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Demonstration Bulletin

Mobile Volume Reduction Unit

U.S. Environmental Protection Agency

Technology Description: The Volume Reduction Unit (VRU), which was developed by EPA, is a mobile, pilot-scale soil washing system for stand-alone field use in cleaning soil contaminated with hazardous substances. Removal efficiencies depend on the contaminant as well as the type of soil.

Soil washing is a water-based ex situ process for mechanically scrubbing soils to remove undesirable contaminants. The process removes contaminants from soils by either dissolving or suspending them in the wash solution (which is later treated by conventional wastewater treatment methods) or concentrating them into a smaller volume of soil through simple particle size separation techniques. The concept of reducing soil contamination through the use of particle size separation is based on the

finding that most organic and inorganic contaminants tend to bind to fine-sized clay and silt particles primarily by physical processes. Washing processes that separate the particles from the coarser soil particles effectively concentrate the contaminants into a smaller volume. The clean larger fraction can be returned to the site for continued use.

Figure 1 provides a diagram of the typical VRU operational setup. (The VRU setup at the Demonstration site was modified slightly from this typical setup.) The basic VRU system consists of the following subsystems:

- Soil handling and conveying (feed soil)
- Soil washing and coarse screening (mini-washer and 100 mesh screen)

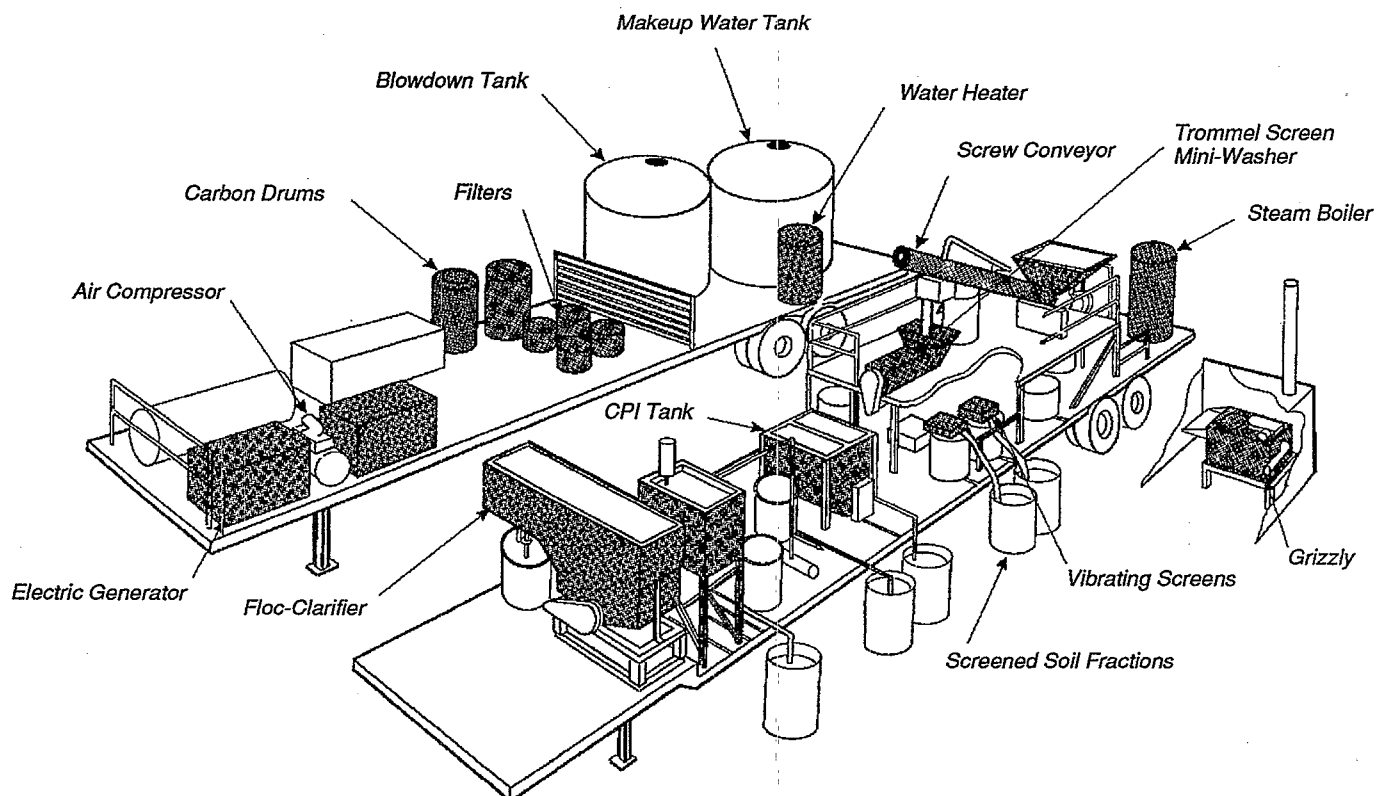


Figure 1. Typical VRU operational setup.



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- Fines/floatables gravity separation (Corrugated Plate Interceptor tank)
- Fines flocculation/water clarification and solids disposal (floc tank)
- Water treatment (10 micron filter, liquid phase carbon adsorbents, blowdown tank, and water storage tank)
- Utilities - electric generator, steam boiler, and compressed air unit.

Two vibrating screens continuously segregate the soil into various size fractions. Mini-washer overflow, containing the coarser solids, falls onto the first screen. Solids from the first screen overflow are gravity-fed to a recovery drum. The first screen underflow is pumped at a controlled rate to the second screen where it is joined by the mini-washer underflow. The overflow from the second screen is gravity-fed to the same recovery drum containing the other washed soils. The second screen underflow drains into a tank with a mixer and is then pumped to a Corrugated Plate Interceptor (CPI). Three