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Demonstration Bulletin

BESCORP Soil Washing System Alaskan Battery Enterprises Site

Brice Environmental Services Corporation

Technology Description: The BESCORP Soil Washing System is an aqueous volume reduction system that utilizes trommel agitation, high-pressure washing, sizing, and density separation to remove lead, lead compounds, and battery casing chips from soil contaminated by broken lead batteries.

The basic concept is to first liberate the lead/lead compounds from the larger soil particles by slurry agitation and spray rinsing and to then separate, by gravity, these heavy particles (greater than 6 sp. gr.) from the soil (sp. gr. 2.5). In a similar manner, the process segregates the casing chips (less dense than soil) by gravity.

The remediation objective was to clean the gravel and sand fractions to the USEPA cleanup levels for the Alaskan Battery Enterprises (ABE) Site: less than 1,000 mg/kg total lead and less than 5 mg/L Toxicity Characteristic Leaching Procedure (TCLP) lead.

A mobile 20 ton/hr unit performed this SITE Demonstration. The system flowsheet, illustrated in Figure 1, receives contaminated soil (minus 2 ½" in diameter) in a hopper/conveyor that feeds the revolving trommel wash unit. Material ranging from minus 2 ½" to plus ¼" (the gravel fraction) passes from a drum screen in the trommel to a casing chip separator that removes, by gravity, both battery casing chips and coarse metallic lead.

Material minus ¼" passes through the drum screen into the first of two counter-flow separation chambers. Additional casing chips (minus ¼" to plus 10 mesh), recovered from the chamber by sizing and density separation, accumulate in a chip pile. The balance of the minus ¼" slurry flows to the second separator which recovers the minus ¼" to plus 150 mesh soil (the sand fraction). This sand passes over another density separator for metallic lead fines removal and then through a dewatering spiral classifier. A unique advantage of using the separation chambers is the small amount (less than 1%) of minus 150 mesh fines left in the sand fraction.

The suspended and highly contaminated fine soil fraction (minus 150 mesh) overflows the separation chambers; the system mixes it with a

