorate has been identified as a contaminant of potential concern at several sites in Alaska. Where sampling has been conducted, it has not been detected above advisory levels.
American Samoa	---	---	---	---
Arizona	14*	55 (res.) 720 (non-res.)	Title 18, Chapter 7: Remedial Action	Arizona DEQ Perchlorate Studies: http://www.azdeq.gov/function/about/perch.html Information available on State research, studies, and sampling and analysis specific to perchlorate.
Arkansas	---	---	---	State uses EPA screening levels.
California	6[a]	28 (res.) 350 (non-res.)	R-16-04, Perchlorate in Drinking Water California Human Health Screening Levels for Perchlorate	California Public Health Perchlorate Website: http://www.cdph.ca.gov/certlic/drinkingwater/Pages/Perchlorate.aspx California Dept. of Toxic Substances Control Website:

STATE	ADVISORY LEVELS/MCLs		GUIDANCE AND POLICIES	ADDITIONAL INFORMATION AND RESOURCES
	GW/DW (ppb)	Soil (mg/kg)		
				http://www.dtsc.ca.gov/HazardousWaste/Perchlorate/index.cfm California EPA State Water Resources Control Board Website: http://www.waterboards.ca.gov/water_issues/programs/perchlorate/ Information available on State research, studies, and sampling and analysis specific to perchlorate.
Colorado	---	---	---	---
Connecticut	---	---	---	Connecticut is not experiencing any issues with perchlorate other than its detection at very low concentrations in areas where explosives have been used for blasting The Connecticut Department of Environmental Protection (DEP) is working with the Connecticut Department of Public Health (DPH) to determine a drinking water concentration above which perchlorate would be expected to be a human health concern in Connecticut. To date, Connecticut has not determined a numerical guideline. Connecticut has not conducted any research regarding perchlorate. However, Connecticut has collected water samples from drinking water wells and analyzed them for perchlorate near areas where explosives have been used to construct

STATE	ADVISORY LEVELS/MCLs		GUIDANCE AND POLICIES	ADDITIONAL INFORMATION AND RESOURCES
	GW/DW (ppb)	Soil (mg/kg)		
				roads for new subdivisions, as well as areas near quarries where explosives have been used. To date, perchlorate has been detected only at concentrations too small to quantify (concentrations reported by the lab with a "J" flag).
Delaware	---	---	---	---
District of Columbia	---	---	---	---
Florida	4 40 (low yield)	---	Groundwater and Surface Water Cleanup Target Levels	---
Georgia	---	---	---	---
Guam	---	---	---	---
Hawaii	26 (DW) 600 (non-DW)	0.007 (DW) 1.2 (non-DW)	Evaluation of Environmental Hazards at Sites with Contaminated Soil and Groundwater	Hawaii Batch Test Leaching Model (BTLM): http://hawaii.gov/health/environmental/hazard/pdf/ealbtlmguidanceapril07.pdf Evaluates potential leaching of contaminants from soil, including perchlorate.
Idaho	---	---	---	---
Illinois	---	---	---	In July 2010, Illinois EPA proposed a groundwater standard for perchlorate based on the new reference dose published by the U.S. EPA and recommended by the National Academy of Science (NAS).
Indiana	---	---	---	---
Iowa	4.9 (protected)	---	Iowa Statewide Standards for Contaminants	---

STATE	ADVISORY LEVELS/MCLs		GUIDANCE AND POLICIES	ADDITIONAL INFORMATION AND RESOURCES
	GW/DW (ppb)	Soil (mg/kg)		
	24 (unprotected)			
Kansas	10.9 (res.) 70.9 (non-res.)	Res.: 54.7 0.0435 (to GW) Non-res.: 1430 0.284 (to GW)	Risk-based Standards for Kansas	---
Kentucky	---	---	---	---
Louisiana	---	---	---	---
Maine	1*	20 (res.) 34 (park user) 37 (excavation) 200 (worker)	Maine Remedial Action Guidelines Maximum Exposure Guidelines for Drinking Water	---
Maryland	1 (DW)* 2.6 (GW)	5.5 (res.) 72 (non-res.)	Cleanup Standards for Soil and Groundwater	---
Massachusetts	2 (GW1) 1,000 (GW3) 10,000 (UCL)	0.9 to 5 0.1 to 5 (to GW) 50 (UCL)	310 CMR 40.0000 310 CMR 22.06	Massachusetts Department of Environmental Protection Perchlorate Information Webpage: http://www.mass.gov/dep/water/drinking/percinfo.htm Information available on State research, studies,

