



STATEMENT OF QUALIFICATIONS

**5070 Robert J Mathews Pkwy
Suite 300
El Dorado Hills, CA 95762**

**(916) 939-7300 Phone
(916) 939-7398 Fax**

www.PRIMAenvironmental.com





OUR MISSION

To provide you with site-specific information so you can make scientifically sound decisions.

Knowing the concentration of the chemicals of concern (COCs) in soil and groundwater is not always enough to determine the most cost-effective approach of managing the environmental issues at a site. Additional site-specific information, such as the effectiveness of different treatment options and the bioavailability of the COCs, is often needed to ensure the success of the project.

PRIMA Environmental, Inc. is an independent laboratory that specializes in treatability testing, technology evaluation, custom laboratory work and scientific consulting services for the environmental community. **Established in 1998** by Dr. Cindy G. Schreier, its purpose is to design and conduct bench-scale laboratory tests that will provide the additional information needed to make cost-effective decisions about the environmental issues at a site. PRIMA Environmental, Inc. can perform bench-scale testing on soil and water impacted by a wide variety of compounds, including chlorinated solvents, petroleum hydrocarbons, pesticides, arsenic, metals and nitrate. Impacted materials have come from sites utilized by the mining, petroleum, railroad, chemical, dry-cleaning, and semiconductor industries as well as by the United States government.

LABORATORY SERVICES

PRIMA Environmental, Inc.'s facility is a modern laboratory designed to perform a broad range of bench-scale tests. Bench-scale laboratory testing is used to evaluate emerging remediation technologies, test new applications of an existing technology, develop design parameters for field treatment systems, obtain bioavailability data for risk assessments, measure parameters not covered by EPA methods, and learn more about what naturally occurs at a site. All tests performed by PRIMA Environmental, Inc. are specially designed to address the particular needs of the client.

TECHNOLOGY EVALUATIONS

Technology evaluations provide a wealth of site-specific information that is necessary to assess the feasibility and cost-effectiveness of the proposed approach. For example, technology evaluations can confirm removal of COCs from site materials, estimate dose and time requirements needed to achieve removal, identify the mode of removal (e.g. chemical destruction versus volatilization), and predict potential short-term and long-term effects of treatment on other water or soil parameters. Examples of technology evaluations performed by PRIMA Environmental, Inc. include



- **Oxidation of chlorinated solvents and pesticides** by permanganate,
- Effect of *in situ* permanganate treatment on the aqueous concentration of Cr(VI),
- **Comparison of reducing agents** such as ferrous iron, calcium polysulfide, and organic acids for conversion of Cr(VI) to Cr(III) in soil and groundwater,
- Fenton oxidation for **destruction of BTEX, MTBE, petroleum hydrocarbons**, and chlorinated hydrocarbons in soil and water,
- **Comparison of oxidizing agents** (ozone, Fenton's reagent and permanganate) for removal of methyl salicylate and biphenyl ether from groundwater,
- **Comparison of adsorbents** for removal of arsenic from groundwater,
- Removal of multiple COCs (nitrate, metals and cyanide) by zero-valent iron,
- **Determination of treatment system design parameters** for destruction of BTEX and MTBE in water,
- **Measurement of rate constants** for reductive dehalogenation of chlorinated solvents by zero-valent iron,
- Effect of chemical stabilization of mine tailings on the quality of leachate,
- **Determination of dose requirements** for stabilization of metals in soil by EnviroBlend and triple super phosphate,
- **Evaluation of Metals Reducing Compound (MRC)** for treatment of TCE and prevention of mobilization of arsenic, and
- **Screening of oxidants** for removal of DDT, DDE, and toxaphene from soil.

TECHNOLOGY DEVELOPMENT

Many emerging technologies in the environmental arena are essentially field applications of well-known chemistry. PRIMA Environmental, Inc. is committed to seeking out and developing new technologies when the current state-of-the-art cannot provide satisfactory results at acceptable cost. PRIMA Environmental, Inc. and its staff have assisted in the development of the following technologies:

- Sulfur Modified Iron (SMI-III™) for the removal of arsenic, nitrate, hexavalent chromium, and copper from water,
- *In situ* reduction and stabilization of Cr(VI) in soil and groundwater,
- Shot-blast dust residual for the removal of arsenic from stormwater, and
- Field screening method for delineation of petroleum hydrocarbon impacts in soil.

