

The EBS-CytoSol BioSolvent Flushing Process For In-Situ Remediation Applications

IN-SITU BIOSOLVENT FLUSHING CASE STUDY

A three-step process was developed to recover heavy waste oil from a former tank pit at a northern California facility. Free product was measured up to 16-inches prior to the treatment. Weekly free product measurements and bailing were performed. A passive hydrophobic oil skimmer was installed in one well, but the waste oil was too viscous to flow into the trap.

The 3-step remedial process included high-pressure air-injection to displace the trapped oil located within the saturated zone. A high-pressure injection (200-600 psi) of EBS-CytoSol® Biosolvent was used to thin and increase the mobility of the trapped heavy oil. A high-vacuum extraction (28" Hg) was used to recover both the heavy oil and the EBS-CytoSol® Biosolvent from the subsurface. The final stage was to separate the heavy oil from the unspent EBS-CytoSol® Biosolvent and groundwater.

The air/biosolvent delivery/extraction system included nine 4-inch diameter liquid recovery wells and nineteen temporary 3/4-inch diameter injection rods on ten-foot centers. High-pressure compressed air was initially used to dislodge the submerged heavy oil from the pore spaces. The floating oil was vigorously mixed with 300 gallons of EBS-CytoSol® Biosolvent injected into the pit gravels at 200 to 600 psi. A 20-hp water ring vacuum pump extracted the oil, biosolvent and groundwater. The waste oil was skimmed off. The extracted unspent biosolvent was reinjected for three complete tank pit flushes. A thermal oxidizer treated the extracted vapors. A total of 550 gallons of heavy waste oil and 480 gallons of spent biosolvent/water mixtures were recovered from the former UST pit. A total of 7,790 gallons of groundwater was extracted and treated by aqueous-phase activated carbon vessels, and discharged to the sanitary sewer. One month after treatment, maximum waste oil thickness was 1/2-inch, later turning into a sheen. The property is being evaluated for site closure.

SHORELINE OIL SPILL REMEDIATION WITH A VEGETABLE OIL-BASED BIOSOLVENT.

A novel shoreline oil spill cleanup approach has been developed to dissolve and extract weathered crude oil off shoreline substrates using a relatively non-toxic EBS-CytoSol® Biosolvent formulation containing methyl esters derived from vegetable oil. The EBS-CytoSol® Biosolvent contains no petroleum products or surfactant, but relies on its inherent solvent properties to extract petroleum hydrocarbons from beaches and shoreline surfaces. The EBS-CytoSol® Biosolvent is immiscible with water and very buoyant (specific gravity = 0.87), facilitating the recovery of the floating mixture of EBS-CytoSol® Biosolvent and extracted oil, with conventional boom, skimmer, and absorbent technologies.

Unlike other shoreline cleaners containing surfactant, the methyl ester-based EBS-CytoSol® Biosolvent has been formulated to minimize the partitioning of petroleum (oil)

fractions into the water column. In contrast, other products containing surfactant allow spilled oil to be dispersed into the water column. The hydrophobic (water-fearing) EBS-CytoSol® Biosolvent maximizes the consolidation of the spilled oil into a floating phase for rapid recovery.

Crude oil extraction efficiencies range from 50% to >90% in laboratory studies. The soil box studies involved Alaskan North Slope crude oil spill simulations on different beach sediments, ranging from fine sand to coarse gravel collected at Prince Williams Sound. These bench studies employed single applications of EBS-CytoSol® Biosolvent to various heavily oiled sediments followed by passive seawater deluges. The EBS-CytoSol® Biosolvent has also proven useful in marsh and wetland habitats where conventional cleanup operations (harvesting or in-situ burning) may be more harmful to the sensitive habitat than the spilled oil itself. The EBS-CytoSol® Biosolvent Process offers a relatively low impact alternative for releasing the trapped oil from the marsh.

Recovered petroleum/ EBS-CytoSol® Biosolvent mixtures are suitable for recycling as burner fuel in ships and power plants, as was demonstrated in a small field test in San Juan, Puerto Rico during the January, 1994 fuel oil spill.

Following the initial extraction with BioSolvent, an impacted shoreline would be treated with established bioremediation protocols to accelerate the biodegradation of the residual petroleum and EBS-CytoSol® Biosolvent left on the beach. In recent field demonstrations supervised by the US EPA and the California Dept. of Fish & Game (Office of Oil Spill Prevention and Response), the EBS-CytoSol® Biosolvent facilitated the recovery of weathered fuel oil from a gravel beach and the release of trapped oil from sand. The EBS-CytoSol® Biosolvent has recently been listed by the US EPA on the National Contingency Plan (NCP) Schedule of Products for use at Oil Spills (Please See US EPA Disclaimer below), and licensed by the California Department of Fish and Game (Office of Oil Spill Prevention & Response) as a shoreline cleaning agent.

EBS has the exclusive license for in-situ applications using the EBS-CytoSol BioSolvent.

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