



## ETI Announces Terrsula Ltd. as Licensee for the United Kingdom

We are pleased to announce that Terrsula Ltd. [www.terrsula.com] has joined EnviroMetal Technologies Inc.'s (ETI's) international license team as our representative for permeable reactive barrier (PRB) technology in the United Kingdom.

Terrsula staff have experience with several PRB applications in the UK for a variety of inorganic and organic contaminants, including treatment of unique compounds such as carbon disulphide (CS<sub>2</sub>). The PRB division of Terrsula is led by Dr. Genevieve Boshoff, who joined Terrsula from the contaminated land consultancy industry. Dr. Boshoff has also worked in academia and was formerly at Queen's University Belfast where she was a major contributor to the UK Environmental Agency guidance document concerning PRB technology. Terrsula offers

### Inside This Issue:

- **New ETI Licensee in the UK**
- **ZVI-Clay Treatment for DNAPL**
- **New Iron Sources for PRBs**
- **AquaBlok™ Sediment Capping**
- **GeoSiphon™ Configuration with EHC™**
- **ETI Settles Legal Action with ARS**

the full array of services required to implement and operate PRB technologies for the treatment of a range of contaminants, including treatability studies, process design, detailed design and implementation, commissioning and monitoring/maintenance, and is able to warrant performance providing appropriate laboratory evaluation and engineering design is undertaken. ETI will be supporting Terrsula on several PRB installations planned over the next 12 months.

## ZVI-Clay Technology for Source-Zone Clean-Up

ETI has recently signed an agreement with Colorado State University (CSU) to market and license CSU's ZVI-Clay technology. The ZVI (zero valent iron) - Clay technology has been proven for mass reduction treatment of source zones including areas containing or suspected to contain DNAPL.

A mixture of iron and clay are introduced into the source area using jetting, shallow soil mixing or deep soil mixing rigs. The mechanical mixing ensures that the iron is distributed into the entire source area, including fine-grained layers, which are difficult to treat with other technologies and can be a significant reservoir of contaminants.



**ZVI-Clay Zone Installation, Martinsville, NC**

*(Continued from Page 1)*

Deep soil mixing can be used to apply the technology to depths of up to 120 feet (37 m). ETI will be working with Dr. Tom Sale and his colleagues at CSU on further advancements of the technology.

The ZVI-Clay technology has several advantages over other treatment technologies:

- physically mixing the iron and clay into the source zone overcomes many of the shortcomings of other remedial methods that arise from heterogeneities in the subsurface;
- mixing iron and clay into the subsurface physically reduces the mass flux of organic contaminants out of the source zone;

- granular iron has been shown to be effective in degrading a wide range of VOCs;
- granular iron is not hazardous to handle or use;
- granular iron is benign in the environment; and
- granular iron has been shown to be reactive over long periods.

This technology has been applied at four full-scale sites; two DuPont facilities, U.S. Marine Corps Base Camp Lejeune, NC, and U.S. Arnold Air Force Base, TN. Results from the DuPont sites and the Camp Lejeune sites show that ZVI-Clay technology was effective at achieving the target contaminant mass reduction levels.

If you would like more information on this technology, please contact us.

## On-going Research Into Alternative Iron Sources

As a result of continuing worldwide cost pressure on cast iron prices (currently about US\$600-\$700/ton), ETI continues to investigate alternative sources of iron for use in PRB technology. While the two primary suppliers of recycled grey cast iron continue to produce a consistent, reliable product, ETI is testing several alternatives, including:

- granular iron derived from primary iron ore processing;
- processed foundry sand; and
- granular iron from reclaimed munitions.

While results to date indicate that the latter two materials may have applications on a site-specific basis, the ore-derived granular iron shows considerable promise as a third primary supplier for PRBs. Several column tests indicate its reactivity with respect to common VOCs such as trichloroethene (TCE) and carbon tetrachloride appears to be comparable to existing commercial products, and its morphology may be particularly suitable for use in injection based methods, such as vertical hydraulic fracturing and pneumatic fracturing and injection.



*Open pit iron ore mine in Northern Quebec. Courtesy of Quebec Metal Powders.*

The unit price of this material is currently about US \$550/ton.

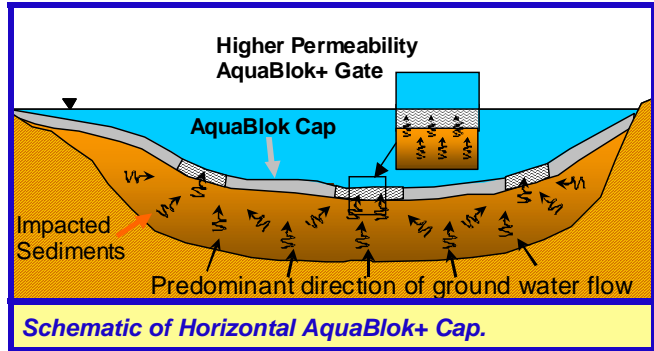
ETI will be disseminating the results of our on-going research into alternative iron sources in more detail in a variety of technical publications and conferences during 2006.

## AquaBlok+™ Capping Technology

In conjunction with AquaBlok, Ltd. and the Adventus Group, ETI is introducing AquaBlok+™ sediment capping technology as a means of mitigating both diffusive and advective solute flux from contaminated sediments to an overlying surface water column.

