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Treatability Study Bulletin

Mobile Volume Reduction Unit at the Escambia Superfund Site

Technology Description: The Risk Reduction Engineering Laboratory (RREL) Releases Control Branch (RCB) has developed a pilot-scale Mobile Volume Reduction Unit (VRU) to determine the feasibility of soil washing for the remediation of contaminated soils. This mobile unit, mounted on two trailers, can process 100 lb/hr of soil feed. Soil washing is a cost effective technology used in conjunction with other methods for remediating contaminated soils. The process reduces the quantity of contaminated material that must be processed by a more expensive technology, such as incineration or bioremediation. In some cases, soil washing may be a successful stand-alone technology.

The Environmental Response Team (ERT) of the United States Environmental Protection Agency (EPA) wanted to evaluate soil washing using the VRU on contaminated soils at the Escambia Superfund Site in Pensacola, FL. This site contains approximately 250,000 yd^3 of sandy soil contaminated with pentachlorophenol (PCP) and creosote from wood treating operations. Thus, soil washing, a relatively inexpensive technology, might provide a large cost savings by significantly reducing the volume of soil requiring expensive treatment. The ERT defined the objectives of the test:

- Determine if the technology is effective in removing the contaminants.
- Determine if the VRU can achieve the cleanup goals of less than 30 ppm PCP, less than 50 ppm carcinogenic creosote compounds, and less than 100 ppm total creosote compounds.
- Estimate process parameters and cost factors for full-scale operation.
- Provide data for process scale-up.

The system, illustrated in Figure 1, begins by screening the excavated soil to remove debris and large objects, greater than 1/4 inch. The soil, fed into a hopper, is transferred by screw conveyor to the soil washer feed hopper, where the surfactant water, and alkali are added. A ribbon blender in the hopper mixes the soil and additives. A screw feeder, with speed control, then feeds into the mix into the soil washer's rotating trommel, where additional wash water is added. The washed slurry flows by gravity to vibrating screens for the separation of the cleaned coarse soil from the fines and wash water, which contain the contaminants.

After sampling, the washed coarse soil and fines slurry were held on-site pending further treatment. The VRU provides a fines slurry treatment system for separation of solids and dissolved contaminants from the effluent water. This slurry treatment system was not utilized.

The test used sodium carbonate as the alkali to raise the pH and Tergitol NP-10, a nonionic surfactant.

Evaluation of Test Results: The VRU treated soil during 20 2-hr tests over a 2-wk period in late July 1992. EPA investigated the following variables:

- Surfactant concentration — 0 to 0.4 wt% of water
- Temperature of washing — 85 to 120 ^oF
- pH — 7 to 10
- Liquid to solids weight ratio — 6:1 to 9:1
- Soils — 2 onsite sources

Technicians collected four types of samples: feed soil; screen overflow—coarse solids (>100 mesh); screen underflow (fines); and effluent water. Laboratory analyses measured particle size distribution and moisture content as well as the presence of PCP and 13 creosote compounds, five of which are considered carcinogenic.

The two feed soils had equivalent particle size distributions, only 1% to 2% by weight less than 125 microns (~120 mesh). The primary test soil, used in Runs 1 to 18, contained approximately 150 ppm PCP and 1,200 ppm total creosote, with 70 ppm carcinogenic creosote compounds. A surfactant concentration of 0.4% was used. Preliminary results, which were available within 48 hr, revealed high PCP and creosote removals. Subsequent runs utilized a lower surfactant concentration of 0.2% by weight of water.

Since these results were so encouraging, two runs used a second soil with higher contaminant levels. This alternate soil contained 135 ppm PCP, 2,550 ppm total creosote, and 115 ppm carcinogenic creosote.

The site action levels were easily achieved. The VRU washed approximately 98% of the PCP from the coarse soils with water alone. Surfactant concentration, pH, or operating temperature had little apparent effect. Residual PCP levels ranged from 1-10 ppm. Contaminant removal efficiency for the creosote without surfactant was about 90%. Analyses of the washed soil showed that residual creosote levels of 60-80 ppm were readily achieved for both soils at surfactant concentration levels of 0.20%. Residual concentrations for the carcinogenic creosote compounds

ranged from 2-6 ppm for the runs with surfactant to 8-12 ppm for those without. In the presence of surfactant, the impact of pH and elevated temperature was minor.

