U.S. Department of Defense
Perchlorate Treatment Technology Workshop
San Antonio, Texas

PERCHLORATE TREATMENT TECHNOLOGY

Fast Track to a Solution

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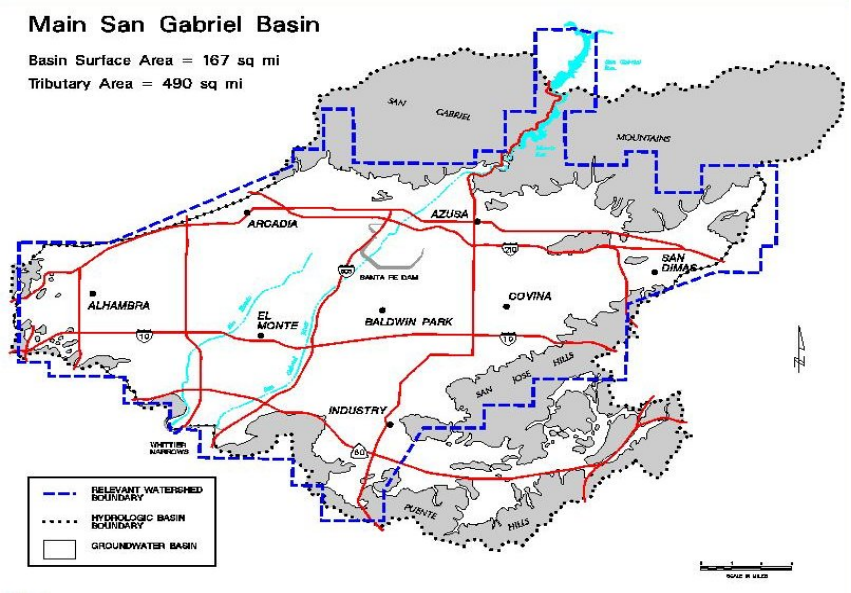
MAIN SAN GABRIEL BASIN WATERMASTER

"Managing groundwater for over one million people"

August 23, 2000

Location of Main San Gabriel Basin, Los Angeles County, California

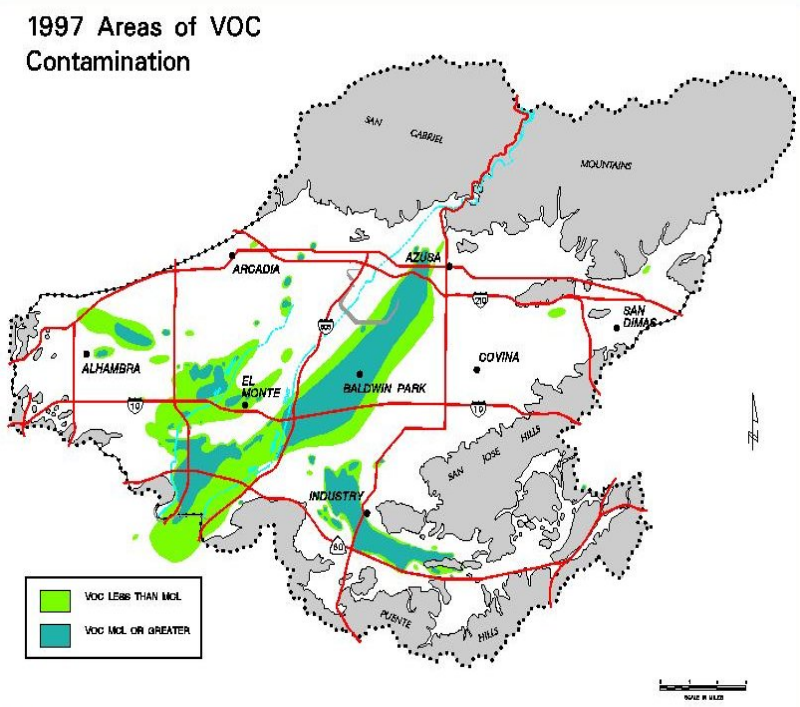
Main San Gabriel Basin



- **Foot of San Gabriel Mountains.**
- **Low-lying mountains on south/east.**
- **Drained by San Gabriel River.**
- **547 sq. mi. drainage area.**
- **167 sq. mi. basin area.**

Basin meets 80%-90% of Valley's water demand – enough for over one million people.