AquaBlok® is a composite-aggregate technology comprised of a dense core surrounded by clay or clay-sized materials, which when hydrated form a continuous cohesive low-permeability layer (schematic). It has been used in several different environments (rivers, bays, estuaries) to cap contaminated sediments.

Reactive AquaBlok™, or AquaBlok+™ involves the addition of small amounts of iron and/or other reactive materials to the composite aggregate. The technology builds on iron/clay liner research at the University of Waterloo (Major, 1999), and ZVI-Clay DNAPL research at the University of Waterloo and Colorado State University (Wadley & Gillham, 2005; Schackelford et al., 2005), which has shown that small percentages of iron mixed with clay can significantly reduce the mass flux of organic contaminants (and presumably certain inorganic contaminants) through thin clay layers. AquaBlok+™ may be deployed in two primary configurations:

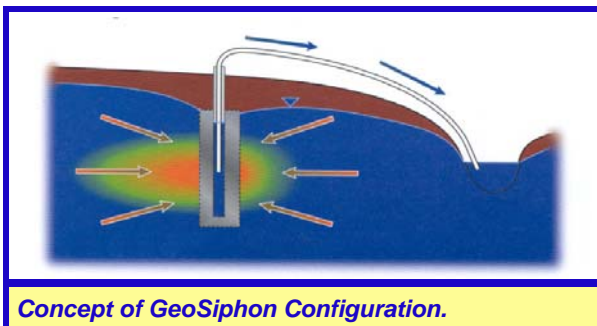


- (i) a continuous, low permeability AquaBlok+™ cap that will degrade any solutes transported vertically through the horizontal barrier by molecular diffusion; and
- (ii) a horizontal reactive gate for sites where the capped sediments are in hydraulic contact with discharging groundwater. In these situations, a relatively permeable iron/sand or AquaBlok+™ gate surrounded by a lower permeability standard AquaBlok® cap will act to relieve hydraulic head pressure and to treat any dissolved contaminants as they migrate vertically through the permeable reactive zone, or gate.

Extensive laboratory testing in support of AquaBlok+™ has been undertaken, and the first field applications of this technology are planned for summer 2006.

## Integrating GeoSiphon™ Treatment Systems with EHC Technology

GeoSiphon™ cell treatment systems, developed over the last 10 years by the Savannah River National Laboratory, innovatively integrate basic siphon principles with permeable reactive barrier methodology. A typical GeoSiphon configuration involves installing a



large diameter well (for example, 2 to 10 feet; 0.6 to 3.0 m), containing a cell of permeable treatment media. The treatment cell surrounds a screened pipe into which the siphon is inserted. The system is installed either by conventional well-drilling techniques or by auger and caisson methods. Drawn by the siphon, contaminated groundwater flows through the cell, where it is treated. The decontaminated water is then discharged, typically to the ground surface, a stream, or a lake.

The GeoSiphon™ offers important benefits as a remediation technology. It is passive technology, requiring no outside energy source and very little maintenance. It harnesses existing natural forces to produce treatment flow rates greater than natural groundwater flow, facilitating accelerated cleanup.

(Continued on Page 4)

(Continued from Page 3)

It can be configured to work with a variety of treatment media to address many different contamination situations.

In particular, EHC™ bioremediation technology (www.AdventusGroup.com), comprising controlled release solid carbon particles, plus mineral amendments, have been shown to promote the rapid biodegradation of perchlorate, nitrate and chlorinated solvents in various site groundwaters using indigenous microbial populations. When combined, these technologies offer several advantages over existing other extraction-based treatment:

- in-situ treatment using these technologies eliminates the need for above-ground structures, piping etc. and routine maintenance of treatment equipment;

- relative to other liquid amendments, the longevity of EHC™ (3 to 5 years) makes it much more cost-effective material for treatment;
- the physical characteristics (uniform grain size, low bulk density) of the EHC™ material are particularly amendable for its use in the GeoSiphon/GeoFlow Cell configurations, especially when periodic replacement of the material is required; and
- ideally, the GeoSiphon/GeoFlow cells are operated passively, taking advantage of natural (horizontal and vertical) gradients existing in the water supply zone, further lowering treatment costs by eliminating the need for expensive pumping/recirculation schemes.

ETI is pro-actively searching for sites where these integrated technologies may be applied. Through the U.S. DoD's CT/LDC Program, there may be funds available to offset costs of GeoSiphon™ technology demonstrations at US government facilities.

## ETI Settles Legal Action with ARS

EnviroMetal Technologies Inc. (ETI) is pleased to announce a settlement in legal proceedings initiated in October 2004 against ARS Technologies Inc. (ARS). As a result of this settlement, the parties have reached an agreement that will result in a profitable relationship in applying ETI's core technology using ARS' patented placement methods.

Under the agreement, all projects utilizing ARS' Ferox injection method will require the site owner to

obtain a site-specific license directly from ETI. This settlement does not affect ARS' patented pneumatic fracturing and gas based atomized injection technology.

The scope of the agreement between ETI and ARS by no means grants other third party installation contractors the right to use the intellectual property of ARS without a separate licensing agreement with ARS directly.

Press release is available on [www.eti.ca](http://www.eti.ca).



solutions for groundwater remediation

For a free estimate or for information, please contact us!

Tel: 519.746.2204  
Web Site: [www.eti.ca](http://www.eti.ca)