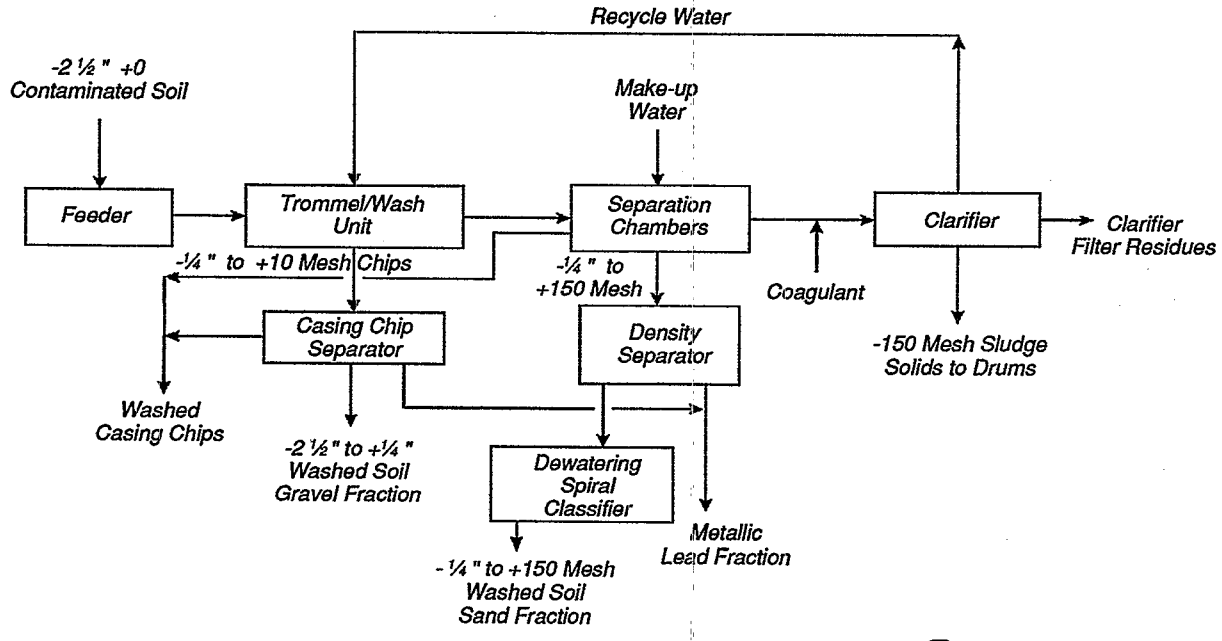

Figure 1. *The BESCORP soil washing system.*

coagulant/flocculant. This mixture flows to a clarifier where it forms a dense sludge that is discharged to waste storage drums for proper disposal or further treatment. After filtration, the clarified water recycles for use in the separation chambers, trommel washer, etc. Make-up water, fed into the clean water tank, maintains process water levels.

Waste Applicability: The system can clean gravelly-to-sandy soils contaminated with lead from batteries. Treatability studies on representative material are necessary to verify that the process will meet volume reduction criteria and cleanup goals.

Demonstration Results: This SITE Demonstration took place at the ABE Site between August 21, 1992 and August 29, 1992. It consisted of three test runs. Two replicate runs processed about 2.4 tons/hr of higher-lead-content soils measuring total lead levels at 4,211 and 10,374 mg/kg and TCLP lead levels at 72 and 132 mg/L respectively. A third run handled about 4.2 tons/hr of soil registering lower lead content: 2,276 mg/kg total lead and 50 mg/L of TCLP lead. The runs averaged about 5 hours in duration and 46 tons in total soil feed processed.

As indicated above, EPA's goals for the ABE Site cleanup are less than 1,000 mg/kg total lead and less than 5 mg/L TCLP lead. Preliminary data indicate the following results:

Lead Removal from the combined gravel and sand fractions during the three runs: 61%, 93%, and 85%.

Metallic Lead Removal from the contaminated soil produced large quantities of discrete lead in various sizes (pieces of terminal posts and internal battery grids). BESCORP tested and modified the metallic lead removal system during the first two runs. The processed sand and gravel in Run 3 contained no metallic lead.

Battery Casing Chips Removal from the combined gravel and sand fractions during the three runs: 94%, 100%, and 80%.

Process Efficiency rose as the Demonstration progressed. Although the process did not meet the 75% target efficiency, performance improved significantly from 11% to 32% to 49% during the three runs. BESCORP projects future efficiencies from 65% to 75%, based on new bench-scale procedures that retain a treated sand fraction of minus ¼" to plus 80 mesh rather than the minus ¼" to plus 150 mesh fraction retained during the Demonstration runs.

Gravel produced by all three runs met TCLP criteria, with average lead concentrations in the TCLP leachate at 1.0, 0.8, and 0.2 mg/L, respectively. The presence of metallic lead, which broke through from the casing chip separator, distorted average total lead concentrations for the first two runs (2,541 and 903 mg/kg respectively). Process modifications greatly improved metallic lead removal during the second and third runs. By the third run, total lead concentration in the treated gravel measured 16 mg/kg.

Sand from all three runs failed both tests: TCLP(42, 40, and 26 mg/L Pb) and total lead (1,819, 1,660, and 1,507 mg/kg). These failures resulted from improper sizing of the sand. The very fine sand (minus 80 mesh to plus 150 mesh) was highly contaminated. Based on recent bench-scale data, BESCORP claims that the addition of an attrition scrubber on the minus 1/4" to plus 80 mesh sand fraction can readily clean this fraction to the level required by EPA. This has not yet been demonstrated by the 20 ton/hr unit.

EPA will publish an Applications Analysis Report and a Technical Evaluation Report describing the complete Demonstration during the summer of 1993.

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