

Large-scale FeroxSM and Sodium Permanganate Injection Project

In 2005, ARS completed its largest project to-date at a DOD facility in Southwest Georgia. ARS was contracted to an international consulting company to provide groundwater remediation treatment that included the injection of more than 170,000 pounds of ZVI powder during a first phase and 133,000 gallons of 8% sodium permanganate during a second phase.

The first phase was completed in the summer and the second in late fall. Two field injection/drilling crews worked simultaneously at separate parts of the base. During the sodium permanganate injection phase, a mixing operation was set up onsite to dilute 40% solution to 8% for the injection operation. Sonic drilling rigs were utilized to advance injection tooling efficiently and as well as to minimize the generation of soil cuttings. The ZVI and permanganate were delivered via 40 injection points, some of which within high activity zones within the facility. The injections were conducted at depths as great as 160 feet into a weathered limestone/clay formation.

Technically, logistically and from a safety standpoint, this was a challenging project. Overall the project was completed on-budget and on schedule.

ARS' Projects being "showcased" at Battelle Conference in Monterey May 22-25, 2006

The following presentations at the 5th International Conference on Remediation of Chlorinated and Recalcitrant Compounds area discuss ARS' technology applications:

Session B1: In Situ Chemical Reduction (ISCR) -

Enhanced In Situ Reduction of cVOCs Using Zero-Valent Iron. *E. Corack, S. MacEwen, J. Liskowitz, and D. Steckler*

Session B7: Improved Delivery Mechanisms -

Field-Scale Pilot Test Evaluating Pneumatic Fracturing In Clayey Till. *C. Riis, A. Christensen, S. Christensen, M. Broholm, C. Scheutz, P. Bjerg, C. Jensen and H. Kern-Jespersen.*



Field crew cooling off in water vapor condensate from liquid nitrogen pumping truck



Injection operation showing tanker with 'site ready' 8% NaMnO₄

2005 Facts *did you know?*

ARS successfully applied the deepest fracturing injection application to date at 160 ft. This application is the deepest environmental remediation fracturing event ever recorded.

In 2005 ARS' fracturing and material injection projects emplaced a total of approximately 1,100,000 lbs of ZVI slurry and 1,400,000 lbs of chemox solutions and biostimulation substrates using more than 9,000,000 standard cubic feet of gas.

in this issue...

- page 1** Large-scale FeroxSM and Sodium Permanganate Injection Project
- page 1** 2005 Facts - Did you Know?
- page 1** ARS Presence in Battelle Conference
- page 2** ARS Opens West Coast Sales Office
- page 2** FeroxSM Implementation at DOD Facility in Maryland
- page 3** Navy Report Documents FeroxSM Success at Hunters Point Naval Yard
- page 3** Pneumatic Fracturing Applied at Copenhagen, Denmark Site
- page 3** ARS and EnviroMetals Settlement Patent Litigation
- page 3** ARS Welcomes New Partners
- page 4** New and Exciting Changes at ARS' Website
- page 4** Deep FeroxSM System Providing Long Term Treatment at DOD Facility

Session E2: Alternative Permeable Reactive Barrier Materials -
Zero-Valent Iron Particle Types and Characteristics That Influence Treatment Reactivity. *J. Hamill and J. Liskowitz.*

Session E3: Reductive Treatment with Nanoscale and micron-scale ZVI -
A Case Study Evaluating Zero-Valent Iron Injection Treatment Technology. *C. Gilmore, R. Hess, R. Ahlersmyer, and S. Chen*

Session E5 - Air Sparging, Soil Vapor Extraction, and Other Physical Treatments -
Improving Soil Vapor Extraction in Loess Deposits.
D. Nelson, M Perlmutter, and M. Strong

Session G1 - Characterization and Treatment in Fractured Media
Pneumatic Fracturing and Dual-Phase Extraction in Fractured Shale Bedrock. *P. Lazaar, J. Butillo, D. Scillieri, B. Johnson and John Liskowitz.*

ARS Opens West Coast sales office

ARS is pleased to announce the hiring of **John Poulson** as Vice President of Sales and Marketing for our Western Region. John has more than 15 years of sales and marketing experience and most recently was the Western Sales Manager for a large drilling and specialty injection contractor. John can be reached at 732-296-6620 ext 24 or email him jp@arstechnologies.com with any questions or inquiries related to projects west of the Mississippi. Welcome on aboard John!

