

IN SITU BIOREMEDIATION & PRODUCT RECOVERY OF #4 FUEL OIL SUPER-OX™ SYSTEM & ENHANCEMENTS

Type of Project:	Full-scale
Contaminants Treated:	#4 Fuel Oil and TPH hydrocarbons
LNAPL Thickness:	Up to 7 feet of #4 LNAPL
Technology Applied:	In situ bioremediation via GW amendment, oxygenation & recirculation in combination with free-product recovery
Geology:	Silty sand
Treatment Interval:	GW and smear zone at 8-14 feet bgs
Average % Reduction:	Less than 0.5 feet of LNAPL in 12 months
Timeframe:	36 months

SITE DISCUSSION: ETEC, LLC installed an automated Super-Ox[®] system to operate in conjunction with an existing pump-and-treat (P&T) system to treat #4 fuel oil-contaminated soil and groundwater. The fuel oil was released from a leaking underground storage tank that fed oil-fired boilers within the housing complex. At project start-up, a 10-foot-thick impacted vadose soil zone and a free product layer (up to 7 feet in some wells) was present in the subsurface. This fuel oil plume measured 120 feet x 100 feet, requiring an innovative remediation strategy to capture, remove, and degrade the significant fuel oil volume. ETEC worked with the environmental site consultant to apply surfactants and biological products in conjunction with our automated Super-Ox[™] equipment to oxygenate, biologically-treat, and recycle groundwater within the subsurface to support in situ biodegradation during product removal.

GOALS: The closed-loop groundwater recirculation system has several remediation goals, including hydraulic control of the existing plume, removal of all appreciable free product, and treatment of soil and groundwater to Massachusetts GW-1 standards.

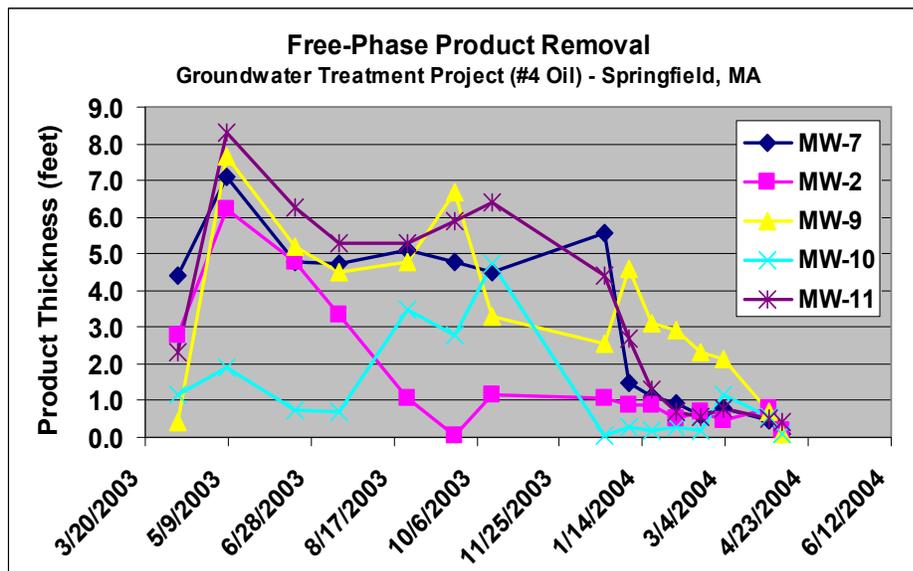
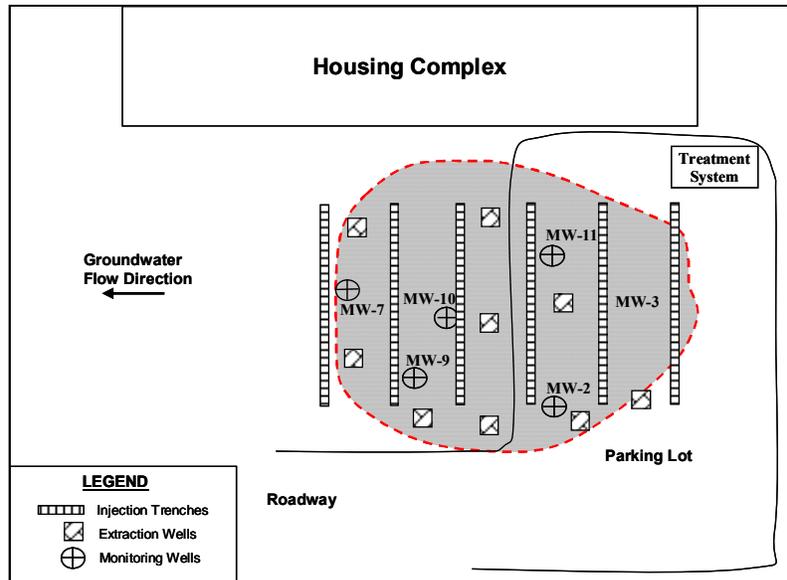
SYSTEM LAYOUT: The site geology consists of silty sand with groundwater occurring at approximately 8 to 14 feet bgs. A series of horizontal injection trenches are installed at 5 feet bgs on 15-foot centers across the plume area, and extraction wells are placed along the plume edge as well as within the plume. This layout promoted the creation of a series of recirculation cells within the subsurface which minimized travel time for the injected treatment water, and maximized contact with the heating oil in these zones. The overall treatment train consists of a coalescing grid oil-water separator, the Super-Ox[®] system, which included an integrated bioreactor system which pre-treated dissolved and emulsified heating oil in the extracted groundwater, and an oxygenation system which generated >40 ppm dissolved oxygen levels in the water stream and injected it into the trenches.



CASE STUDY

TYPE: In Situ Bioremediation (TPH)
 COMPONENTS: Oxygenation Equipment and Amendments

RESULTS: Our specialized surfactant product (PetroSolv[®]) and our biological enhancements (PetroZyme[®]) have successfully maximized removal of free product in the subsurface. In conjunction with the total-fluids extraction pumps, the emulsified oil (resulting from PetroSolv[®] product injection/recirculation) is coalesced and captured in the oil-water separator. This technique has been critical for removing the free product so that subsequent in situ biological degradation can occur. To date, over 400 gallons of free oil have been removed from the system, and the product thickness has been reduced to less than 0.5 feet across the site (see attached graph). Ongoing system operation is focused on removal of the remaining product layer and treatment of residual adsorbed and dissolved-phase constituents.



Using its unique oxygen mixing system and powerful biological enhancements, the DO-IT[™] technology can perform hydraulic plume control, free product recovery, and groundwater treatment