

EnviroBlend<sup>®</sup> 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 Herbicide Manufacturing – Kansas City, MO**

The Armour Road site was used for railroad herbicide manufacturing and blending from 1948 to 1986. Powdered arsenic (95% pure), monosodium arsenic, and various other chemicals were part of the herbicide production. Subsurface testing showed significant arsenic contamination in over 40,000 tons of soil. The EnviroBlend team formulated site-specific treatment chemistry for the contaminated soil that was effective at low doses, saving the owner considerable off-site disposal costs.

Table 1. Initial Full-scale Treatability Data Summary

	Pre-Treatment		Post-Treatment	
	Dose	Total Arsenic	TCLP Arsenic	TCLP Arsenic
Range	0.75% - 2.30%	1,700 - 10,600	1.7 - 63.6	0.28 - 2.90
Median	1.25%	5,220	15.1	1.20
Mean	1.53%	5,450	20.7	1.32

**Former Mining Site – Missouri**

Site soils ranged from 1,000 mg/kg to 5,000 mg/kg arsenic, leaching from non-hazardous to over 30 mg/L. The soil was variable with some mine tailing inclusions. A 2% dosage of EnviroBlend CR50 was appropriate for the majority of site soils, and a 3% dosage of EnviroBlend CR50 was used for the pile/source area soils.

Leaching Results							
Sample Name	Lab ID	EnviroBlend <sup>®</sup> Dosage		Screening Leaching Test Results			
		Chemical	Percentage	Pretest pH	Solution	Final pH	Arsenic, mg/L
Composite	14-02015	Untreated	-	3.57	TCLP 1	5.52	4.45
		EnviroBlend <sup>®</sup> CR50	2.0%	-	TCLP 1	5.83	0.087
Source	14-02016	Untreated	-	1.87	TCLP 1	5.50	30.7
		EnviroBlend <sup>®</sup> CR50	2.0%	-	TCLP 1	5.64	3.87
		EnviroBlend <sup>®</sup> CR50	4.0%	-	TCLP 1	6.08	0.53

**AIG Technical Services, Inc. – Indiana**

Expedited property transfer of arsenic and chromium impacted site. Successfully treated with only 2 % dosage of EnviroBlend chemistry and disposed of off-site as non-hazardous soil.

### ***CMC Lite Yard- Former Pesticide Production – Minnesota***

Pesticides were produced from 1938-1968 at this 5-acre former railroad yard adjacent to a residential area. Tests identified significant contamination, both on the site and in the surrounding neighborhoods. The remedial action plan called for the arsenic to be treated in place and disposed of off-site. EnviroBlend chemistry for arsenic was found to be the best overall chemistry for the on-site treatment due to its effectiveness at very low doses and its low cost per treated ton of soil. More than 15,000 tons of contaminated soil were treated and removed from the site.

### ***Former Lumber Company Site – Wisconsin***

Wisconsin's Taylor County inherited a prime location 45-acre Brownfield site. The former landowner used the site to treat lumber with copper-chromate arsenate (CCA). Arsenic levels exceeded 1,000 mg/kg in some areas. EnviroBlend was used to stabilize approximately 2,400 tons of soil contaminated with CCA. Arsenic concentrations in the soil were reduced to below 0.005 mg/L and the treated material was left on-site.

### ***Former Ashepoo Fertilizer Works- Charleston, South Carolina***

Spills at this former fertilizer plant contaminated the soil and groundwater with acid, arsenic, and lead. Sampling found arsenic as high as 220 mg/L. Over 45,000 cubic yards of saturated affected soil were effectively treated *in-situ* with EnviroBlend to below-drinking water standards. The site was located in a tidally influenced coastal environment, and the project was hailed as a success by both the USEPA and the client.

### ***Copper Smelting Facility - Australia***

Conducted treatability tests to determine field dosages for the treatment of arsenic, cadmium, copper, lead, selenium, and zinc. Designed a mapping plan that resulted in a 10% savings in treatment costs by identifying regions of the waste that required lower treatment dosages than would be required for a composite sample. Most parcels of material required only single dosing of chemicals. The overall percentage of batches passing the TCLP after a single treatment exceeded 95%. Total treatment cost was less than half of the cost of hazardous waste disposal.

