

ARS and University Enter Into Patent Licensing Agreement

ARS and New Jersey Institute of Technology (NJIT) recently entered into a six year licensing agreement to market and broaden the commercial application of the university's five environmental treatment patents including *Pneumatic Fracturing*, *Liquid Atomized Injection of Biological substrates*, *Dry Material Injection and insitu Ultrasound Treatment*. The agreement provides ARS with the sole right to apply the patented processes and negotiate third party sublicenses on behalf of the university. The agreement includes five unique innovative processes including *Pneumatic Fracturing*, *Liquid Atomized Injection of Biological substrates*, *Dry Material Injection and insitu Ultrasound Treatment*. Under the agreement, all third party inquiries related to the technology patents and licensing will be handled by ARS.



ARS is offering geographical, site-specific and full turn-key licenses to interested third-party firms. The license includes technology usage rights, application equipment, training and optional field support. Financing of the licensing packages is available to qualified firms. For further information, email us at

licensing@arstechnologies.com.

Installation of Feroxsm Source Zone Treatment at Hunters Point Navy Shipyard

In October of 2004, ARS completed a second-phase application of Feroxsm treatment at Parcel C located at Hunters Point Shipyard in San Francisco, California. The objective of the project was to address groundwater TCE contamination in a roughly 40,000-sq. ft. area under and around two buildings. This application was an expansion



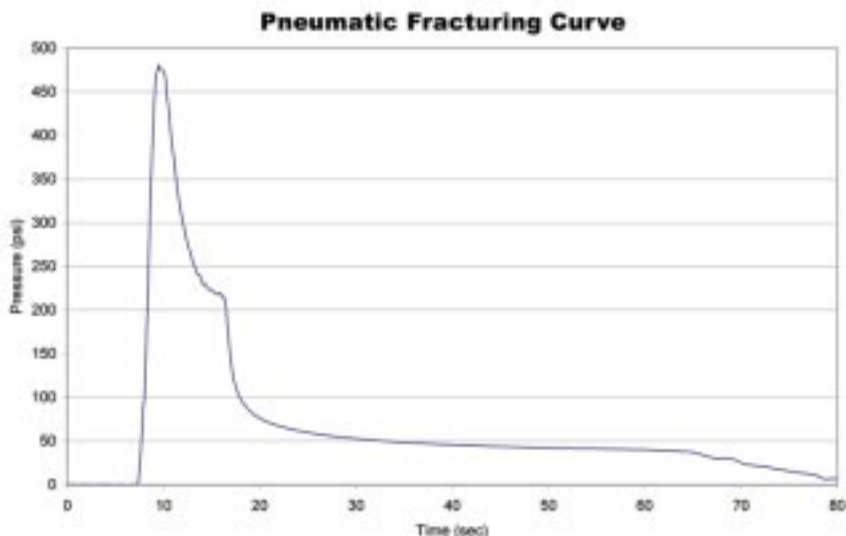
of a successful application by ARS in December of 2002 as part of a technology demonstration to address the hot spot of the plume with TCE concentrations upward of 80,000 ug/l. Subsequent to the first application, TCE in the hot spot area was reduced to double-digit ppb levels.

The recently completed 2nd application targeted the portion of contaminations outside the first treatment area with TCE concentrations higher than 1,000 ug/l. ARS successfully emplaced more than 70,000 pounds of a proprietary zero-valent iron powder (H-200, visit www.zerovalentiron.com) via thirteen (13) injection points at

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various depths ranging from 14 feet to 60 feet bgs. Pneumatic fracturing was required at some locations to facilitate delivery of the ZVI material into the subsurface. Post-Injection sampling results 3 months after this field application shows TCE concentrations reduced by 99% or higher in a number of monitoring points. TCE in the “hottest” monitoring well was reduced from 4,400 ug/l to 230 ug/l as of January 2005. ARS expects the concentration within the treatment area to continue decreasing following a similar long-term pattern observed after the first phase treatment.

