

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.

Industrial Waste Disposal NPL Site -South Carolina

Stabilization/solidification of more than 57,00 cubic yards of soil impacted by arsenic, cadmium, chromium, lead, mercury, and nickel. The site is surrounded by extensive residential development. Used advanced geostatistics and XRF analysis to focus on the site excavation and treat and handle only affected soil. Constructively reused treated soil, sludge, and waste. Treated soil was used as internal berms within the on-site landfill. Significantly reduced treatment of additional material by ascribing the existing chromium to background sources. Performed project for final cost of \$7 million versus the preliminary cost estimated at \$14-25 million based on USEPA data.

Copper Smelting Facility – Australia

Conducted treatability test to determine field dosages for treatment of arsenic, cadmium, copper, lead, selenium, and zinc. Designed a mapping plan that resulted in a 10 percent savings in treatment costs by identifying regions of waste that require lower treatment dosages than site composite sample. Percentage of parcel batches passing TCLP after a single treatment exceeded 95 percent. Total treatment cost was less than half the cost of hazardous waste disposal.

Former Manufacturing Facility – Southeastern U.S.

Treated 30,00 tons of slag and slag-affected soil impacted by lead, cadmium, chromium, and zinc. Treatment bulking of less than 2 percent additional weight, saving additional costs for landfilling. Treated over sixty, 500-ton batches in five weeks, and disposed treated soil and slag at Subtitle D permitted landfill. Maintaining properties encouraged favorable pricing from landfills. Performed treatment at less than 90 percent of budget estimates.

Secondary Aluminum Smelter

A secondary aluminum smelter in the US has found the use of EnviroBlend® for *in-situ* treatment of heavy metal wastes has allowed them to save cost on raw material inputs via the use of lower value scrap while still maintaining the metallurgical properties demanded by their customers.

The high cost of hazardous heavy metal waste disposal associated with the use of lower value aluminum scrap had been a disincentive for the smelter. Higher purity scrap had been the alternative until EnviroBlend use was investigated. EnviroBlend utilization with *in-situ* heavy metal treatment of furnace dust allowed for the use of less pure scrap without the added cost of hazardous waste generation and disposal. This allowed the smelter to dispose of the now non-hazardous waste in a local landfill thereby greatly reducing the costs of tipping fees.

The bulking of the waste stream with reagent addition was minimal. The cost of the minimally bulked waste disposal in a non-hazardous landfill was favored over the elimination of a costly hazardous waste alternative and the liabilities associated with its disposal in hazardous materials landfills.

Secondary Aluminum Smelter – Western U.S.

Another western U.S. smelter has enjoyed cost savings by switching away from hydrated lime to magnesia-based chemistries. This allowed for acid gas emissions treatment and reduced flammability concerns with their solid wastes due to a lower pH reagent not causing free hydrogen gas formation in the baghouse. This allows for easy transport to a local landfill without violating DOT 4.3 regulations.

Airport Firing Range – Ohio

Environmental Remediation Contractor remediated a former firing range which sat on a seven-acre area in the middle of the taxiways and runways of an active airport. The site's constituents of concern were hazardous and non-hazardous lead (Pb), arsenic (As), and PAH-contaminated soils.

- Worked closely with city officials, onsite consultants, and airport management to maintain compliance with all regulatory and FAA rules
- Performed *in-situ* treatment and soil fixation of over 11,000 tons of hazardous lead-contaminated soil using Enviromag dosages ranging from 1% to 3% weight to weight
- Excavated and loaded over 20,000 tons of treated and non-treated non-hazardous, contaminated soils to an approved off-site disposal facility

Services:

- Dig and Haul
- Soil Treatment and Stabilization
- Landfill/Earthmoving

C&R Battery Superfund Site – Virginia

EnviroBlend® was used to remediate 38,000 cubic yards of soil with a pugmill. Treated material was disposed of off-site at a Subtitle D landfill. The project averaged throughput of 1,000 tons per day and reduced bulking of treated material by over 7,500 tons compared to treatment with Portland cement. In total, the client saved \$300,000 compared to alternative technologies.

