EnviroBlend®
Metal Waste Treatment
BY PREMIER MAGNESIA LLC

Groundwater/Injection

EnviroBlend® has extensive knowledge of the fate and transport of heavy metal contamination, as well as remedial action experience. Our scientists have spent years developing cost-effective chemistries for rendering lead, cadmium, arsenic, hexavalent chromium, zinc and other heavy metal contaminants non-hazardous. This research has resulted in a number of patented products that have been widely applied for heavy metal remediation sites across the country.

Former Conoco Fertilizer Manufacturing Facility – South Carolina

EnviroBlend was used to treat 90,000 cubic yards of soil and groundwater from a former fertilizer manufacturing facility. The soil was treated in-place and up to depths of 30 feet.

Automobile Parts Manufacturer – Indiana

EnviroBlend was used to remediate approximately 9,000 tons of chromium-impacted soil adjacent to the building foundation *in-situ*. Chromium was no longer detectable in groundwater after approximately 150 days of treatment. Resulting in cost savings of approximately $600,000 compared to traditional dig-and-haul alternatives.

Former Tomco Wood-Preserving Site – Indiana

From 1980 to the fall of 1993, Tomco Wood-Preserving used the property to pressure-treat wood products intended for exterior construction. In 1999 the presence of arsenic and chromium impacts in surface and subsurface soils were identified. In 2000, on-site buildings were demolished, and a fence was erected around the facility. The Voluntary Remediation Program (VRP) accepted the Tomco application in May 2001. The remediation consisted of excavation along with *in-situ* EnviroBlend remediation. A total of 2,872 tons of arsenic-and-chromium-containing soil and 116 tons of debris were excavated as part of the source removal operation. After groundwater was sampled for four (4) consecutive quarters, it was determined that arsenic did not exceed acceptable risk levels, and subsequently, VRP issued formal closure to the site.

Former Fertilizer Facility -Ashepoo, South Carolina

Remediation efforts have concluded at a former fertilizer-manufacturing site near Charleston, SC. Significant concentration reductions for the primary metals of concern (arsenic and lead) in soil and groundwater were achieved through stabilization involving excavation of contaminated soil, mechanical mixing with EnviroBlend C, and backfilling with treated soil.

The Ashepoo site is underlain by 1-8 feet of low-strength fill and debris above 14-28 ft of loose permeable sand resting on low-permeability clay; the water table is approximately 4 ft below ground surface. The fertilizer manufacturing process used at Ashepoo between the mid-1800s and the 1960s involved dissolution of phosphate rock (containing trace levels of naturally occurring arsenic) with sulfuric acid in lead-lined vats. Dissolved lead and arsenic were found at concentrations up to 18mg/L and 220 mg/L, respectively. Additionally, the pH of groundwater was as low as 0.4 standard units.

In 1999, a PRB was selected as the preferred remedy for the site. Pre-design investigations, however, found the remedy was not appropriate due to unfavorable hydrogeologic conditions. The amendment selected for use at Ashepoo (EnviroBlend) was based on pH neutralization and buffering, reduction/oxidation, lead-complexation, and arsenic adsorption/co-precipitation. Excess acid neutralization capacity was added to the process to provide for long-term pH control of the treated soil mass.

Successful treatment results were achieved through the excavation of unsaturated soil and direct mechanical mixing with dry chemicals using a specialized Lang rotary mixer. Full-scale application of this technology began in February 2002 and was completed nine months later.

Quality control of the aquifer soil treatment was monitored through a porewater screening process followed by groundwater sampling from 20 temporary wells. Post-treatment median arsenic and lead concentrations in groundwater from the six wells were 92 and 98% lower, respectively than pre-treatment median concentrations. The maximum post-treatment lead concentration was 0.028 mg/L, with approximately 70% of the samples meeting the lead concentration target. The maximum post-treatment arsenic concentration was 0.68 mg/L, with about 25% of the samples meeting the arsenic target.

Former Industrial Operations Site - Mid Atlantic

A 21-acre parcel in the Mid-Atlantic United States hosted several industrial operations from 1907 to 1982. Groundwater at a pH of 5 SU and containing as much as 30 mg/L of zinc discharges to a small stream on one edge of the facility. The site surface was remediated and redeveloped into an apartment complex. Groundwater remediation to a goal of 2.0 mg/L zinc was deferred until after the apartment complex was built. *In-situ* stabilization technologies that could be applied with minimal interference with site use were evaluated and implemented to achieve the remediation goal.

The remediation had to reduce aqueous zinc concentrations using reagents that were amenable to injection. Two approaches were considered:

1. Zinc Hydroxide: Zinc sequestration as a hydroxide [Zn(OH)2] can achieve the necessary concentration reductions with an increase of pH from the acidic site conditions to pH values in the range of 8 to 10 SU. EnviroBlend AQ was selected as a pH buffer for zinc stabilization.

2. Zinc Sulfide: Zinc can also be sequestered as a zinc sulfide mineral [ZnS] to low aqueous concentrations. Sulfide application is commonly used in wastewater treatment systems as calcium polysulfides [CaSx]. The material has a very high pH and has the potential to create hydrogen sulfide odors. A slurry consisting of native sulfur and a pH buffer that would produce polysulfides after injection (and thereby mitigate potential odor issues) was also evaluated.