STATE	ADVISORY LEVELS/MCLs		GUIDANCE AND POLICIES	ADDITIONAL INFORMATION AND RESOURCES
	GW/DW (ppb)	Soil (mg/kg)		
				and sampling and analysis specific to perchlorate.
Michigan	---	---	---	Michigan has developed draft Part 201 soil and groundwater cleanup levels for perchlorate. These have not been finalized and are being used for internal screening purposes only.
Minnesota	---	---	---	---
Mississippi	---	---	---	---
Missouri	10.9	0.0145	Missouri Risk-based Corrective Action Technical Guidance	At one perchlorate site, the responsible party has determined that perchlorate concentrations are reduced through anaerobic composting. This was determined incidental to the treatment of other contaminants. Other than this, the state has not been involved with perchlorate research.
Montana	---	---	---	---
Nebraska	0.91	2 (res.) 100 (non-res.)	Voluntary Cleanup Program, Remediation Goals	---
Nevada	18*	---	Defining a Perchlorate Drinking Water Standard	Southern Nevada Perchlorate Cleanup Project http://ndep.nv.gov/bca/perchlorate05.htm Information available on State research, studies, and sampling and analysis specific to perchlorate.
New Hampshire	---	---	---	New Hampshire studied perchlorate extensively and decided not to adopt a policy or standard. New Hampshire requested that water systems voluntarily sample for perchlorate. The

STATE	ADVISORY LEVELS/MCLs		GUIDANCE AND POLICIES	ADDITIONAL INFORMATION AND RESOURCES
	GW/DW (ppb)	Soil (mg/kg)		
				contaminant was not found at significant levels in any water system samples. The State also worked with a stakeholder group to develop a process to calculate a public health goal for perchlorate. Additionally, New Hampshire collected some water samples at locations potentially impacted by perchlorate. The highest detections occurred in a swimming pool and hot tub.
New Jersey	5*	---	---	New Jersey Homeowner's Guide to Perchlorate http://www.state.nj.us/dep/watersupply/perchlorate.htm NJ Drinking Water Institute's MCL Recommendation http://www.state.nj.us/dep/watersupply/perchlorate_mcl_10_7_05.pdf
New Mexico	1*	54.8 (res.) 217 (excavation) 795 (industrial)	New Mexico Soil Screening Levels	---
New York	5* 18 (notification)		---	---
North Carolina	2*	---	Interim Maximum Allowable Concentrations	---
North Dakota	---	---	---	---
Northern Mariana Islands	---	---	---	---

STATE	ADVISORY LEVELS/MCLs		GUIDANCE AND POLICIES	ADDITIONAL INFORMATION AND RESOURCES
	GW/DW (ppb)	Soil (mg/kg)		
Ohio	---	---	---	---
Oklahoma	---	---	---	---
Oregon	---	---	---	Perchlorate in Oregon http://www.deq.state.or.us/er/PerchlorateSites.htm Information available on State research, studies, and sampling and analysis specific to perchlorate.
Pennsylvania	---	---	---	---
Puerto Rico	---	---	---	---
Rhode Island	---	---	---	---
South Carolina	---	---	---	---
South Dakota	---	---	---	State uses EPA Region 8 screening levels.
Tennessee	---	---	---	---
Texas	17 (res.) 51 (non-res.)	57 (ingestion) 500 (contact) 0.14 (0.5 acre, to GW) 0.07 (30 acre to GW) Class 3 Soil 14 (0.5 acre source are to GW) 7.0 (30 acre	Texas Risk Reduction, Protective Concentration Levels	---

STATE	ADVISORY LEVELS/MCLs		GUIDANCE AND POLICIES	ADDITIONAL INFORMATION AND RESOURCES
	GW/DW (ppb)	Soil (mg/kg)		
		source to GW)		
Utah	---	---	---	---
Vermont	2* (prevent) 4* (enforce)	---	Vermont Interim Groundwater Quality Standards	---
Virginia	15 431 (worker, Tier 3)	72	Selection of Contaminants of Concern, Virginia VRP	---
Virgin Islands	---	---	---	---
Washington	11 (GW, B) 25 (GW, C)	56 (unrestricted) 2,500 (industrial)	Washington Cleanup Levels and Risk Calculations	---
West Virginia	---	---	---	---
Wisconsin	1 (prevent) 0.1 (enforce)	---	Wisconsin Administrative Code, Chapter NR 170	---
Wyoming	---	---	---	---

1 ppb = 1 micrograms per liter
*****Advisory/Interim/Provisional Level
[a] In January 2011, California released a draft public health goal of 1 ppb.

DC - direct contact
DW - drinking water
GW - groundwater
mg/kg - milligrams per kilogram
ppb – parts per billion
res. – residential
non-res. – non residential
UCL – upper concentration limit