ATTENUATION

The ability of compounds to attenuate is of interest both for the primary chemical of concern as well as for compounds that might be generated during *in situ* remediation. PRIMA Environmental, Inc. has designed and performed tests to assess whether



compounds are likely to attenuate at the site including

- **Natural attenuation of DDT** in anaerobic site sediment,
- Evaluation of **attenuation of Cr(VI) formed during in situ chemical oxidation**. Tests assess attenuation within the treatment zone and downgradient of the treatment zone since oxidation could adversely affect the ability of soil to attenuate Cr(VI), and
- **Generation of buffering curves** to estimate the amount of acid that can be added (usually as Fenton's reagent or from decomposition of persulfate) without causing significant long-term changes in pH.

COMPOUND SPECIATION / BIOAVAILABILITY

The toxicity, fate, and appropriate method of removal a COC often depend not only upon the total analytical quantity of the COC, but also upon the form in which the COC exists and upon the bioavailability of the COC. PRIMA Environmental, Inc. can perform the following tests to elucidate these forms and help assess their bioaccessibility and behavior in the environment:

- Speciation of metals such as Cr(III)/Cr(VI),
- Extraction of arsenic and lead from soil using special, **physiologically based extraction tests** procedures described in *Environmental Science & Technology* and in "Guide for Incorporating Bioavailability Adjustments into Human Health and Ecological Risk Assessments at US Navy and Marine Corps Facilities" NFESC User's Guide UG-2041-ENV (July 2000).

OTHER TESTING

PRIMA Environmental, Inc. has conducted numerous bench-scale tests to identify unknowns and to assist clients in better understanding their site. Examples of such tests include

- Investigation of natural formation of Cr(VI) by soils,
- Measurement of manganese and iron oxides in soil using procedures described in *Methods of Soil Analysis, Part II*,
- Measurement of easily reducible manganese (vs. total manganese), which can be used to evaluate availability of manganese to plants as well as assess the potential for natural formation of Cr(VI),
- Measurement of lead distribution in soil to evaluate whether sieving can reduce the amount of soil to be disposed,
- Identification of black residue on fixtures at a public pool.



LABORATORY EQUIPMENT AND CAPABILITIES

To conduct the bench-scale tests described above, PRIMA Environmental, Inc. utilizes modern equipment including

- Ozone generation and detection equipment
- Visible Spectrophotometry
- Colorimetric test kits
- Ion-specific electrodes
- pH meters
- Dissolved oxygen meter
- Rock crusher/mixer mill
- Single-port and multi-port columns
- Batch testing apparatus
- High speed centrifugation
- Microbalance
- Temperature controlled baths/mixers
- Multi-position hot plate and stirrers
- Reciprocal shaker table
- Multi-channel digital peristaltic pumps
- Glove bag

CONSULTING SERVICES

In addition to conducting laboratory tests, PRIMA Environmental, Inc. offers consulting services to assist clients with chemical and technical issues.

TECHNICAL OVERSIGHT

Many new and emerging remediation technologies are new uses of old chemistry. PRIMA Environmental, Inc. has extensive experience with several innovative technologies and recognizes the importance of chemical knowledge when designing effective treatment systems. PRIMA Environmental, Inc. works closely with engineers and geoscientists to provide the chemical information necessary to ensure successful implementation. Innovative technologies with which PRIMA Environmental, Inc. is experienced include:

- Fenton's Reagent (and variations, thereof)
- Zero-Valent Iron
- Permanganate Oxidation
- Stabilization of Cr(VI)
- Sulfur-Modified Iron (SMI-III™)
- Persulfate Oxidation



SCIENTIFIC CONSULTING SERVICES

Understanding the science behind different management options can help identify the best approach for addressing environmental issues at a site and help stake-holders accept and support that approach. PRIMA Environmental, Inc. therefore, offers the following services

- Scientific review of previous treatability studies and other reports,
- Development and/or review of testing protocols,
- Literature searches/reviews, and
- Presentation of scientific issues and information to clients, legal counsel, regulatory agencies, stakeholders, students and other interested groups.

