

Replacement of P&T with ORC Advanced® Reduces Cost to Closure

CASE SUMMARY

Service Station, Mears, MI

Two leaking underground storage tanks (USTs) resulted in soil and groundwater contamination at a service station in Michigan. Naphthalene, trimethylbenzene (TMB) and benzene, toluene, ethylbenzene, and xylenes (BTEX) contamination were discovered in the subsurface prompting the need for remedial cleanup. Michigan DEQ began remediation via UST removal and soil excavation. A total of 4,000 cubic yards of contaminated soil was removed. A pump and treat (P&T) system was installed and operated for 8 years through November 2003. The system removed 1,575 pounds of BTEX and significantly lowered contaminant concentrations. However, the P&T system reached asymptotic conditions and would not be effective in achieving site closure goals. Regulators began looking into new ways of accelerating the remediation process and reducing the overall cost of cleanup. Enhanced aerobic bioremediation using ORC Advanced® was deployed to replace the P&T system and degrade the remaining contamination.

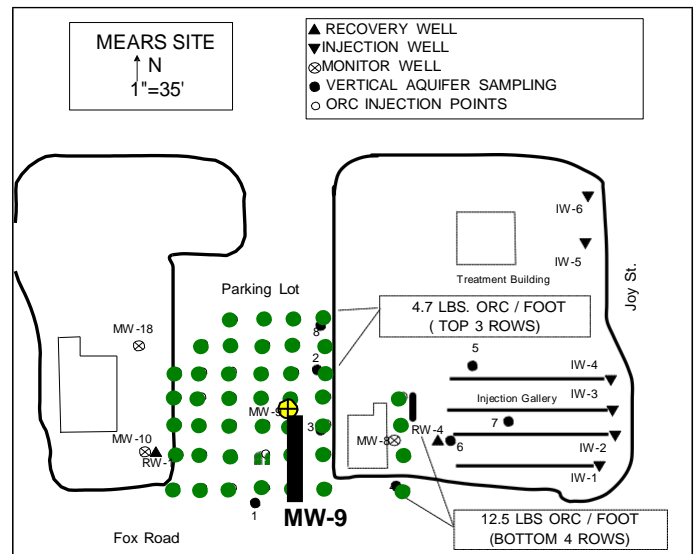
REMEDIATION APPROACH

The remediation objective was to continue the reduction of petroleum hydrocarbons in the subsurface and reduce the cost to closure. Three months after the P&T was shutdown an ORC Advanced application took place. The ORC Advanced injection included 43 injection points in a grid design within the contaminated area surrounding well MW-9 (Figure 1).

Table 1. Concentrations Post-P&T / Pre-ORC Advanced Injection and Cleanup Goals

Contaminant	Post-P&T/Pre-ORC Advanced	Cleanup Goal
Benzene	<1	5
Toluene	29	790
Ethylbenzene	110	74
Xylenes	322	280
Naphthalene	760	520
1,3,5-TMB	650	72
1,2,4-TMB	2800	63
2-Methylnaphthalene	220	260

Figure 1. ORC Advanced Injection Grid Location

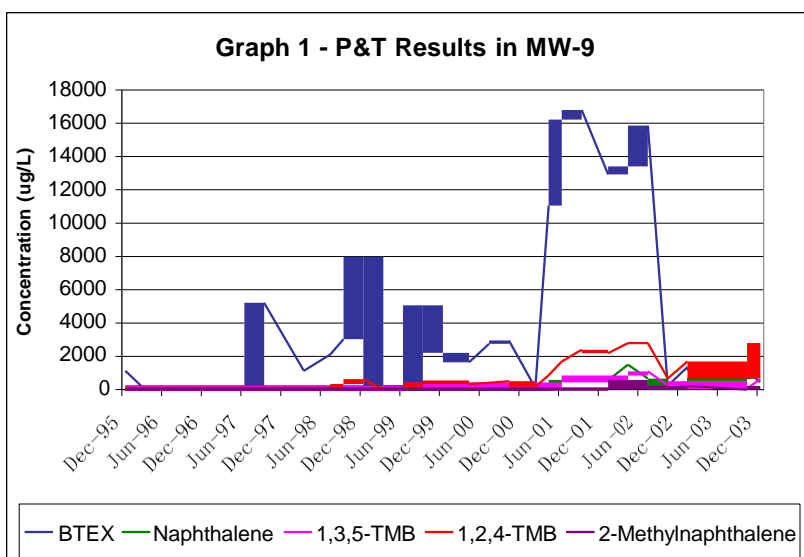


<p>Product: ORC Advanced® Application Rate: 5 lbs/ft Injection Spacing: 10 ft Quantity Applied: 2,325 lbs Product Cost: \$20,343</p>	<p>Application Type: Grid Injection Treatment Area: 4,200 ft² Soil Type: Sand Groundwater Velocity: 0.5 ft/day Depth to Groundwater: 25 ft</p>
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RESULTS

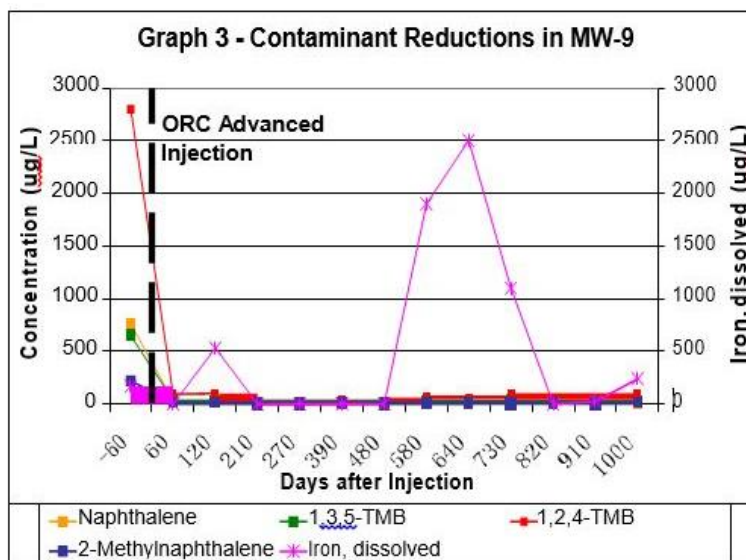
Pump & Treat Results



An increase in rainfall during certain parts of the remedial period contributed to some of the increases observed in Graph 1. During wet periods, an increase in concentrations resulted from the mobilization of contaminants within the capillary fringe smear zone. An infiltration gallery was installed to flush the contamination into the dissolved-phase where it was available for P&T removal.

Prior to shutdown in November 2003, O&M costs were increasing and low-level dissolved-phase concentrations were still elevated indicating the system was not effective at reaching the required low cleanup levels.

ORC Advanced Injection Results



Within 60 days of the ORC Advanced application, low-level concentrations were significantly reduced below post-P&T levels. Reduction continued throughout the monitoring period and a 99% mass reduction was achieved approximately 13 months after the initial injection. In well MW-9, concentrations in all contaminants were reduced to below the cleanup goals.

The ORC Advanced application eliminated increasing O&M costs of an aging P&T system and allowed the site to be closed years ahead of projections.

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