FeroxSM Implementation at DOD Facility in Maryland

In early 2005, ARS completed a full-scale FeroxSM project at a DOD facility in Maryland. The primary goal of this remedial action was source zone reduction. The CVOC's of concern were 1,1,2,2-PCA, *cis*-1,2-DCE, PCE, and TCE at concentrations greater than 1,000 mg/liter.

The geology consisted of coastal plain deposits of silty sand and gravel overlying a layer of weathered bedrock (saprolite) that was approximately 10' to 20' feet thick. The saprolitic bedrock transitioned to competent fractured garnet schist at approximately 30' feet bgs. The treatment zone extended from the saprolite into the fractured schist.

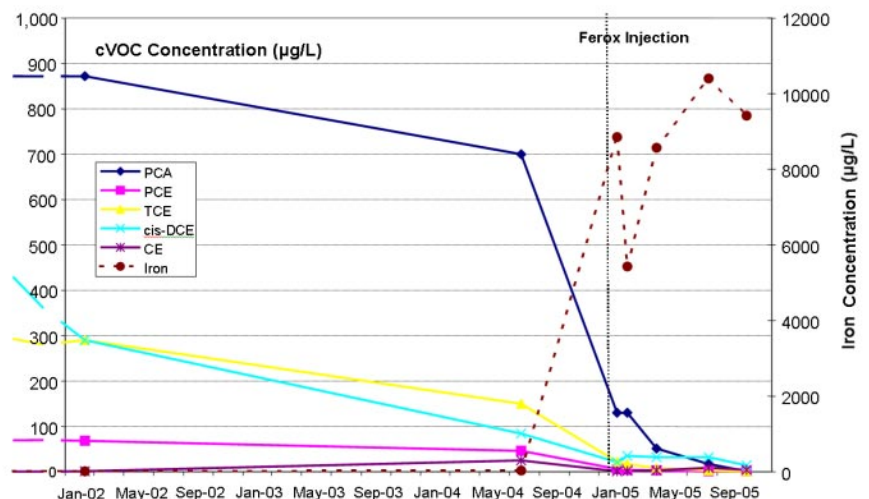
As part of the injection process, Pneumatic Fracturing (PF) was applied as a precursor to emplacing ZVI powder. More than 77,000 pounds of H-200 ZVI powder were delivered at depths between 15 feet to 35 feet bgs. through 15 boreholes. The project was completed within 16 workdays and on-budget.

Groundwater monitoring within the treatment zone conducted by the site consultant showed immediate and long-term reduction in the target CVOCs. A paper titled "Enhanced Insitu Reduction of CVOCs using Zero-Valent Iron" is scheduled for presentation at the Battelle Chlorinated Solvents Conference in Monterey in May.



ARS crew working in snow

Well 13GW02 COCs



Navy Report Documents Feroxsm Success at Hunters Point Naval Yard



Nitrogen tube trailer, drill rig and injection trailer

As mentioned in our last newsletter (<http://www.ifracture.net/vol5iss3/index.html>), ARS conducted an expanded treatment in a TCE-contaminated area within Hunters Point Shipyard in 2004 after a successful technology demonstration in 2001. Recently a technical report was produced for the Navy reporting results of our work at Hunters Point Shipyard. The title of the report:

Cost and Performance Report: Nanoscale Zero-Valent Iron Technologies for Source Remediation

A. Gavaskar, L. Tatar, and W. Condit.

Naval Facilities Engineering Service Center, Port Hueneme, CA. CR-05-007-ENV, 54 pp, 2005.

Key cost and performance report is the result of a comparative evaluation of the performance of zero-valent iron injections at three Navy sites: Hunters Point Shipyard (micron-scale particles), Naval Air Station Jacksonville and Naval Air Engineering Station Lakehurst (nanoscale particles).

Pneumatic Fracturing Applied at Copenhagen, Denmark Site

In December 2005, ARS was contracted by a Danish engineering company to apply Pneumatic Fracturing at two separate industrial sites near Copenhagen to demonstrate the technology's applicability in creating fracture networks in the local surficial geology. Fracturing was also performed to facilitate the delivery of reagents or substrate for insitu remediation. The first site consisted of a clayey till material. ARS fractured at the depth of approximately 10 feet bgs to 26 feet bgs. Tracer dyes were injected to evaluate the fracture propagation. The fracture operation was carried out smoothly and observations indicated effective fracturing of the formation. The results of this project are being presented at the Battelle Chlorinated Conference in May of this year.