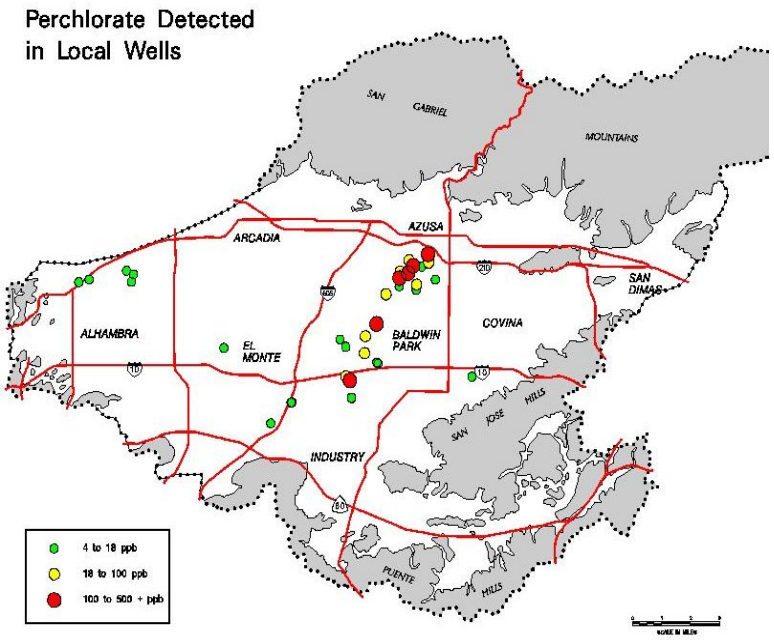
Main San Gabriel Basin designated as Superfund site due to VOC contamination.



- 1979 – Discovered in San Gabriel Valley.
- 1984 – USEPA National Priorities List.
- 1986 – Four areas named as Superfund Sites.

Volatile organic compounds were/are used as industrial solvents and chemicals.

Discovery of Perchlorate caused shutdown of eight public drinking water wells…

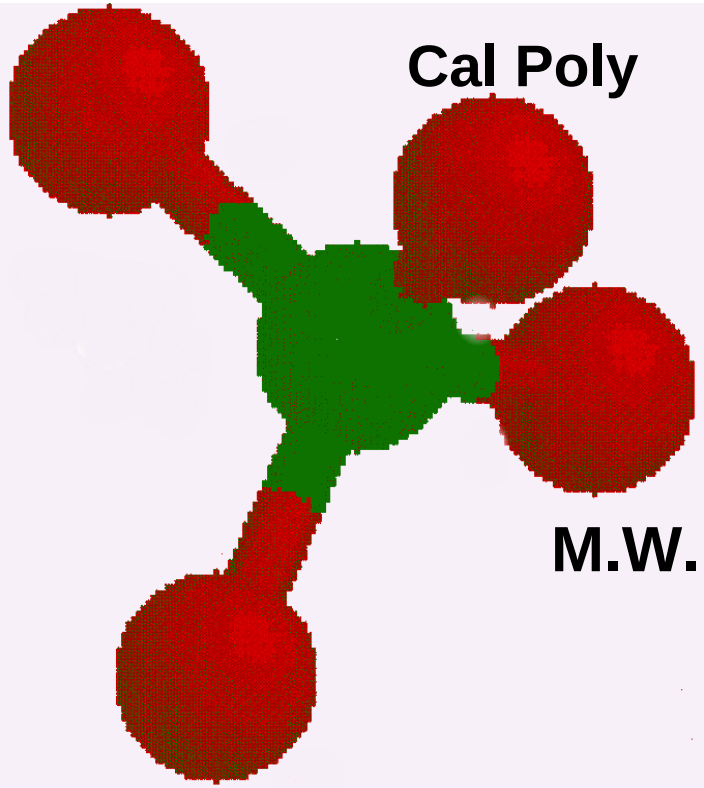


- **Discovered in May 1997.**
- **4 wells shutdown.**
- **2 wells being blended.**
- **2 wells inactive due to other contaminants.**

…and largest Superfund project stymied by discovery of perchlorate.

Four-pronged approach taken to fast-track development of treatment technology.

SGPCT



- **Formed SGPCT (10/97).**
- **Screening study by Cal Poly Pomona (6/98).**
- **Ion exchange study by Montgomery Watson (2/99).**
- **Joint-study with Calgon Carbon (10/98).**

San Gabriel Perchlorate Coordinating Team formed to share information, pool research resources…

- Local and regional water agencies.
- Regional, state and federal regulatory agencies.
- Potentially responsible parties.
- Highly-specialized technical consultants.

…and to fast-track peer and regulatory review process.