A pilot test was completed to demonstrate the in-field application of the injection process and the efficacy of the remedy. Zinc concentrations in groundwater downgradient of the injections fell from 21.2 mg/L to less than 1.0 mg/L within 7 months following the injections.

A total of 45,000 gallons of EnviroBlend AQ was injected into 63 borings to form treatment barriers along the downgradient side of the site. Approximately 3 weeks were required to complete the injections. Downgradient monitoring wells will be sampled periodically to assess the full-scale performance of the remedy.

Callahan Mine Superfund – Maine

The Callahan Mine Superfund Site is the location of a 150-acre former zinc/copper open-pit mine adjacent to a residential neighborhood. Charter executed remediation of OU1 to address mine contamination (lead, arsenic, and PCBs) present in the residential-use area. Lead, arsenic, and PCBs were discovered to exceed acceptable levels for human contact and long-term

exposure. The mine ore pad was the source of significant groundwater contamination.

Project highlights

- On-site treatment with EnviroBlend® of 3,000 tons of TCLP-failed lead-mine waste prior to off-site disposal
- Excavate and relocate metal-impacted soils from residential properties; remove 5,000 cubic yards (cu. yds.) of lead and arsenic-contaminated soil
- Excavate, stockpile, characterize, and dispose of PCB contamination; the PCB-impacted soils totaled 15,000 tons
- Total of 65,000 tons of contaminated soil excavated and staged
- 22,000 cu. yds. of ore material relocated and installed as a multi-layer soil and geotextile cap to cover <10ppm PCBs
- Site improvements to minimize discharge runoff

MRI Superfund Site – Florida

The MRI Corp Superfund site is an area where a recycling facility operated from 1961 to 1968 leaving contaminated soil and groundwater as result from facility operations. Over 60,000 tons of lead-contaminated soil was treated with a 2% dosage rate specialty EnviroBlend reagent. The project took bulk pneumatic deliveries, stored material on-site in silos and used a pugmill for mixing. The treated soils were rendered non-hazardous as confirmed by TCLP testing.

Phosphate Fertilizer Plant

ENTACT performed a removal action to address arsenic and lead-impacted soils and sediments at a former phosphate fertilizer plant site.

Scope of work included:

- Sizing, removal, disposal, and/or recycling of 7,000 tons of concrete, asphalt, and debris
- Excavation of 80,000 cubic yards of impacted soils from an approximately 14-acre area
- Solidification/stabilization of 13,600 tons
- Removal, dewatering, and solidification of 1,600 cubic yards of sediment in a freshwater marsh situated in a tidally influenced area adjacent to a river
- Loading 121,757 tons of non-hazardous soils and 1,000 tons of ACM for off-site transportation and disposal by the client
- Removal and disposal of 1,132 linear feet of asbestos piping
- Amendment and placement of backfill in saturated zone areas for groundwater treatment
- Site restoration including uplands and marsh restoration

Power Plant Industrial Wash Water – Florida

In Florida, laboratory treatability studies were conducted to evaluate the nickel-stabilizing capacity of various soil amendments for the purpose of enhancing the attenuation of dissolved nickel from industrial wash water derived from operations at a power plant fired with Number 6 fuel oil. The wash water, containing an average nickel concentration of 10 mg/L, percolated through the base of a holding pond into groundwater. The ambient attenuation capacity of native soil was inadequate to attenuate the nickel concentration to less than the state groundwater protection standard of 0.1 mg/L. Studies were conducted to evaluate approaches

to improve the attenuation capacity of the native soil with regard to nickel binding with the intent to modify the percolation pond to allow its operation for wash water disposal while also complying with groundwater quality requirements.

A series of tests were performed to identify and select appropriate metal-binding reagents, evaluate the nickel binding capacity of the selected reagents, and test various mixtures of native soil and the reagent for removing nickel from wash water to below the groundwater standard. Tests were performed in flow-through columns to measure percolation rates and nickel removal under gravity-driven flow with relatively short contact times to simulate *in-situ* infiltration through the percolation pond.

Results indicated that a relatively small concentration (4% by weight) of EnviroBlend® CS mixed to a depth of 12 inches into the native soil effectively attenuated nickel from the wash water and would continue to be effective for at least 30 wash cycles (up to at least 133 mg/kg of nickel loading) or approximately five years of normal operation. Synthetic Precipitation Leaching Procedure (SPLP) analyses performed on the amended soil samples exposed to the equivalent of 30 wash cycles of soluble nickel indicated the attenuated (bound) nickel did not leach from the soil at detectable concentrations.

The state regulatory agency approved the addition of the amendment to the soil in the bottom of the pond for the removal of nickel from the facility's industrial wash water. The amendment was spread in the bottom of the pond during renovation and mixed to a depth of 12 inches. Following the placement of the amendment, wash water was discharged to the pond with no apparent effect on the percolation rate of the pond. The performance of the modified pond bottom with regard to nickel removal is being evaluated through shallow groundwater monitoring. This approach provided an initial cost savings of approximately $250,000 over other water treatment alternatives and was operated with no ongoing O&M costs.