Perchlorate

Perchlorate Removal

This fact sheet provides an overview of perchlorate regulations, occurrence, advances in treatment, and applications since 1997.

Regulatory Highlights

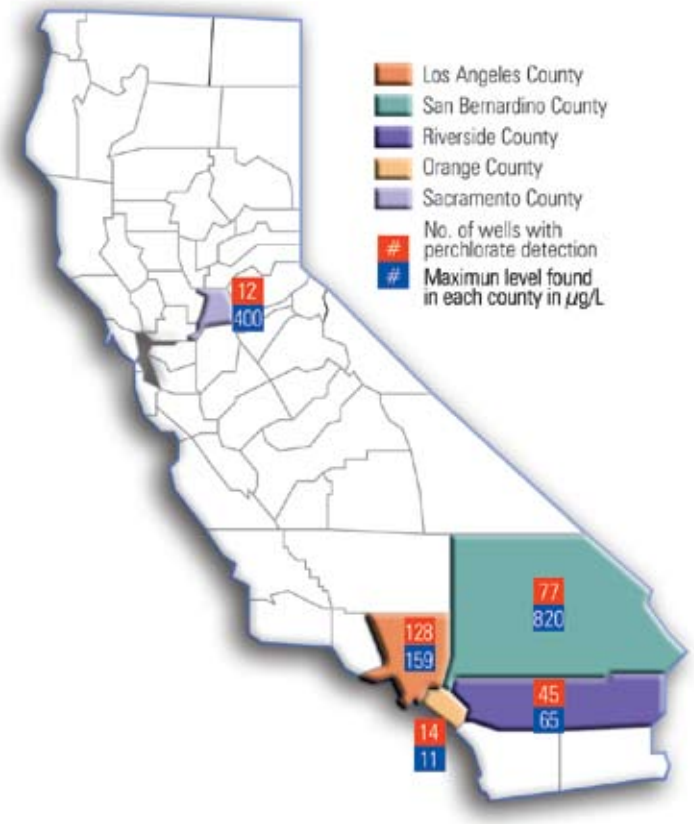
January 7, 1997	Perchlorate AL of 18 μg/L was established by CA-DHS.
January 7, 1999	Perchlorate was added to UCMR under Title 22 of the California Code of Regulations §64450.
January 3, 2001	Title 22 of the California Code of Regulations §64450 became effective, which requires monitoring of perchlorate.
January 16, 2002	CA-DHS published AL of 4 μg/L for perchlorate in drinking water.
March 5-6, 2002	Peer review of US EPA toxicity report, which was the basis for the new AL and the 1 μg/L "safe" drinking water equivalent concentration based on the US EPA draft reference dose (RfD) of 0.00003 μg/kg/day.
March 11, 2002	OEHHA published a draft PHG of 6 μg/L for perchlorate.
January 1, 2003	OEHHA will adopt a PHG for perchlorate.
Jnauary 1, 2004	CA-DHS will use a final PHG to adopt an MCL for perchlorate.

AL: Action Level; CA-DHS: California Department of Health and Services; OEHHA: Office of Environmental Health Hazard Assessment; PHG: Public Health Goal; UCMR: Unregulated Contaminant Monitoring Rule.

Perchlorate Occurrence in California

Perchlorate compounds from the manufacture and use of solid rocket propellants, munitions, and fireworks are found in groundwater wells as shown in the map at right. These compounds in the groundwater are a potential threat to public health.

Source: DHS, October 2002



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Carollo's EDR Pilot Study, Magna, Utah.

Brine Treatment Options

Technology	Advantages	Disadvantages
High Energy Destruction	▾ A high pressure, high temperature reaction destroys both nitrate and perchlorate	▾ Energy-intensive process ▾ High cost associated with treatment process ▾ Treated brine may require one extra step to remove sulfate if present ▾ Brine reuse has not yet been granted a permit by CA-DHS
Biological Reduction	▾ Low cost ▾ Low Energy ▾ Removes both perchlorate and nitrate	▾ May be difficult to reduce perchlorate in the presence of nitrate under high salt condition ▾ Process is still in a development stage

Testing of Pilot Full-Scale Installations

Site	Start Date	Treatment Technology	Size
Rancho Cordova, CA	1999	Biological Fluidized Bed Reactors	4,000 gpm
La Verne, CA*	1999	Biological Fixed Bed Reactors	2 gpm
Magna, UT*	1999	Electrodialysis Reversal (EDR)	10 gpm
La Verne, CA*	2000	Membranes (RO, NF, UF)	5 gpm
La Puente, CA	2001	Ion echange and brine discharge	2,500 gpm
City of Redlands, CA	2001	Modified GAC/ thermal regeneration and destruction	500-1,000 gpm
Henderson, NV	2002	Ion exchange	1,000 gpm
Riverside, CA	2002	"Throw-away" ion exchange	
Caldomestic, CA	2002	"Throw-away" ion exchange	
Santa Clarita, CA*	2003		
La Puente, CA*	2003		

** Projects where current Carollo staff participated.*

Overview of Perchlorate Treatment Technologies

Technology	Advantages	Disadvantages
Biological Reduction	▾ Biological reduction of nitrate and perchlorate can be achieved without generation of waste stream ▾ Process has been extensively applied in wastewater containing high levels of perchlorate ▾ Low cost	▾ Regulatory/public acceptance ▾ Performance may not be stable upon upset of a system
GAC Adsorption	▾ Existing GAC may be used ▾ GAC can also remove other contaminates	▾ Limited adsorption capacity ▾ Requires frequent regeneration of spent media ▾ Technology currently under research
Ion Exchange	▾ Removal of multiple contaminates ▾ Treated brine may be reused ▾ Proven technology	▾ Efficiency depends on resin type and raw water quality ▾ Some resins leach NDMA ▾ Generates large volumes of concentrated spent brine which may require treatment before disposal
Electrodialysis Reversal	▾ Can be applied to water with high TDS and silicate	▾ High capital and O&M costs ▾ Produces large volume of waste stream
High-Pressure Membrane Filtration (RO/NF)	▾ Effectively rejects perchlorate and other contaminates present in water matrix ▾ Proven technology	▾ High capital and O&M costs ▾ Requires treatment and disposal system for concentrate generated ▾ Reduced effectiveness for water with high TDS and silicate