Columbia Development Corporation – South Carolina

Remediated over 500 tons of lead-impacted soil at a brownfield redevelopment site in South Carolina. Soil was rendered non-hazardous with a low dosage rate of EnviroBlend in accordance with UTS treatment standards. Met the client's 2-week time frame, completing the project at half the cost of the alternative option of disposing in a hazardous waste landfill.

Confidential Site – Pennsylvania

Approximately 8,000 tons of soil and sediments were treated and removed off-site using EnviroBlend® CS.

The soil was remediated by bringing contaminated soil from a creek and applying 1 ton of EnviroBlend to every 300 tons of waste. After mixed, the soil was sampled and taken to a non-hazardous landfill.

Diamond State Salvage Superfund Site

EnviroBlend® treated over 11,000 tons of lead-hazardous soil *ex-situ* at a former salvage yard. A low dosage rate resulted in reduced cost for transportation and disposal of treated soil. Treated material was disposed of off-site in a Subtitle D and TSCA landfill. The project was completed in less than seven working days.



Fairmont Battery Site – Kansas

Conducted a time-critical removal action to clean up a site purchased as part of a residential relocation program. Provided construction management for *in-situ* treatment and stabilization of 3,700 cubic yards of soil impacted with lead from crushed batteries. Removed impacted soil to an off-site landfill and backfilled excavations with general fill. Completed the project within 1 month of authorization, and the client met the regulatory deadline.

Former Absco Scrap Yard – Pennsylvania

The former Absco scrap yard had been used for 40 years, and previous to that the location had been used as a rail yard. As a result of this long history of industrial use, site soils were contaminated with polychlorinated biphenyls (PCBs), petroleum, lead, and other metals. The site was designated as a Superfund site and the former owner was under a consent order agreement with the United States Environmental Protection Agency (USEPA) and the Pennsylvania Department of Environmental Protection (PADEP) to remediate the property. Once sold, the remediation became the responsibility of the new owner prior to plans for redevelopment. The untreated soil was found to be hazardous for lead, containing total lead concentrations in excess of 3,000 parts per million. EnviroBlend® was added at 1% to 3% by weight of the soil.

Post-treatment, the soil of the former Absco scrap yard was transported off-site and disposed of at a non-hazardous Subtitle D landfill. This work was conducted in close contact with USEPA and the agency approved the remediation and disposal option upon its completion. The client found the use of EnviroBlend to be a technically sound, environmentally acceptable, and cost-effective solution.

Former Foundry

Treated approximately 2,000 cubic yards of soil in stockpiles *ex-situ* with backhoes. Treated material disposed of at a Subtitle D permitted landfill. The total treatment and non-hazardous disposal costs were less than half of the cost of hazardous waste disposal.

Former Skeet & Trap Shooting Range - California

20,000 tons of lead-contaminated soil was remediated to below TCLP treatment standards using EnviroBlend® CS. Soil was excavated into stockpiles and batch-treated. The remediated soil was removed off-site to a non-hazardous landfill.

GNB Technologies, Inc – Illinois

Remediated 30,000 tons of soil, initially *ex-situ* with a pugmill, with subsequent phases treated *in-situ* at GNB Technologies, Inc. Used the treated material to construct a surface water diversion berm, saving them time and expense of hauling the treated material to a Subtitle D landfill. After the Illinois DOT identified impacted soil at another area of the facility due to a right-of-way expansion project. This area was treated *in-situ* with IEPA and IDOT approval. This saved the client approximately \$600,000.

Golf Course Reclamation – Midwest

Suburban golf club was constructed on a former firing range. Site soil mainly impacted with handgun and rifle rounds. During course construction, urban fill and firing range soils were introduced to native site soils for ground leveling and physical improvement.

For reclamation, soils were not screened to remove bullets or urban fill inclusions. Untreated soil composite sample “Bulk 2” contained 37,100 mg/kg of total lead leaching at 1,900 mg/L. A dosage rate of 4% EnviroMag Coarse reduced lead leachability to 0.47 mg/L (TCLP standard of 5.0 mg/L). Soil was disposed off-site in a Subtitle D landfill.