PRIMA Environmental, Inc. has also assisted clients with unusual projects such as

- Identification of unknowns (through in-house laboratory testing, literature review, and/or coordination of outside laboratory testing), and
- Estimation of the effect of chemical additives (used for sanitation) on the electrical conductivity of process water from food processing facility.

SUMMARY OF EXPERIENCE

PRIMA Environmental, Inc. has experience with a broad range of technologies and contaminants. This experience is summarized below.

SUMMARY OF CONTAMINANT EXPERIENCE

- Organics
 - Total petroleum hydrocarbons, (TPH) such as gasoline and diesel
 - BTEX compounds (benzene, toluene, ethylbenzene, xylenes)
 - Fuel oxygenates (MTBE, TBA, ETBE, DIPE, ETBE)
 - Chlorinated solvents (PCE, TCE, DCE, VC, DCA)
 - Pesticides (Dieldrin, Aldrin, DDT, toxaphene)
 - Nematacides (DBCP)
 - Polynuclear aromatic hydrocarbons (PAHs)
 - Pentachlorophenol (PCP)
 - Dioxins
 - Methyl Salicylate
 - Diphenyl ether
- Inorganics
 - Arsenic
 - Hexavalent chromium [Cr(VI)]
 - Lead
 - Nitrate



SUMMARY OF PRODUCT/TECHNOLOGY EXPERIENCE

- Permanganate
- Fenton's reagent (classical and modified)
- Ozone
- Peroxone (ozone and peroxide)
- Persulfate (activated and unactivated)
- Metals Remediation Compound (MRC™)
- Zero-valent Iron (ZVI)
- Sulfur-Modified Iron (SMI™)
- Calcium polysulfide (Cascade®)
- EnviroBlend™
- Activated alumina
- Natural Attenuation
- Physiologically-based extraction tests (PBETs), single or dual stage

WORKING WITH PRIMA ENVIRONMENTAL, INC.

PRIMA Environmental, Inc. performs laboratory testing under subcontract to environmental consulting and engineering firms located throughout the United States. After discussing the particular needs of the project, PRIMA Environmental, Inc. will design and conduct tests to address the site-specific questions. PRIMA Environmental, Inc. welcomes input from clients and regulators during the design phase to ensure that all parties agree that the methods used are reasonable and that the results will be meaningful. In addition, PRIMA Environmental, Inc. can perform tests using procedures developed by the client or described in the literature.

KEY PERSONNEL

CINDY G. SCHREIER, PH.D.

President and Chief Scientist

Dr. Schreier founded PRIMA Environmental, Inc. in 1998 to provide high-quality scientific testing for clients whose projects cannot be handled by a traditional analytical laboratory. Before starting PRIMA Environmental, Inc., Dr. Schreier worked in and managed treatability laboratories of major, international environmental and engineering firms. She earned her B.S. in Chemistry from the University of California, Santa Cruz and both her M.S. in Chemistry and Ph.D. in Civil Engineering from Stanford University.

Dr. Cindy G. Schreier has been interested in cleaning up the environment since high school. She studied chemistry in order to develop new and inexpensive methods of remediating contaminated soil and water. While in graduate school, she was one of the first to investigate environmental applications of zero-valent iron and catalytic



dehydrohalogenation using palladium catalysts. Zero-valent iron is now frequently used in permeable reactive barriers to destroy chlorinated solvents, while field pilot tests have shown that catalytic dehydrohalogenation can be as cost-effective as activated carbon for removal of trichloroethylene from groundwater.

Since founding PRIMA Environmental, Inc., Dr. Schreier has focused her efforts on designing and performing tests to gather the site-specific information clients need to manage their projects. She designed a method of collecting off-gases generated during oxidation of contaminants by Fenton's reagent or ozone, which enables verification that contaminants are destroyed, not volatilized. Dr. Schreier has also implemented general test protocols prepared by clients. This included identifying the best type of reaction vessel to use and creating a support structure that would allow simultaneous mixing of over 40 reaction bottles. Finally, through PRIMA Environmental, Inc.'s newsletter and website, Dr. Schreier keeps clients informed of new and emerging technologies such as the use of ascorbic acid for reduction of hexavalent chromium and persulfate for the oxidation of organic compounds.

