GeoSierra

Newsletter

Spring 2003

GeoSierra LLC – Spring 2003

Individual Highlights:

Iron Permeable Reactive Barrier (PRB) – Now a Proven Technology

Zero valent iron PRBs strategically placed in the saturated zone have been proven to abiotically degrade a wide range of chlorinated compounds into non-toxic end products. Iron filings in a PRB are also proven to precipitate and/or immobilize numerous heavy metals, thus removing them from the groundwater.

The first iron reactive PRB was constructed in 1991 as a field trial followed by two in early '95, and during the past seven years a number of full scale and pilot systems have been installed with over eighty (80) iron PRBs having been installed to date.

The rapid increase in the number of PRBs installed reflects the increasing maturity and acceptance of the zero valent iron technology and benefits of passive *in situ* remediation. Iron PRB technology is now considered a well-established and proven long-term solution for groundwater remediation and is acknowledged by many experts and regulatory agencies as a preferred remedy with a life of greater than thirty years. The advantages and applicability of iron PRB technology are numerous. Please call Jim Ortman at (770) 492-8214 to discuss.

GeoSierra's Patented Technology for Construction

GeoSierra's "azimuth controlled vertical hydraulic fracturing technology", the name of one of the patents, has been used to construct full-scale iron permeable reactive barriers (PRBs) from moderate depths (~50 ft bgs) to significant depths (130 ft bgs). GeoSierra has installed three PRBs to date that are deeper than 100 ft bgs. Our vertical hydrofracturing technology constructs the iron treatment wall from a series of conventionally drilled boreholes along the prescribed wall alignment, with a specialized frac casing grouted into the boreholes. The iron treatment wall is constructed by injection of the iron filings into each frac casing with real time quality assurance monitoring of the injections to quantify the PRB geometry and iron loading densities and to validate the wall placement is in accordance with design specifications.

GeoSierra technology and installation methods have advanced significantly in the past five years. With each new project, we apply our continuously improving best practices along with our patented tools and processes to remediate groundwater plumes and stop source areas from continuing to feed plume growth. In most cases, because of their depth, the areas of groundwater contamination would, without our deep PRB installation technology, be otherwise impossible to reach with an iron PRB wall. This is not to say we don't install shallow walls because we do. In fact, because of the many advantages of our "trenchless" installation technology, if the site is complicated with underground utilities –or- is in a densely populated area –or- would have excessive waste disposal costs from conventional PRB construction methods, we are also often the best choice to design and install PRBs at depths less than 40 feet. Having said this, it is worth noting all of the significant additional benefits to be gained from GeoSierra installed PRBs. The advantages and applicability of the GeoSierra technology are outlined on page 4.

Rigorous Quality Control Assures Quality Results

Active Resitivity Imaging

Hydraulic Pulse Interference Test

Many PRBs are continuing to be constructed with little, if any, QA/QC processes and tools. Considering the amounts of money spent on PRB design and construction we never cease to be amazed at the fact that so little effort goes into QA/QC involved with PRB design and construction. As the famous line from the Wizard of Oz states, “if you don’t know where you want to go, any road will get you there”. When it comes to design and construction of PRBs, GeoSierra always knows where we want to go and how we are going to get there.

GeoSierra has perfected a comprehensive Start-To-Finish suite of QA/QC tools and processes to ensure each PRB is designed to specifications in terms of height, depth, length and thickness, that it has not negatively affected the permeability of the formation surrounding the PRB, and that it will perform as expected with a high degree of probability.

START (PRE-CONSTRUCTION)
GeoSierra starts the pre-construction phase with a groundwater column test to establish the contaminants and their daughter products, to determine the half lives of the contaminants and to make certain there are no conditions that could lead to clogging of the PRB. We then do a baseline hydraulic pulse interference test (we are the only company in the GW industry that does this test - gauges are not available and we make our own). This is a true hydraulic transient test and determines the permeability of the formation in the area where the PRB will be placed. After the PRB is completed, we repeat the hydraulic pulse interference test to validate the permeability of the formation has not been affected.

Armed with the column test data and the characterization data from the baseline hydraulic pulse interference test, we are then able to complete a "Probabilistic Design".

REAL-TIME QA/QC DURING CONSTRUCTION OF THE PRB
One of our patented tools, "Active Resistivity Imaging" allows us to "see" the PRB wall on a computer monitor in real-time as the iron filings carried in our proprietary HPG gel is being injected. Monitoring the PRB injection image on the computer enables verification of coalescence between each PRB wall section, thus ensuring the PRB wall is continuous and completely coalesced, both horizontally and vertically in the subsurface. Additionally, the software calculates the thickness of the wall with a high degree of accuracy from the geometry associated with the cross-section view and weight of the iron injected during each sequence.

FINISH (POST-CONSTRUCTION)
Once the PRB construction is completed, we repeat the Hydraulic Pulse Interference Test and compare it to its pre-construction results. This before/after comparison process enables us to verify that placement of the PRB wall has not negatively affected the permeability of the formation.

The final series of QA/QC tests is our “Inclined Profile Resistivity Probe” across various points of the PRB. This serves as a second method of verifying the thickness of the wall. This actual measurement of the wall thickness combined with the calculated thickness from the active resistivity imaging test provide a high degree of confidence that the wall thickness is as designed.