streams exit the CPI: materials lighter than water, solids and washwater. Materials lighter than water (floatables such as oil) flow over an internal weir, collect in a compartment within the CPI, and drain by gravity to a drum for treatment and disposal. Solids are discharged by the bottom auger to a recovery drum. Effluent from the CPI overflows into a tank with a mixer to a static mixer located upstream of the floc clarifier's mix tank.

Flocculating chemicals such as liquid alum and aqueous poly-electrolyte solutions are metered into the static flash mixer tank. The slurry overflows into the floc chamber, where bottom solids are augured to a drum for disposal. Clarified water is pumped from the floc overflow tank through 10-micron filters for fine particle removal and through activated carbon drums for hydrocarbon removal to permit recycle.

Waste Applicability: The VRU is a mobile research unit that was developed for treatability studies on soils contaminated with a wide variety of contaminants. It was designed to be extremely flexible in terms of equipment and washwater additives used. In general, soil washing is effective on soils with a large, coarse sand and gravel fraction contaminated with a wide range of organic, inorganic, and reactive contaminants.

Demonstration Results: The Demonstration took place at the former Escambia Treating Company in Pensacola, FL between November 5 and 13, 1992. The 26-acre facility had used pentachlorophenol (PCP) and creosote (polynuclear aromatic hydrocarbons or PAHs) to treat wood products from 1943 to 1982. The site is currently undergoing a Superfund cleanup that is being managed by EPA Region IV.

During the Demonstration, the VRU operated at a feed rate of approximately 100 lb/hr and a washwater-to-feed ratio of about 6:1. The physical condition of the washwater was modified with various combinations of surfactant, caustic, and temperature change. Condition 1 (no surfactant and ambient pH and temperature), Condition 2 (surfactant addition and ambient pH and temperature), and Condition 3 (surfactant addition, pH of 9-10 and temperature of 150°F). A summary of the preliminary data is shown in Table 1.

Table 1. Summary of Preliminary VRU Demonstration Data

	Condition (%)		
	1	2	3
Average PCP removal	80	93	97
Average PAH removal	79	84	96
Feed soil returned as washed soil	96	96	81
Mass balance of total mass	104	113	98
Mass balance of PCPs	108	60	24
Mass balance of PAHs	87	60	17

An Applications Analysis Report and a Technical Evaluation Report describing the complete demonstration will be available in the Fall of 1993.

For Further Information:

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