

# **SERDP Perchlorate Research**

**Catherine Vogel**  
**SERDP/ESTCP Program Manager**  
**for Cleanup**

# SERDP-Funded Perchlorate Research

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- **Research Focus:**

- Lab-, bench- and pilot field-scale research to develop biological approaches for the cost effective in-situ treatment of groundwater contaminated with ammonium perchlorate

- **Objectives**

- Improve fundamental understanding of the chemical, physical, and biological phenomena related to perchlorate reduction;
- consider a wide range of sites and hydrogeochemical conditions;
- provide information to predict practicability of proposed technologies under field conditions.

# In-Situ Bioreduction and Removal of Ammonium Perchlorate

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- **Southern Illinois University; FY00 – FY02; 384 K**
- **Technical Approach:**
  - **Identify & enumerate predominant perchlorate reducers in contaminated environments;**
  - **Identify genes that encode the chlorite dismutase enzyme;**
  - **Identify environmental controls on metabolic capabilities**
  - **Investigate techniques for in-situ stimulation**
  - **Develop a molecular probe specific for all perchlorate reducing bacteria.**
- **Benefits:**
  - **Fundamental understanding of biological perchlorate reduction mechanisms**

# In-Situ Bioremediation of Perchlorate

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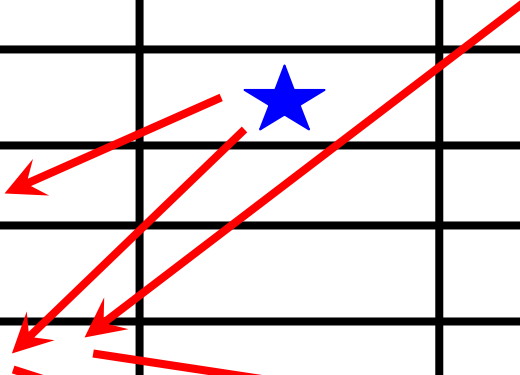
- **Envirogen; FY00 – FY01; \$579K**
- **Technical Approach.**
  - **Microcosm and column studies using aquifer material from several perchlorate contaminated sites to:**
    - **Identify the most effective electron donor and effect of competing electron acceptors**
    - **Evaluate environmental variables on perchlorate reduction**
    - **Evaluate need for bioaugmentation**
    - **Develop models to evaluate substrate application rates and perchlorate reduction kinetics**
- **Benefits:**
  - **Collect information for design of pilot-scale remediation effort**

# In-Situ Bioremediation of Perchlorate-Impacted Groundwater

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- **GeoSyntec Consultants; FY00 – FY 01; \$355K**
- **Technical Approach.**
  - **Confirm indigenous groundwater microorganisms can be stimulated to biodegrade perchlorate.**
  - **Evaluate the ubiquity of the process at sites having differing groundwater conditions.**
  - **Assess the suitability of the process for treating mixed plumes using microcosm studies.**
  - **Conduct small field pilot-test at a perchlorate contaminated site.**
- **Benefits:**
  - **Demonstrate perchlorate biodegradation under field conditions**
  - **Initial Design & Cost Data for potential technology scale-up**

	S. Illinois Univ.	Envirogen	GeoSyntec
Ubiquity of perchlorate degraders (microcosms)	★ (5 sites)	★ (3-5 sites)	★ (6 sites)
Enrichment/Isolation	★	★	
Identification	★		
Enzymology	★		
Molecular Probes	★		
Biostimulation/Bioaugmentation	★ pure culture + microcosms	★ microcosms + columns	★ microcosms + field pilot test
Effect of Env. Conditions <ul style="list-style-type: none"> <li>pH</li> <li>temperature</li> <li>salinity</li> <li>ion concentration</li> <li>alternate e- acceptors</li> <li>co-contaminants</li> <li>perchlorate concentration</li> </ul>	★ pure + mixed culture	★ mixed culture	★ mixed culture
	low - med	low	high
Modeling/Preliminary Design		★	★



# Perchlorate Sites Providing Samples

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- **Southern Illinois University:**
  - Samples collected thus far from Indian Head NSWC, MD; Jet Propulsion Laboratory, CA; and USN San Nicolas Island, CA.
- **Envirogen:**
  - Jet Propulsion Lab, CA; Indian Head NSWC, MD (2 sites); Rocky Mt commercial site, CO; Oyster, Virginia (pristine site). Longhorn AAP, TX is a possible 5th site.
- **GeoSyntec:**
  - Aerojet, Sacramento, CA; Edwards AFB, CA; USN Allegany Ballistics Lab, WV; American Pacific Corporation, NV; USN San Nicolas Island, CA; Boeing Alpha & Sigma Complex, CA.