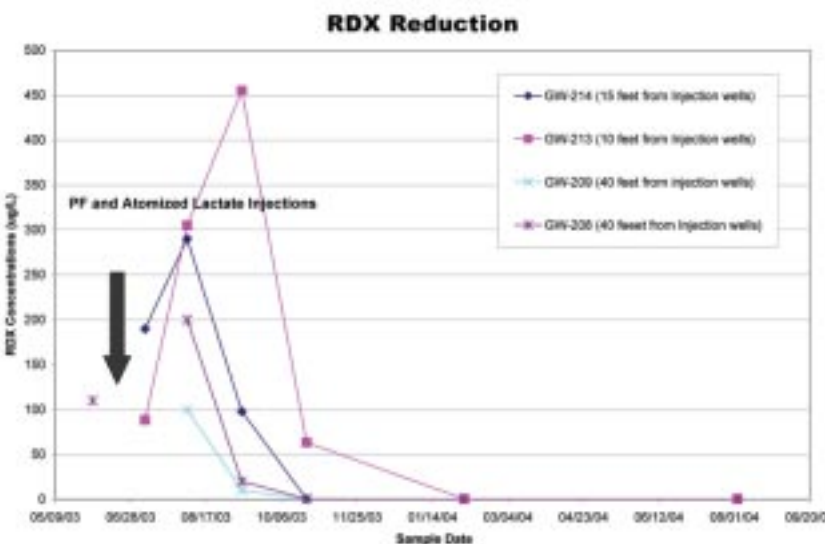
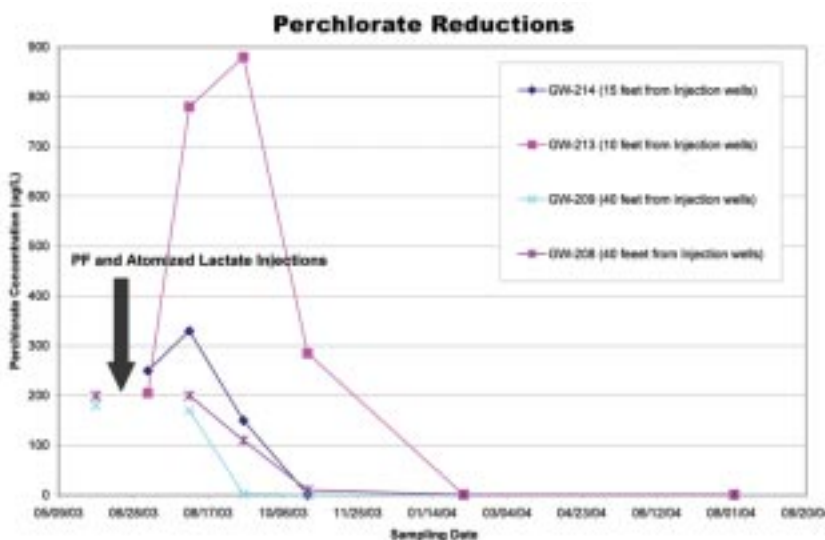


Pneumatic Fracturing and Sodium Lactate Injection Leads to Successful Treatment of Perchlorate and RDX

A recent ARS project was performed using sodium lactate to treat ground-water impacted with perchlorate and RDX at the former Naval Surface Warfare Center (NSWC) in Silver Springs, Maryland.

To address the low permeability and heterogeneous (saprolite) geology at the site, ARS was contracted to provide Pneumatic fracturing (PF) and liquid atomized injection (LAI) services to distribute sodium lactate within the target treatment zone. Approximately 1,000 gallons of a 60% sodium lactate solution were injected into five boreholes, spaced approximately 50 ft apart within the 10,000 square foot treatment area. Seven monitoring wells, located 10 to 175 feet (ft) from the injection points, were used to monitor the distribution and persistence of the lactate and the effectiveness of the treatment.

During the injection operations, pressure influence was observed in monitoring wells at distances exceeding 70 ft. Post-injection groundwater sampling results show effective distribution of the sodium lactate and significant degradation of perchlorate, RDX and other energetic compounds. Lactate concentrations as high as 8,400 mg/L were observed in monitoring wells within the treatment zone three weeks after the injection.



Perchlorate concentrations in the four wells located within the treatment area were reduced to less than 1 mg/L. Additionally, perchlorate concentrations were reduced from 160 to 95 mg/L within 6 months at a distance of 175 ft from the injection points. RDX concentrations were reduced from 190 mg/L to less than 0.52 mg/L.