COMPREHENSIVE QUALITY ASSURANCE / QUALITY CONTROL IS A MUST
GeoSierra is the only company employing the quality tools and processes just described. Because of these QA/QC processes and tools we are able to warrant and verify that each PRB wall has been constructed in accordance with all specifications.

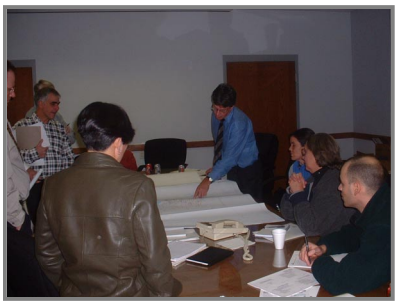
Recent Workshops & Presentations

GeoSierra has been spending a large amount of time over the last six months educating both regulatory bodies and consulting companies on GeoSierra's deep PRB technology. Although PRBs have been accepted as a proven and preferred method of groundwater remediation, many organizations still believe there is a depth limitation in the construction of these PRBs.

GeoSierra has sought to overcome this perception by providing presentations and workshops to increase awareness that deep PRBs have already been installed and are successfully remediating the groundwater as designed, at depths of over 100 feet.

Over the past six months, more than 25 workshops or presentations have been given to the offices of the Federal and State regulator community, AFCEE, US Army Corp of Engineers, DOE and a significant number of industry consulting companies

If you are interested in participating in a workshop please contact GeoSierra at (770) 492-8214.



Grant Hocking (CEO, GeoSierra) during a recent workshop.

GeoSierra Opens Office on West Coast

To better serve our west coast clients, GeoSierra recently opened an office in Torrance, CA. This will enable GeoSierra to logistically mobilize its equipment and resources in a more efficient manner to best accommodate our client's needs. The Torrance office is managed by Brian Bracken.

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Aerial view of PRB Site in Gardena California

Recent GeoSierra Project Contract Awards

GeoSierra has been awarded contracts by British Petroleum (BP) and a US Army site for deep PRB installations in Gardena, California and Northern California respectively. The BP wall will be 82 feet in height from 18 ft to 100 ft bgs. The Army wall will be 20 feet in height from 95 ft to 115 ft bgs. In the case of both sites, GeoSierra's ability to install a preferred remedy (zero valent iron) at these considerable depths was a major factor in each decision.

Longest PRB Wall to Date

Montross, VA 2002 - An Iron PRB system was designed and built by GeoSierra for treatment of groundwater contaminated with VOCs. The PRB is approximately 1200 ft long with depths ranging from 17 ft bgs to 45 ft bgs on one section and from 5 ft bgs to 30 ft bgs in the shallowest section. The soils consist of sands and silts, with extremely loose flowing sands and silts encountered over a 15 ft depth interval.

Although moderate in depth, the PRB was installed by GeoSierra's trenchless construction technology because of the complications and the excessive costs of waste disposal. The project was completed in October 2002.

1200 ft. PRB at Arrowhead Superfund Site

GeoSierra

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We're on the Web!
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Lessons Learned While Installing PRBs

A number of problems can occur during the construction of PRBs using the biopolymer slurry wall method. Each of these problems can cause clogging of a PRB wall but in combination, can have devastating effects on its permeability. The problems associated with Slurry Wall construction can include the following: Trench wall cave-ins during construction, smearing of the trench side walls caused by the backhoe bucket, fines in the guar gel slurry, problems with the guar gel not bio-degrading (breaking), and the use of biocides to kill indigenous microbes and inhibit the degradation of the guar.

Another problem endemic to slurry wall construction involves "filter caking" which is caused by guar gel adhering to the trench walls and thus escaping the breaking enzyme. The results of these construction difficulties and problems with the slurry wall construction method itself have, in some cases, led to an impermeable PRB.

GeoSierra's installation technology completely avoids all of these types of problems associated with other PRB installation methods.

Benefits of GeoSierra's Patented Technology, cont'd...

1. Construction of deep PRB systems with significant cost savings and superior remediation efficacy over alternative remedies.
2. Proven technology with demonstrated effectiveness of placement of iron PRBs at both deep and shallow depths.
3. Installs a continuous iron filings PRB wall with high permeability and porosity.
4. Minimal impact on the natural groundwater flow regimes.
5. Comprehensive start-to-finish QA/QC processes and tools for confirmation of constructed PRB geometry; continuity, iron loading, thickness, height, length and hydraulic characteristics.
6. Minimally invasive installation of PRBs in congested workplaces in and around buildings, underground and overhead utilities and right of ways.
7. Trenchless construction - no excavation and minimal site disturbance.
8. Very safe with low risk exposure to personnel and property.

Iron & HPG Gel Mixing

Iron & HPG Gel Crosslinked

About GeoSierra...

GeoSierra, a privately owned company, is based in Atlanta, GA. GeoSierra concentrates its expertise and technology focus on projects and services involving solutions for remediation of contaminated groundwater and soil. While we are capable of providing turnkey completion of projects; from investigation, testing, design and construction, we frequently participate in teaming arrangements with other solution providers. We are always open to such teaming arrangements and recognize the added value such arrangements can often bring to a project. Application of GeoSierra's specialized deep PRB technologies have been instrumental in helping to successfully modify a number of soil and groundwater records of decisions (RODs). The result in each case has been substantial life cycle cost savings and accelerated cleanup times.