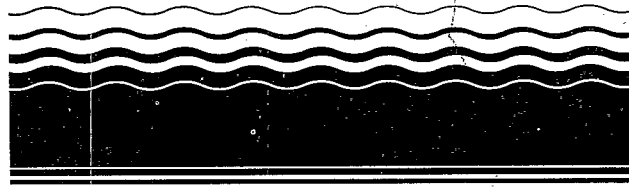




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Demonstration Bulletin

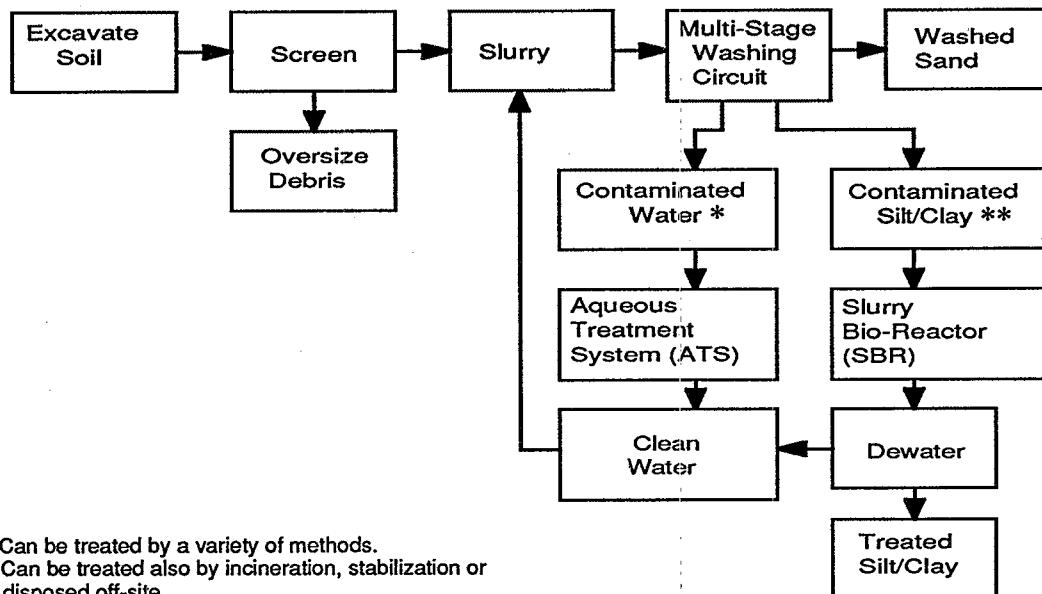
Soil Washing System

BioTrol, Inc.

Technology Description: The three component technologies of the BioTrol Soil Washing System (BSWS), tested in the SITE demonstration were a Soil Washer (SW), an Aqueous Treatment System (ATS), and a Slurry Bio-Reactor (SBR). The Soil Washer operates on the principle that a significant fraction of the chemicals in a contaminated soil are either physically or chemically bound to the silt, clay or humic particles, and removal of these fine particles leaves the bulk of the soil (mostly sand) relatively clean. Excavated soils are screened to remove debris and mixed with water to form a slurry. The slurry is subjected to a series of intensive scrubbing and physical classification steps to scour the contaminants and silt and clay fines from the sand particles. The washed sand is separated from the slurry, and the remaining contaminated fines can be treated in the SBR. Contaminated process water from the Soil Washer can be sent to the ATS to remove organics. Figure 1 is a simplified flow diagram of the Soil Washer, the ATS, and the SBR.

The ATS is a microbiological system for degrading toxic organics in contaminated water. It consists of a multi-cell, submerged packed-bed reactor where naturally occurring microbes along with an inoculum of a bacterium species specific to the chemical are allowed to grow on a plastic support material. Process water from the Soil Washer is pumped to the system where the pH is adjusted and nutrients are added to optimize the performance of the microbes. The waste stream is then passed through the reactor where the combination of microbes rapidly degrades the penta-chlorophenol (penta) and polynuclear aromatic hydrocarbons (PAHs) into carbon dioxide, water, and inorganic chloride, which are harmless products.

The SBR is a three stage microbiological system for treating degradable organic contaminants associated with fine soil particles. The equipment for the system is an EIMCO BioLift™ reactor manufactured by the EIMCO Process Equipment Company. BioTrol



* Can be treated by a variety of methods.

** Can be treated also by incineration, stabilization or disposed off-site.

Figure 1. Flow diagram of the BioTrol soil washing system.

uses the reactor to remove contamination from silt and clay soil fractions. The system consists of three upright, continuously-stirred reactors in series. The silt and clay slurry enters the first reactor where the degradation of organic contaminants by the indigenous and inoculated microbial populations begins. As the slurry flows to each successive reactor, the contaminants are further degraded to inorganic products. However, the contaminated residual products from soil washing can be treated by other methods than the ATS and the SBR.

Waste Applicability: This technology was initially developed to treat soils contaminated with oil, penta, and creosote (PAHs) from wood preserving sites. It is also expected to be applicable to soils contaminated with petroleum hydrocarbons and pesticides.

Demonstration Results: The SITE demonstration of the soil washing technology took place from September 25 to October 27, 1989 at the MacGillis & Gibbs superfund site in New Brighton, Minnesota. The Soil Washer used in the demonstration was a pilot scale unit with a treatment capacity of 500 to 1,000 lb/hr. The Soil Washer was operated continuously for two days on a soil contaminated with low levels of penta (about 130 mg/kg) and seven days on a high penta level soil (about 680 mg/kg). All process water from soil washing was treated in the ATS and recycled back to the Soil Washer. A portion of the fine particle slurry from the high penta soil washing test was treated in the pilot scale SBR. Table 1 summarizes the test results:

Table 1. Demonstration Results

	Test Contaminant	High Conc. Soil Test			Low Conc. Soil Test		
		Influent Conc. mg/kg	Effluent Conc. mg/kg	%Reduction	Influent Conc. mg/kg	Effluent Conc. mg/kg	%Reduction
Soil Washer	Penta	680	87	87	130	14	89
	PAH	58	6.5	89	17	2.3	86
	(carcinogenic)						
	PAH	300	37	88	230	33	86
	(non-carcinogenic)	mg/l	mg/l		mg/l	mg/l	
ATS	Penta	44	3	94	15	1.3	91
	PAH	N/D ¹	N/D ¹		N/D ¹	N/D ¹	
SBR ²	Penta	3500	280	92			
	PAH	800	140	82			
	(carcinogenic)						
	PAH	280	7.3	97			
	(non-carcinogenic)						

¹N/D: Not Detected.

²Results for the SBR are for the solid fraction (after filtration) of the slurry only. Performance results are maximum values observed as no steady-state performance was achieved during the test.

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