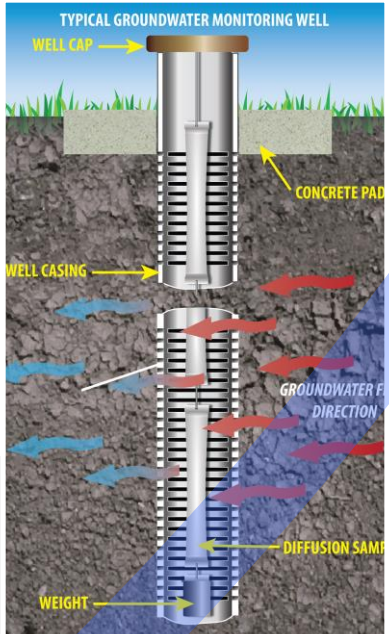


## The Perchlorate Experts

- Responsible Party Identification
- GIS and Geomatics
- Contaminant Hydrogeology
- Fate and Transport Modeling
- Risk Assessment
- Remediation Feasibility Studies
- Soil and Groundwater Remediation
- Natural Resource Damage Assessment
- Water Resources Assessment
- Source Water Assessment and Protection
- Drinking Water Treatment
- Environmental Risk Management
- Litigation Support/Expert Witness
- Forensic Engineering
- Stakeholder/Public Participation
- Regulatory Strategy

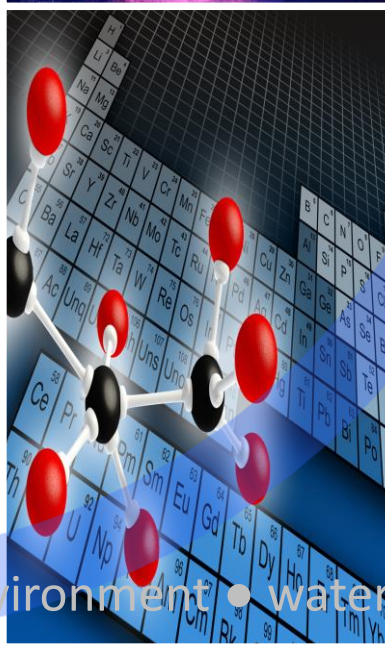


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## Perchlorate Properties<sup>1</sup>

Perchlorate Compound	Formula	Molecular Weight	Density	Solubility
-	-	g/mol	g/cm <sup>3</sup> at 20°C	g/L at 25°C
Ammonium	NH <sub>4</sub> ClO <sub>4</sub>	117.49	1.95	200
Sodium	NaClO <sub>4</sub>	122.44	2.52	209.6
Potassium	KClO <sub>4</sub>	138.55	2.53	15
Perchloric Acid	HClO <sub>4</sub>	100.47	1.768	Miscible

## Affected California Drinking Water Sources<sup>3</sup>

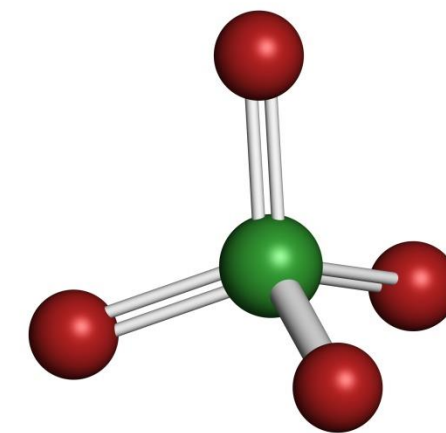
County	Number of Sources at or above 4 ug/L	Number of Systems	Maximum Detected Concentration (µg/L)
Kern	4	3	34
Los Angeles	113	33	91
Madera	2	1	9
Monterey	1	1	7
Orange	15	10	9
Riverside	61	8	72
Sacramento	3	2	11
San Bernardino	63	17	94
San Diego	11	2	9
San Luis Obispo	1	1	20
Santa Clara	9	4	10
Stanislaus	1	1	6
Sutter	2	1	7
Tehama	1	1	82
Tulare	8	5	24
Ventura	1	1	5
Total	296	91	-

### Sources:

1. CA EPA (2004). Public Health Goals for Chemicals in Drinking Water – Perchlorate. March.
2. USGS. (2006). Description, Properties, and Degradation of Selected Volatile Organic Compounds Detected in Groundwater – A Review of Selected Literature. Open-File Report 2006-1338.
3. CDPH. (2011). MCLs, DLRs, and PHGs for Regulated Drinking Water Contaminants. July 27. California Department of Public Health as of November 2011.
4. Andrea Leeson, Ph.D. (2000). RDT&E for Emerging Contaminants. SERDP/ESTCP
5. USEPA, 2005. Perchlorate Treatment Technology Update. May. <http://www.epa.gov/tio/download/remed/542-r-05-015.pdf>.
6. [http://www-chne.unm.edu/faculty/nuttall/estcp\\_site/description\\_estcp.htm](http://www-chne.unm.edu/faculty/nuttall/estcp_site/description_estcp.htm)

## Regulatory Levels<sup>2</sup>

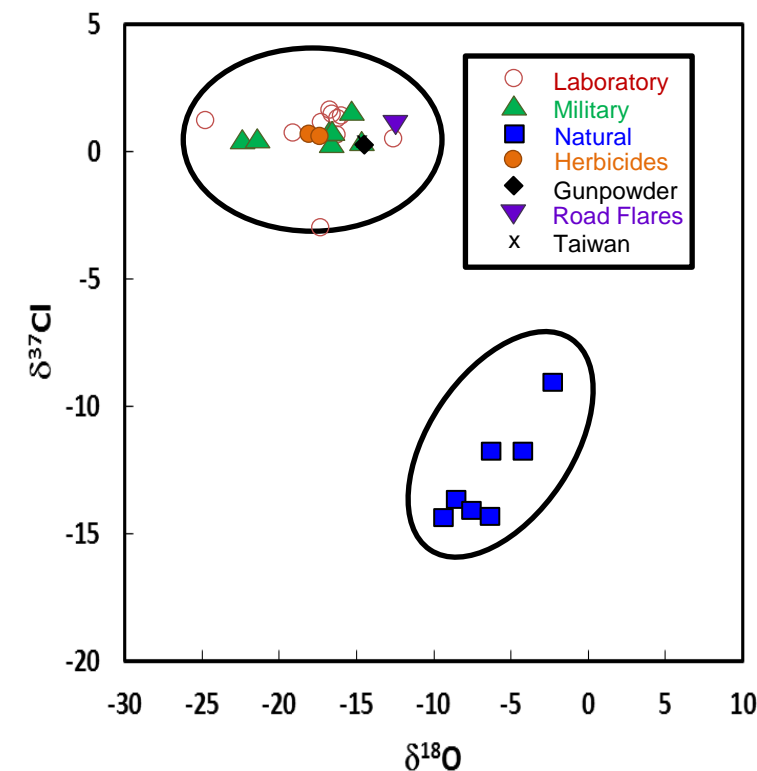
Criteria	Concentration
Maximum Contaminant Level (CA)	6 ug/L
Public Health Goal (CA)	1 ug/L



## Uses of Perchlorate<sup>5</sup>

- Air Bag initiators for vehicles
- Bleaching agent
- Ejection seats
- Electroplating
- Engine oil testing
- Etching of brass and copper
- Fireworks
- Flash powder
- Leather tanning
- Oxygen generators
- Paints and enamels
- Perchloric acid production and use
- Production of matches
- Propellant in rocket engines
- Road flares

## Isotopic Ratios of Perchlorate Sources<sup>4</sup>



## Perchlorate Reduction Pathways<sup>6</sup>