### ***Former Fertilizer Manufacturing Site – Carteret, New Jersey***

This client needed to remediate 37,000 tons of soil in tidal areas impacted with lead (up to 136,000 mg/kg) and arsenic (54,000 mg/kg). The soil was in a low pH environment and was located at depths of 8-16 feet. The project was performed during winter. The soil was rendered non-hazardous by the application of EnviroBlend and was reused on the site, saving the client approximately \$1 million.

### ***Property Development Corporation – Rhode Island***

Treated 750 tons of arsenic-impacted soil using conventional construction equipment. Treated material was used for on-site backfill.

### ***AIG Technical Services, Inc. – Indianapolis, Indiana***

Soil impacted with arsenic and chromium was successfully treated with only 2% dosage of EnviroBlend chemistry and disposed of off-site as non-hazardous soil.

**Former Fertilizer Manufacturing Facility – Tennessee**

Untreated composite of arsenic impacted soil, average soil concentration result was 3,720 mg/kg; untreated high arsenic impacted sample was 6,330 mg/kg. The average sample resulted in leaching of 18.9 mg/L in TCLP prior to treatment. A dosage rate of 1% wt./wt. EnviroBlend HXD reduced arsenic leachability to 0.69 mg/L. The highly impacted area, untreated sample leached at 50.6 mg/L in TCLP testing. Dosage of 2% wt./wt. met TCLP criteria, and further dosage dropped the concentration of leachable arsenic.

Sample Name	EnviroBlend <sup>®</sup> Dosage				
	Chemical	Percentage	Solution	Final pH	Arsenic mg/L
Average	Untreated	-	TCLP 1	4.83	18.9
	EnviroBlend <sup>®</sup> AS	1%	TCLP 1	4.63	0.69
		2%	TCLP 1	4.55	0.42
High	Untreated	-	TCLP 1	4.88	50.6
	EnviroBlend <sup>®</sup> AS	1%	TCLP 1	4.62	8.26
		2%	TCLP 1	4.47	3.16
		3%	TCLP 1	4.44	1.48

**Former Manufacturing Site – Missouri**

C Comp and D Comp samples resulted in 1,170 mg/kg and 4,900 mg/kg TCLP arsenic, respectively. Treatment with EnviroBlend HX or EnviroBlend 50/50 HX produced exceptional treatment results at dosage rates of 1-4% wt./wt. EnviroBlend 50/50HX selected for application across affected areas at rates of 1-4%wt./wt. dosage.

Sample Name	EnviroBlend <sup>®</sup> Dosage				
	Chemical	Percentage	Solution	Final pH	Arsenic mg/L
C Comp	Untreated	-	TCLP 1	5.52	4.45
	EnviroBlend <sup>®</sup> HX	1.0%	TCLP 1	5.11	0.87
	EnviroBlend <sup>®</sup> 50/50 HX	2.0%	TCLP 1	5.83	0.087
D Comp	Untreated	-	TCLP 1	5.50	30.7
	EnviroBlend <sup>®</sup> 50/50 HX	2.0%	TCLP 1	5.64	3.87
		4.0%	TCLP 1	6.08	0.53

**Former Pesticide Production Site – Superfund - (MN)**

Pesticides were produced from 1938-1968 at a 5-acre former railroad yard adjacent to a residential area. Tests identified significant contamination, both on-site and in surrounding neighborhoods. EnviroBlend chemistry for arsenic was selected as the best solution

for on-site treatment due to its effectiveness at very low doses and low cost per treated ton of soil. More than 15,000 tons of contaminated soil were treated and removed from the site.

### ***Industrial Waste Disposal (SC)***

Stabilization of more than 57,000 cubic yards of soil impacted by arsenic, cadmium, chromium, lead, mercury, and nickel. The site is surrounded by extensive residential development. Constructively reused treated soil, sludge, and waste. Treated soil was used as internal berms within the on-site landfill.

