



Antler Mine Competitive Study
Lead and Arsenic
Reduction/Stabilization



Site Background: The Antler Mine project involved removal of mill tailings and impacted soil from BLM land, and consolidation of the mill tailings and impacted soil in an onsite waste repository on previously impacted BLM land. Due to the acid generating potential and low pH of the mill tailings, neutralization and stabilization of waste is required during placement of waste in the repository.

The mine tailings have a low pH (2 to 3 pH units) that must be neutralized (6 to 8 pH units) as part of this study. Maximum concentration of total lead and arsenic found at the site is 3,400

milligram/kilogram (mg/kg) and 850 mg/kg, respectively. The two samples which exhibited the highest lead levels (DU-3 1445 and DU-3 1500) were analyzed for leaching potential using TCLP (Toxic Characteristic Leaching Potential) and SPLP (Synthetic Precipitation Leaching Potential). In addition, analysis of cadmium levels was added to the study based on prior testing which showed occasional high levels of cadmium in the DU-3 1500 tailings. A summary of the Baseline testing results is provided here.

Tailings Name	Metal of Concern	Total Level mg/kg	TTL Limit mg/kg	Sample Result SPLP mg/kg	SPLP Limit mg/kg	Sample Result TCLP mg/kg	TCLP Limit mg/kg
DU-3 1445	Arsenic	590	50	ND	5.0	0.19	5.0
DU-3 1445	Cadmium	4.6	100	0.3	1.0	0.29	1.0
DU-3 1445	Lead	1,000	1,000	1.2	5.0	2.4	5.0
DU-3 1500	Arsenic	23	50	0.1	5.0	0.14	5.0
DU-3 1500	Cadmium	15	100	1.0	1.0	0.68	1.0
DU-3 1500	Lead	4,700	1,000	ND	5.0	0.15	5.0

CERES Remediation Products was asked to recommend reagent(s) that would reduce lead and arsenic and bring the pH back to neutral conditions after soil mixing and treatment at the site while considering long term resilience and performance of the treated tailings. CERES provided MTS[®] remediation chemistries to achieve the site goals during the treatment trials.

Solution: An inhouse laboratory for the contracting parties performed the treatability studies comparing MTS[®] performance to that of Enviroblend[®] and Portland Cement mixing reagents at dosages between 1 and 6% by wt.

Performance Testing Results:

pH: The MTS[®] was shown to be the best performing reagent to provide neutral pH (pH levels of 7.25 and 7.09) at the 1.5% dose. Note that Ordinary Portland Cement was not capable of maintaining the pH within the neutral range (exhibited low pH levels of 4.72 to 4.81 pH units) at the lower dose (1.5% dose).

Arsenic and Lead Reduction: MTS[®] reduced leachable Arsenic and Lead to acceptable criteria in the tailings as shown in the summary table below.

Sample Name	Treatment Reagent and Dose	Replicate	Metal	SPLP Leachable Arsenic mg/L	TCLP Leachable Arsenic mg/L	Metal	SPLP Leachable Lead mg/L	TCLP Leachable Lead mg/L	Metal	SPLP Leachable Cadmium mg/L	TCLP Leachable Cadmium mg/L
DU-3 1445	MTS 1.5-2	Replicate #2	Arsenic	ND	0.096	Lead	0.0064	0.220	Cadmium	0.0420	0.061
DU-3 1445	MTS 1.5-3	Replicate #3	Arsenic	ND	0.110	Lead	0.0086	0.210	Cadmium	0.0660	0.032
DU-3 1500	MTS 2-2	Replicate #2	Arsenic	ND	ND	Lead	0.0073	0.420	Cadmium	0.0440	0.053
DU-3 1500	MTS 2-3	Replicate #3	Arsenic	ND	ND	Lead	0.2100	0.500	Cadmium	0.0710	0.085



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Comparison to Enviroblend®

A second treatability study was completed (free of charge) in February 2022 by Ursus Remediation & Technologies, LLC using a chemical reagent named EnviroBlend® for the stabilization of the mine tailings. A complete version of this second Treatability Study is provided in Appendix A. Results from the treatability study show that:

- the pH of the tailings was not easily neutralized by EnviroBlend®. Higher dosage rates of 5% to 7% are required. These rates are much higher when compared to the dosage rates needed for MTS and OPC (1.5% to 2.5%).
- the dosage rates (up to 5% to 7%) required to stabilize the cadmium to be within the metals leaching limit (SPLP) using EnviroBlend® was much higher than estimated.
- due to the required high dosage rates, use of EnviroBlend® will not be practical as the costs are expected to be higher.

Summary and Conclusions



“The results of the two treatability studies confirm that MTS reagent (at 1.5% dose) was the best performing reagent to provide both pH neutralization (pH levels of 7.25 and 7.09) and metals stabilization (leachable arsenic, lead, and cadmium levels are all below regulatory limits). This study also showed that while Ordinary Portland Cement was capable of stabilizing the arsenic, lead, and cadmium, it was not able to maintain the pH within the neutral range (OPC exhibited low pH levels of 4.72 to 4.81 pH units) at the lower dose (1.5% dose).... An added value of the MTS product is that the chemically bound metals are not only highly non-leachable but are extremely stable over hundreds of years. Thus, the use of MTS is considered to be a sustainable treatment that is also highly resilient.”

Contact C.E.R.E.S. Remediation Products for information about arsenic or lead remediation at your site.

C.E.R.E.S. Corporation is a remediation products manufacturer focusing on innovative and economical solutions for the sustainable remediation of heavy metals, chlorinated solvents, and petroleum hydrocarbons.