Leaching Results							
Sample Name	Lab ID	EnviroBlend® Dosage		Screening Leaching Test Results			
		Chemical	Percentage	Pretest pH	Solution	Final pH	Lead mg/L
Bulk 2	10-07025	Untreated	-	1.82	TCLP 1	4.77	1,900
		EnviroMag® Coarse	3.0%	-	TCLP 1	7.82	1.77
			4.0%	-	TCLP 1	9.25	0.47

Kerr-McGee Cleveland Refinery – Oklahoma

AES Certified did extensive work in Cleveland, OK, remediating waste from a former refinery that occupied roughly 170 acres of land, plus adjacent impacted areas. Operations from the former Kerr-McGee Cleveland Refinery produced fuel products and operated between 1912 to 1972; crude oil tanks and pipelines were in use until 1995. Portions of the facility were also used to make hydrocarbon products by blending imported hydrocarbons.

Activities at the site included remediation of 86,000 tons of lead-and-hydrocarbon-impacted soils, backfill operations, and site restoration. AES Certified was successful in treating 30,000 cubic yards of hazardous lead-impacted soil with EnviroBlend® to render it non-hazardous for transport and disposal to a local non-hazardous landfill.

Ultimately, this provided a significant cost savings of \$2,820,000 for the client. The project was completed on time and within budget.

Landfill Foundry – Utah

A landfill based in Utah has been using EnviroBlend® in a fixed mixing tank to treat waste at their facility for the past 20 years. EnviroBlend’s product, EnviroMag XL, is used to treat 32,400 tons of lead-contaminated soil, baghouse dust, sediments, and sludge annually.

Prior to EnviroBlend treatment, the Toxicity Characteristic Leaching Procedure (TCLP) levels average around 5mg/L to 110 mg/L. EnviroBlend XL successfully reduces the lead to non-detect. The site is regulated by the Utah Department of Environmental Quality.

Lemac Foundry – Pennsylvania

EnviroBlend® rendered over 350 tons of lead-affected soil non-hazardous at Lemac Foundry. The treated soil was transported to and disposed of at a Subtitle D landfill, which provided significant savings over disposing at a hazardous-waste landfill.



Nahant Marsh – Iowa

The Nahant Marsh site in Davenport, Iowa is a former shooting range with lead-contaminated soil and sediment. Heavy-metal contamination consisting of lead, arsenic, silver, and antimony was found in soil and sediment surrounding the five shooting platforms on site. An additional shooting area was identified and appeared to have been used early in the history of the site. An estimated 9 tons of lead shot was deposited on the site annually for 27 years for a total of 243 tons of lead shot.

The source area was identified as the area impacted by the past shooting activities. The U.S. Fish and Wildlife Service conducted sampling of the marsh area and found up to 283 lead pellets per grab sample in sediment samples collected between 109 and 177 yards from the shooting platforms. Local waterflow was diagnosed with lead poisoning from lead shot. Since arsenic, silver, and antimony concentrations did not exceed RCRA Toxicity Characteristic Leaching Procedure (TCLP) limits, lead was the only constituent of concern.

The remedial objectives for the site included the development and implementation of a stabilization approach to meet the Toxicity Characteristic Leaching Procedure (TCLP) criteria of 5.0 mg/L for lead in the TCLP test, followed by off-site disposal of stabilized materials.

Through bench-scale treatability study analysis, it was determined that a 2% dosage rate by weight of EnviroBlend® CS would effectively reduce TCLP-lead concentrations in the soil to below 5.0 mg/L. EnviroBlend was applied to stockpiled materials, then thoroughly mixed using conventional construction equipment. After receiving conformational results from a certified laboratory, the stabilized material was disposed of at an off-site landfill.

The cost per treated ton on this project was \$6.75 using EnviroBlend.

Pre-Regulatory Landfill Closure – North Carolina

A former unpermitted landfill had lead-contaminated soil caused by battery cracking and disposal. Prior to treatment, TCLP levels were >5.0 mg/l lead. The client utilized pre-staged stockpiles and an excavator to apply EnviroBlend® CS at a 3% dosage rate. Total cost savings of \$1.75 million were realized by being able to dispose of the material in a non-hazardous Subtitle D landfill versus a hazardous Subtitle C landfill.