### ***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. Soils not able to be treated were shipped to an off-site disposal facility. 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. Groundwater was sampled for four (4) consecutive quarters it was determined that arsenic did not exceed acceptable risk levels. VRP issued formal closure to the site on April 25, 2003.

### ***Former Mill - Montana***

EnviroBlend was used to treat 3,000 tons of mill tailings *ex-situ* at a former mill. Waste was contaminated with lead, arsenic, and cadmium. The remediated soil was leave-in-place at the site.

### ***Nahant Marsh – Davenport, 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 waterfowl were 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 confirmational 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.

### ***Army Ammunitions Plant – EPA Region V***

In-situ remediation at Army Ammunitions Plant treated approximately 5,000 tons of soil contaminated with lead, arsenic, and barium.

### ***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

### ***Ductile Iron Foundry – Texas***

A ductile iron foundry in Texas has been using EnviroBlend® CS to treat baghouse dust for the past 11 years. The metals treated annually are Lead, Arsenic, Barium, Beryllium, Boron, Cadmium, Hexavalent Chromium, Mercury, Selenium, and Silver. The baghouse dust pH levels are also of concern for the foundry and are treated with EnviroBlend. The foundry uses the baghouse injection method for application at a dosage rate of 2-3lbs per hour of baghouse run time.

While the initial Toxicity Characteristic Leaching Procedure (TCLP) levels were unknown, the waste did test as hazardous per an EPA inspection. After treatment, the TCLP levels for each metal were all below detection limits.

Since the facility has had great success with EnviroBlend treating the baghouse dust, they recently started treating the baghouse filters prior to removal with a specialized EnviroBlend chemistry. Each filter has tested as non-hazardous since the use of EnviroBlend.

The site is regulated by the Texas Commission on Environmental Quality and the U.S. Environmental Protection Agency.

### ***Former Broadway Commons – Ohio***

Independence Excavating (IX) recently completed the stabilization of on-site soils and remediation of approximately 12,500 tons of soil at the former Broadway Commons property in Cincinnati, OH. Soil stabilization parallels the mechanical processes utilized for soil solidification. The differences inherently are the end product; soil solidification is a process to ultimately provide a dryer

material that meets certain geotechnical criteria; soil stabilization renders a material that would otherwise require management as hazardous for metal(s) as non-hazardous. IX saved the customer nearly a million dollars by rendering and stabilizing site soils and thereby allowing the soil to be disposed of as non-hazardous.

Soil stabilization is accomplished by introducing chemicals, also known as stabilizing reagents, into the soil via an excavator or through a spreader. IX heavily relied on the fast application processes of their specialized equipment, including a computerized truck-mounted spreader and a Wirtgen 2500 recycler operated through their affiliated company Flex-Tech Resources. For this project IX elected to team with Premier Magnesia, LLC, the sole manufacturer of EnviroBlend® heavy metal treatment products. EnviroBlend products are blended and manufactured to address waste-specific chemistry needs.

The main contaminants of concern at the former Broadway Commons site were lead and arsenic along with elevated soil pH. The EnviroBlend product Independence utilized effectively stabilized the lead (made it non-hazardous) without adversely affecting the arsenic and at the same time controlled the soil pH. Controlling the pH is essential in metal treatment, specifically with lead, as lead leaches at both high and low pH values. IX saved the customer nearly \$1 million by stabilizing site soils and thereby allowing the soil to be disposed of as non-hazardous.

### ***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

### ***Callahan Mine Superfund***

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

### ***Leave-in-Place Saves \$2 Million – Connecticut***

Approximately 12,000 cubic yards of soil contaminated with lead and arsenic was leaching above hazardous levels in the TCLP test. The soil was treated with EnviroBlend at a 3% mix ratio by weight and left on site to be compacted and capped. Total savings by using EnviroBlend over alternative opt-ins was \$2 million. Once remediated, this Connecticut-restricted-use site has the potential to have a second life as a commercial development.