Pneumatic Fracturing with Proppant Injection evaluated in Loam Formation

ARS recently completed a field pilot test at an Army facility in Tennessee to evaluate the use of Pneumatic Fracturing integrated with proppant injection within a loess (silts and clays) formation to facilitate the installation and operation of SVE to treat the vadose zone. Field activities included the fracturing of three locations in a triangular orientation about 100 feet from one another and the subsequent injection of a ceramic proppant using either a slurry delivery technique or dry-media injection method.

After the fracturing and proppant injection, an air flow extraction test was conducted by the site consulting engineering firm. The results indicated an increase in extraction flow rate through the loess material of approximately 50-100%. A Vacuum ROI increase of approximately 200-300% relative to baseline testing was also observed. Overall, the field data indicate the dry-media injection of proppant in conjunction with Pneumatic Fracturing is an effective process for enhancing the permeability of a difficult formation.

ARS Memphis Field Application

A full-scale Feroxsm implementation recently occurred at a large military site in Tennessee. The project was part of an early implementation of the approved groundwater ROD for the facility. As part of the scope, ARS injected Feroxsm into 14 injection points at depths ranging from 70-100 ft bgs within a fine-sand aquifer. This project represented the first full-scale use of a newly developed rotasonic drilling/atomized injection method. This unique integration provides rapid hole advancement and efficient injection operations in deep formations. In total, 189,000 lbs of reactive iron powder were injected into the formation. A critical component of the Feroxsm process is ensuring that the Zero Valent Iron (ZVI) is sufficiently distributed within the subsurface formation overcome the heterogeneities in the formation and contaminant distribution. Using our patented high flow gas delivery system, nitrogen gas flow rates of 2000-3000 SCFM attained emplacement of ZVI 75 feet from injection points (verified with sample coring) during the operation.

Visit us at the Battelle In Situ and On-Site Bioremediation Conference.

The Eighth In Situ Bioremediation Symposium will be held in Baltimore, Maryland, on June 6-9, 2005. ARS will be exhibiting at booth # 507. In addition a paper titled



“Bioremediation of Perchlorate and RDX using Pneumatic Injection of Lactate” will be presented.

Make your plans to see us in Baltimore in June 2005!



Visit the Navy flash presentation on Nanoscale Zero Valent Iron. This demonstrates how the NZVI injection technology can be a suitable remedy for eliminating or migrating a contaminant source zone.

www.ert2.org/nzvit/tool.aspx

ARS Projects Coming to a Site Near You

Alabama

Chemical Oxidation for treatment of CVOCs and Hydrocarbons.
Pneumatic Fracturing to enhance tight clay soils

California

FeroxSM Project at former Government Facility in the San Francisco Bay Area

Georgia

FeroxSM Project at Government Facility in Central Georgia
KMnO₄ Project at Large Government Facility

Kansas

Pneumatic Fracturing to enhance SVE
Pneumatic Fracturing to enhance Insitu chemical oxidation

New Jersey

Pneumatic Fracturing and FeroxSM Treatment in Fractured Bedrock
Pneumatic Fracturing in Fractured Bedrock

New York

FeroxSM to treat Freon 113 source area

South Carolina

CVOC source reduction using FeroxSM at Government Facility



Tennessee

FeroxSM Application at Government Facility

Wyoming

Pneumatic Fracturing to enhance free product recovery

Technical Resource - www.arstechnologies.com

Have you checked out www.ARSTECHNOLOGIES.com lately? Our website is regularly updated and is a great resource for the latest fracturing and subsurface injection techniques. Recent additions include easier-to-use navigation and drop down menus. All content has been further refined including our chemical oxidation section, state-of-the-art Shockwave Flash animation and featured videos of our injection of emulsified nanoscale iron slurry. A new and improved search engine makes it even easier to locate specific terms in the vast resource of articles, case studies and white papers. All our case studies are now placed on a interactive map of North America. If interested in our work, sign up for our quarterly electronic newsletter, ifracture.net. Keep checking back for regular updates!



Contact Information

Online

website: www.arstechnologies.com
www.zerovalentiron.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