“EnviroBlend has always been a reliable product. We have successfully treated many tens of thousand tons of soil through the years.” – Confidential Client

Railroad Company – Minnesota

On-site stabilization with EnviroBlend[®] recently saved a large railroad company over \$8 million in hazardous waste transportation and disposal costs. Historical sandblasting operations had generated a stockpile of over 90,000 tons of hazardous lead-impacted soil. The site had been included on both the Superfund National Priorities List (NPL) and the Minnesota Permanent List of Priorities.

EnviroBlend treatment additives were mixed with the stockpile of lead-impacted soil to stabilize the hazardous material on-site. The stabilized soil was then disposed of at an off-site Subtitle D non-hazardous landfill.

By using EnviroBlend, this railroad company realized a number of benefits in addition to substantial cost savings, including:

- EnviroBlend was mixed with the contaminated material using conventional construction equipment.
- Soil treated with EnviroBlend is stable over a wide pH range and will not leach in the environment. This translates into long-term liability protection as supported by the USEPA's National Risk Management Laboratory.
- EnviroBlend has been used on over 50 remediation sites across the country and is widely accepted by regulatory agencies.

Twin Cities Army Ammunition Plant – Minnesota

The former Twin Cities Army Ammunition Plant (TCAAP) is a four-square mile site located in New Brighton/Arden Hills, MN. The extent of the contamination covers a 25-square mile area. Land use in the area consists of residential, commercial, and industrial with on-site wetlands and woodlands surrounding Rice Creek watershed. From 1941 to 1981, the site was used to manufacture, store, and test small arms ammunition and related equipment. Waste materials such as VOCs, heavy metals, corrosive materials, and explosives were disposed of at 14 source areas. Several of the source areas impacted by test-firing activities were targeted for remediation to remove metals and reduce the toxicity characteristics concentrations of the soil.

The remedial objective for this work included on-site stabilization of contaminated soil to below the Toxicity Characteristics Leaching Procedure (TCLP) criteria for lead and antimony and off-site disposal.

Phytoremediation and lead-extraction processes were implemented in earlier remediation phases of the TCAAP project. In 1998 EnviroBlend[®] was selected in a competitive bid process to stabilize additional soil. Total lead concentrations in the soil were between 113,000 and 330,000 mg/kg. Stabilization with EnviroBlend achieved results below the Toxicity Characteristic Leaching Procedure (TCLP) criteria of 5.0 mg/L.

Contaminated soil at the TCAAP site was characterized, excavated, and stockpiled. A coarse granular EnviroBlend was thoroughly mixed in the stockpiles using conventional construction equipment at a recommended dosage rate of 3%. The EnviroBlend stabilization process does not require the use of water or a curing period. The treated material was then analyzed using the TCLP test. All stabilized material passed the TCLP criteria and was disposed of in a Subtitle D landfill. Ethylenediamine tetra-acetic

(EDTA) acid was found in soil at a portion of the site, potentially leftover from former lead-extraction processes implemented at the site. EDTA complexes lead and other heavy metals and increase their leachability. A quick-turnaround treatability study in a third-party applied chemistry laboratory demonstrated treatment effectiveness using EnviroBlend on a representative sample of soil contaminated with lead and EDTA.

EnviroBlend was used for the stabilization of 47,000 tons of soil. The total project cost was less than \$10 per treated ton for soil stabilization assistance, including treatability studies, technical assistance, pilot studies, and reagent supply.

Winston-Salem Police Firing Range – North Carolina

The project consisted of remediating 2,400 tons of lead-contaminated soil from the municipal firing range by stabilizing the soil with the use of EnviroBlend® and transporting stabilized soils to a local land-fill. The stabilized lead-contaminated soil was required to pass a series of tests, including TCLP, MEP, and SPLP metals prior to removal. Working in the different areas and concentrations of lead contamination, CST teamed with Premier Chemical to evaluate and pretest the soil to best determine the proper mixing of EnviroBlend. This enabled CST to provide a competitive bid and win the award of the job. Working as a team with the city and Premier Chemical, CST was able to complete work under budget and ahead of schedule. The finished product not only met but exceeded the city's expectations, allowing the city to continue to use the site for future training rather than abandoning the site.