California State Polytechnic University Pomona investigated three basic treatment methods:

- **Biological**
  - Armstrong Lab, Bioden, GAC Fluidized Bed, Autotrophic Sulfur Reactor
- **Chemical**
  - Chemical Oxidation and Reduction, Ion Exchange
- **Physical**
  - Nanofiltration, Reverse Osmosis, Electrodialysis, Carbon Aerogel Capacitive Deionization

Cal Poly conclusions on biological treatment:

- **Pilot studies indicated perchlorate will be destroyed (no waste brine).**
- **Addition of microorganisms and potential disinfection by-products were concerns.**
- **Regulatory approval could be time-consuming**
- **Additional studies should be conducted.**

Cal Poly conclusions on chemical treatment:

- **Ion exchange was most promising alternative.**
- **Calgon Carbon's ISEP treatment system resulted in low waste brine (<1%).**
- **Ion exchange technology is currently used in public drinking water systems.**
- **Waste brine disposal may become a problem in future.**

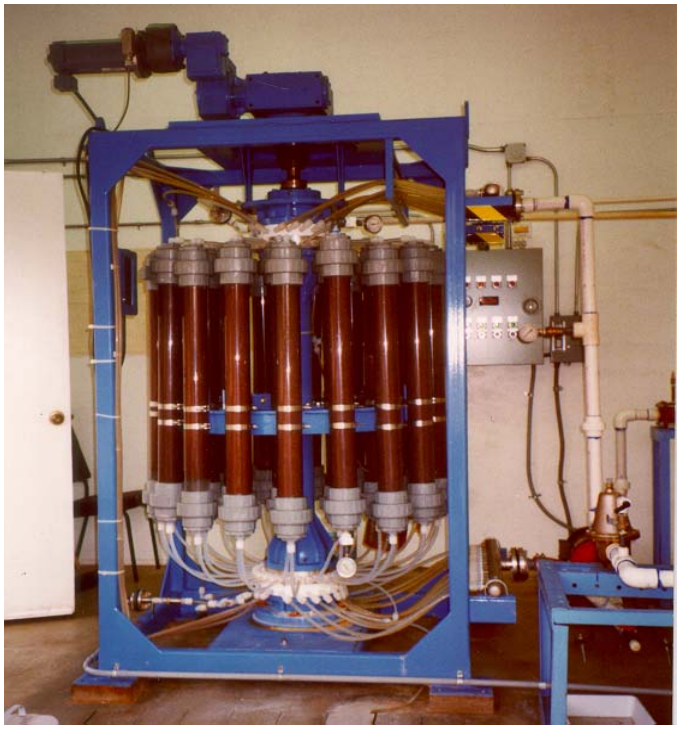
Cal Poly conclusions on physical treatment:

- **Reverse osmosis was proven technology and should remove perchlorate.**
- **Large volume of waste brine (10% - 30%).**
- **Disposal of waste brine was a major concern.**

Bench/pilot scale tests by Montgomery Watson indicated feasibility of IX technology.

- **Strong-base resin tested.**
  - Sybron Chemicals (ASB-2)
  - Purolite (A850)
  - Rohm & Haas (IRA 458)
- **Perchlorate concentrations**
  - Bench/inflow: 200 ug/L
  - Pilot/inflow: 90 ug/L
  - Treated: ND
- **Polystyrene resins were very difficult to regenerate.**
- **Polyacrylic (A850) resin: 725 B.V. before breakthrough, then fully regenerated.**

Watermaster solicited engineers, contractors, suppliers and manufacturers to participate in a joint venture.



- **Watermaster would provide site and source water.**
- **J.V. partner would provide "black box" treatment plant.**
- **Only one proposal was accepted: Calgon Carbon's ISEP treatment process.**

Photo of 25 gpm nitrate treatment plan, Campo, California.

Pilot-scale testing by Calgon Carbon indicated the feasibility of ISEP treatment process.

- **Location:** Big Dalton Well
  Baldwin Park, CA
- **Flowrate:** 4.28 gpm
- **Brine:** 0.75% of inflow
- **Perchlorates**
  - Influent: 18-76 ppb
  - Treated: <4 ppb

Negotiated agreement to construct ISEP treatment plant at LPVCWD.

- Calgon agreed to refund costs if performance standards were not met.
- Construction completed in 3/00.
- Test period from 2/10 to 3/12/00.
- Reliability/ease proven in subsequent/intermittent operations.
- Waste brine is 0.85% of inflow.

Conclusions:

1. **Ion exchange is a common and proven technology.**
   - **used to treat public drinking water supplies.**
   - **will remove perchlorate.**
2. **Calgon Carbon's ISEP process has additional benefits.**
   - **minimizes waste brine (0.85%)/salt usage.**
   - **higher safety factors due to multiple chambers.**
3. **Waste brine disposal may be a problem in future.**
4. **Partnerships, workshops and multi-prong approach resulted in a fast track to a solution.**