

## CASE STUDY

<b>Type of Project:</b>	Full-Scale
<b>Contaminants Treated:</b>	#4 Fuel Oil and TPH hydrocarbons
<b>LNAPL Thickness:</b>	Up to 7 feet of #4 LNAPL
<b>Technology Applied:</b>	In situ bioremediation via GW amendment, oxygenation and recirculation in combination with free-product recovery
<b>Geology:</b>	Silty sand
<b>Average % Reduction:</b>	Less than 0.5 feet of LNAPL in 12 months
<b>Timeframe:</b>	16 months

**SITE DISCUSSION:** BioRem-2000 Products were used in conjunction with an existing pump-and-treat 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. The environmental site consultant applied biological products (BioRem-2000) in conjunction with equipment to oxygenate, 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 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.

**RESULTS:** Our specialized biological enhancements (BioRem-2000) have successfully maximized removal of free-product in the subsurface. 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. Ongoing system operation is focused on removal of the remaining product layer and treatment of residual, absorbed and dissolved-phase constituents.