Conclusions:

- Soil washing reduced the coarse soil (>100 mesh) contaminant concentrations to levels that met the cleanup goals at the Escambia Site.
- The addition of surfactant improved the cleanup levels for the creosote, but had little or no impact on PCP levels.
- The soil washing achieved about 98% removal of the PCP in the coarse soil fraction.
- A 0.2% surfactant concentration in the washing fluid enhanced creosote cleanup, providing removal efficiencies of better than 95% for the coarse soil fraction.

EPA will publish a report to provide a more detailed discussion of the Escambia test.

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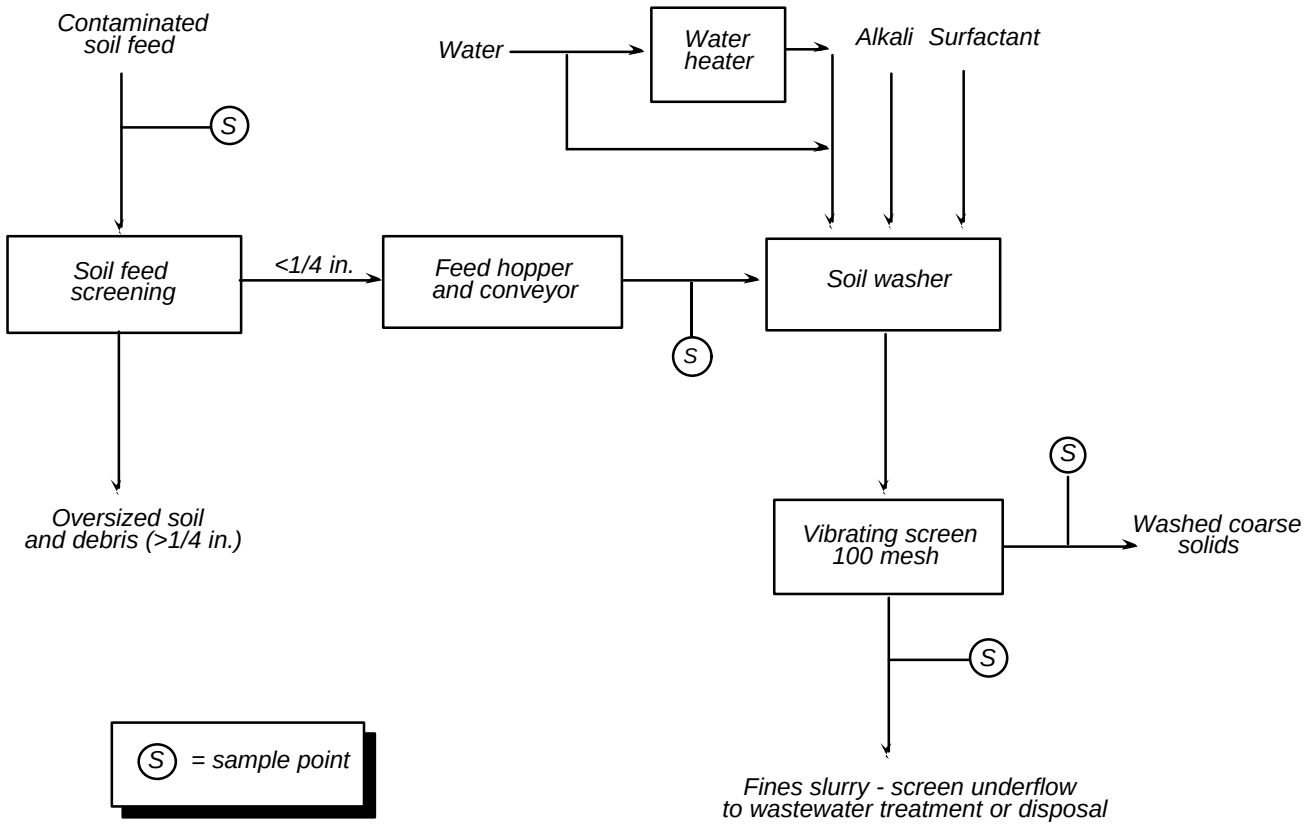

Figure 1. *VRU process.*

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