CORINNE E. ACKERMAN, PH.D.
Senior Project Manager

Dr. Ackerman's background and experience in microbial ecology enhance the bioremediation testing services PRIMA offers. Her responsibilities at PRIMA include experimental design, data interpretation, report writing, and client support. Projects involve bench testing of bioremediation of COC's, as well as bench testing of in-situ chemical oxidation (ISCO) for the removal of petroleum hydrocarbons and other chemicals of concern (COC's) from site soil and groundwater.

Dr. Ackerman has over 10 years of experience working with environmental issues impacting soil and water quality, including the study of MTBE bioremediation. She earned her B.S. in Environmental Resource Science from the University of California, Davis, and both her M.S. and Ph.D. in Agronomy from Purdue University, studying the microbial ecology of soil agroecosystems. Her graduate studies implemented a variety of DNA based molecular tools in order to better understand the relationship between the rhizosphere soil microbial community and plant development over time, as affected by crop management practice. Dr. Ackerman has prepared technical reports, presented results at scientific meetings, and written scientific articles that have been published in peer-reviewed journals.

PRIMA Environmental, Inc. - Previous Work Experience

1.	Client	Project Name	Performance Date	Contract Value	Client Contact	Phone
	Walker & Associates	Spenceville	2000-2001	\$ 21,547	Lara Pucik	916-802-4130

Description

Testing was conducted to assess the long-term effectiveness of hydrated lime (lime) and of sugar beet processing lime (SB) to stabilize hematite and jarosite mine tailings from the Spenceville mine site (California). Testing consisted of leaching treated and untreated tailings with water over the course of six months and analyzing the leachate for pH, sulfate, total arsenic and copper and zinc. Both treatments prevented the formation of acidic leachate from tailings during the study period. Lime prevented leaching of arsenic, copper and zinc in the jarosite tailings, but did not in the hematite tailings. Treatment with sugar beet processing lime prevented leaching from both types of tailings.

2.	Client	Project Name	Performance Date	Contract Value	Client Contact	Phone
	Tetra Tech NUS	As Removal/Retardation	2000	\$ 22,564	S. Raju Dantuluri	

Description

Column tests were conducted to as arsenic adsorption capacity of three media—surfactant-modified zeolite, iron-modified zeolite, and activated alumina. Tests used site groundwater. Of the three media tested, only alumina removed arsenic to below the detection limit of 5 µg/L.

Column tests were also conducted to measure the retardation factors of Arsenic (III) and Arsenic (V) in site soil. Retardation factors were determined by comparing the velocity of a tracer to the velocity of arsenic.

3.	Client	Project Name	Performance Date	Contract Value	Client Contact	Phone
	Confidential	Site in Central Valley, CA	2008	\$ 9,985	Jeff Bold	530-204-5210

Description

Column tests were designed and run to evaluate in situ chemical reduction of hexavalent chromium by calcium polysulfide (CaSx). Column were 4 inches in diameter and about 18 inches tall and were constructed of clear PVC. Movement of the CaSx within the soil bed and color changes associated with treatment were visually noted.

4.	Client	Project Name	Performance Date	Contract Value	Client Contact	Phone
	Confidential	Site in Central Valley, CA	Sept. 2009	\$ 31,371	John Fortuna	510-285-2720

Description

Bench scale treatability studies were conducted to evaluate the ability of various chemical treatment technologies to destroy 1,2,3-trichloropropane (1,2,3-TCP). Batch tests evaluated zinc, iron, SMI and activated persulfate. Based on these preliminary tests, column tests were conducted using zinc and iron. Columns were 3 inches in diameter, about 12 inches high and contained mixtures of either zinc and sand or iron and sand. In these column tests, ZVI and ZVZn removed 98 to 99.7% of 1,2,3-TCP.