The second site was part of a biostimulation pilot study in which molasses was injected after Pneumatic fracturing was applied to a "gytje" formation. The long-term effect is being monitored by the site consultant.

ARS' work attracted widespread interest from both the Danish government, academia and media personnel along with regional interest from other Scandinavian countries. Based upon the success at the sites, ARS is looking forward to future fracturing projects in Norther Europe.

Soil core showing dye tracer



American and Danish team

ARS and EnviroMetals Settle Patent Litigation

On March, 2006 ARS and ETI/Adventus successfully reached a settlement to their ongoing litigation regarding intellectual property rights using zero valent iron in the treatment of groundwater contamination. As the leading organization and pioneer in using ZVI for source treatment of organic contamination of ground water, ARS looks forward to collaborating both on research and commercial applications with the folks at ETI and Adventus. Additionally, the settlement will facilitate the use of ARS' injection methods for the emplacement of other ADVENTUS chemical/biological products such as Diamende and EHC. A copy of a press release announcing this settlement is available on our website.

ARS welcomes new partners

In 2006, ARS Vice President of Operations, Steve Chen and Principle Engineer and Sr. Project Manager, Mike Liskowitz became partners in ARS. Both individuals have contributed invaluable to the growth and success of ARS over the last 5 years.

New and Exciting Changes at ARS' Website

If you have visited our website recently, you would have noticed some discrete changes not only in the titles, but also in the name of the company. It reflects organizational changes to more clearly define our core expertise business lines.



Since 1997, we have used the term 'technologies' in our name. This name provided a broad description of a range of field services, engineering studies, field contracting and product research and development and sales.

We have changed our name to 'ARS Field Services' to better define our organizational alignment with our field related injection and fracturing services.
VISIT WWW.ARSFIELDSERVICES.COM

Deep Feroxsm System Providing Long Term Treatment at DOD Facility

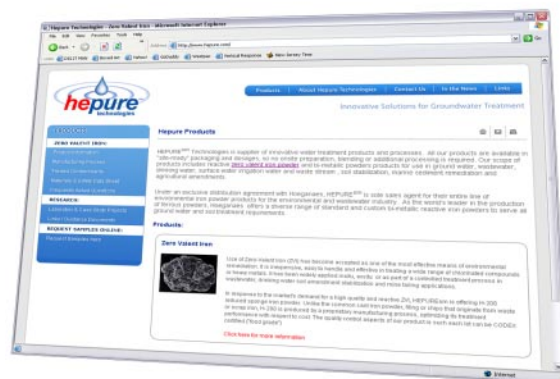
A two-year performance evaluation on the longevity of a 90-foot deep Feroxsm Treatment Cell (FTC) was recently completed at a DOD facility in Tennessee. Installation of the FTC was implemented in October 2004 as part of a Remedial Investigation Pilot Study within a suspected source area impacted with elevated concentrations of TCE and 1,1,2,2-PCA. As part of the field application, ARS utilized an innovative injection process combining sonic drilling and our proprietary gas-based injection technique to disperse 25,000 pounds of H-200 ZVI powder via four injection points from a depth of 75 - 90 ft bgs.

Groundwater samples collected within the FTC two years after the installation indicated the continuing reduction of CVOCs by the ZVI. More notably, CVOC levels in a monitoring well situated with the FTC have been reduced from a baseline concentration of 11,000 ppb to Non Detect. In addition, geochemical conditions within the FTC, as demonstrated by such indicators as D.O., ORP, pH and ferrous iron, remain highly reductive as the emplaced iron continues to react and reduce the contaminants.

The two-year evaluation also revealed limited increases in groundwater pH and therefore minimizing the formation of oxide coatings on the iron particles.

Looking for Zero Valent Iron? Visit www.hepure.com

HEPUREsm Technologies is supplier of innovative water treatment products and processes. All our products are available in "site-ready" packaging and dosages, so no onsite preparation, blending or additional processing is required. The scope of products includes reactive zero valent iron powder and bi-metallic powders products for use in ground water, wastewater, drinking water, surface water irrigation water and waste stream, soil stabilization, marine sediment remediation and agricultural amendments.



Contact Information

Online
website: www.arstechnologies.com
www.hepure.com
www.ifracture.net
eMail: moreinfo@arstechnologies.com

Head Office

Tel: 732.296.6620
Fax: 732.296.6625
98 North Ward St New Brunswick, NJ 08901