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# CF SYSTEMS CORPORATION
## (Solvent Extraction)

## TECHNOLOGY DESCRIPTION:

The CF Systems Corporation technology uses liquified gases as solvent to extract organics from sludges, contaminated soils, and wastewater. Propane is the solvent typically used for sludges and contaminated soils, while carbon dioxide is used for wastewater streams. The system is available as either a continuous flow unit for pumpable wastes or a batch system for nonpumpable soils and sludges. Typical costs for contaminated soils treatment range from $80 to $250 per ton, excluding excavation and disposal.

Contaminated solids, slurries, or wastewaters are fed into the extraction system (see figure below) along with solvent. Typically, more than 99 percent of the organics are extracted from the feed. Following phase separation of the solvent and organics from the treated feed, the mixture of solvent and organics passes to the solvent recovery system. Once in the solvent recovery system, the solvent is vaporized and recycled as fresh solvent. The organics are drawn off and either reused or disposed of. Treated feed is discharged from the extraction system as a slurry in water.

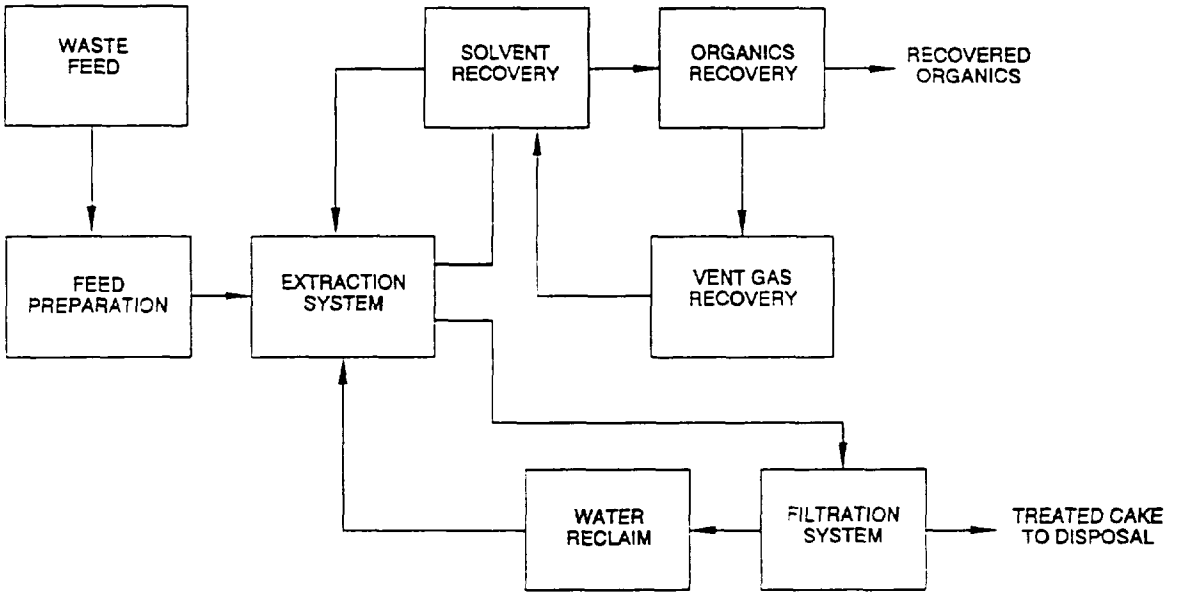
The extraction system design is different for contaminated wastewaters and semisolids. A tray tower contactor is used for wastewaters, and a series of extractor/decanters is used for solids and semisolids.

## WASTE APPLICABILITY:

This technology can be applied to soils and sludges containing volatile and semivolatile organic compounds and other higher boiling complex organics, such as polynuclear aromatic hydrocarbons (PAH), polychlorinated biphenyls (PCB), dioxins, and pentachlorophenol (PCP). This process can also treat refinery wastes and wastewater contaminated with organics.

## STATUS:

Under the SITE Program, a mobile demonstration unit was tested on PCB-laden sediments from the New Bedford (Massachusetts) Harbor Superfund site during September 1988. PCB




Solvent Extraction Remediation Process



The SITE Program assesses but does not approve or endorse technologies.

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concentrations in the harbor sediment ranged from 300 parts per million (ppm) to 2,500 ppm. The Technology Evaluation Report (EPA/540/5-90/002) and the Applications Analysis Report (EPA/540/A5-90/002) were published in August 1990.

CF Systems Corporation completed the first commercial on-site treatment operation at Star Enterprise, in Port Arthur, Texas. The propane-based solvent extraction unit processed listed refinery K- and F-wastes, producing treated solids that met EPA land-ban requirements. The unit operated continuously from March 1991 to March 1992 and was on-line more than 90 percent of the time. Following fixation for heavy metals, the treated solids were disposed of in a Class I landfill.

During operation, 100 percent of the feed material treated met land-ban specifications. Multiple feeds, including API separator solids, slop oil emulsion solids, slop oils, and contaminated soils, were treated.

The technology has been selected by EPA Region 6 and the Texas Water Commission on a sole-source basis for cleanup of the 80,000-cubic-yard United Creosoting site in Conroe, Texas. This Superfund site is heavily contaminated with wood treatment wastes. Detailed design is scheduled to begin in late 1993.

Other ongoing demonstrations and applications of this technology include on-site pilot demonstrations and new a SITE Program demonstration with process improvements.

## DEMONSTRATION RESULTS:

This technology was demonstrated concurrently with dredging studies managed by the U.S. Army Corps of Engineers. Contaminated sediments were treated by the CF Systems Pit Cleanup Unit, using a liquified propane and butane mixture as the extraction solvent. Extraction efficiencies were high, despite some operating difficulties during the tests.

The demonstration at the New Bedford site yielded the following results:

- Extraction efficiencies of 90 to 98 percent were achieved on sediments containing PCBs between 360 and 2,575 ppm. PCB concentrations were as low as 8 ppm in the treated sediment.
- In the laboratory, extraction efficiencies of 99.9 percent were obtained for volatile and semivolatile organics in aqueous and semisolid wastes.
- Operating problems included solids retention in the system hardware and foaming in receiving tanks. The problems were corrected in the full-scale commercial units.
- Projected costs for PCB cleanup are estimated at approximately $150 to $450 per ton, including material handling and pre- and posttreatment costs. These costs are highly dependent on the utilization factor and job size, which may result in lower costs for large cleanups.

## FOR FURTHER INFORMATION:

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