Successful Pilot Test Results in Full-Scale Treatment of Large BTEX Plume

CASE SUMMARY

Refueling Station – Algonquin, IL

Leaking underground storage tanks at a refueling station resulted in a benzene, toluene, ethylbenzene and xylene (BTEX) plume in the underlying sand/gravel aquifer. The plume covered 1-acre and extended 390 feet downgradient from the source area, with a total BTEX concentration exceeding 24,000 parts per billion (ppb). In an effort to mitigate the source, 795 cubic yards of contaminated soil was excavated; however, further groundwater monitoring revealed that BTEX concentrations still exceeded the Illinois EPA cleanup levels. To address the remaining contamination and reduce concentrations to the state cleanup goal, a remediation plan was implemented using Oxygen Release Compound (ORC®) and ORC Advanced®.

REMEDIATION APPROACH

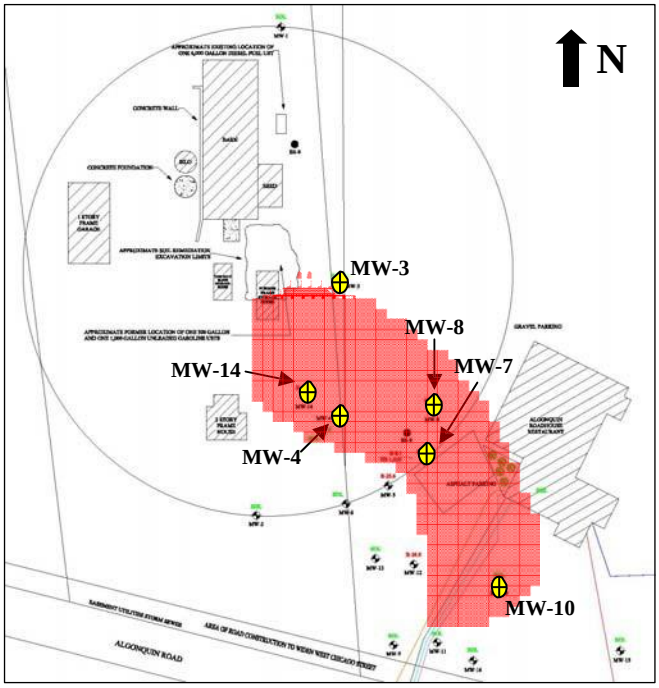
The remediation objective was to reduce petroleum hydrocarbon contamination, mainly benzene, to the state cleanup goal. A pilot test was performed using ORC to observe the effectiveness of reducing BTEX concentrations. Successful reduction was achieved within 4 months and a full-scale application was implemented. The full-scale application was focused near the source area as well as within the mid-plume area (near MW-7 & MW-8). Two applications followed within the mid- and lower plume areas to continue BTEX reduction.

Table 1. ORC and ORC Advanced Application Details

	Product	Pounds Applied	Location of Injection
September 2000	ORC (Pilot)	300	Upper Plume (MW-4)
January 2002	ORC (Full Scale)	8250	Upper Plume (MW-4) Mid-Plume (MW-7)
December 2002	ORC	8250	Mid-Plume (MW-7)
July 2004	ORC Advanced	7525	Mid-Plume (MW-7) Lower Plume (MW-10)

- **Application Type:** Grid & Barrier Application
- **Soil Type:** Clay above Sand/Gravel
- **Groundwater Velocity:** 0.25 ft/day
- **Treatment Area:** 43,500 ft^2
- **Injection Spacing:** 10–20 feet
- **Product Cost:** $171,600

Figure 1. BTEX Plume Location

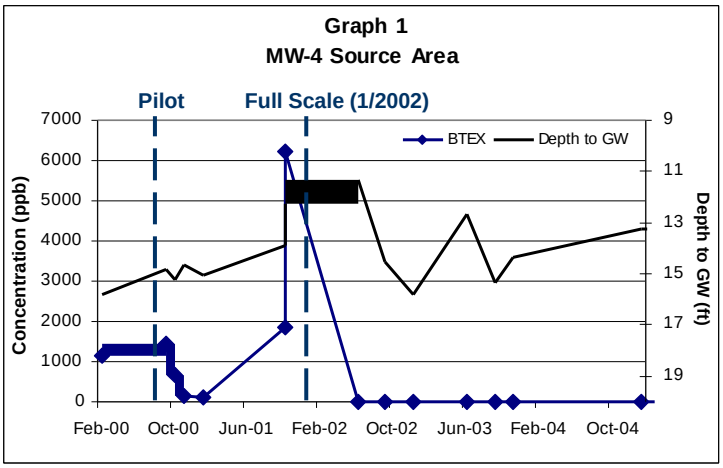


RESULTS

Table 2. Pre- and Post-Treatment Results for BTEX in Well MW-4 (ppb)				
	Pilot Test		Full-Scale Implementation	
Contaminant	Pre-ORC	Post-ORC	Pre-ORC	Post-ORC
Benzene	352	42.6	2,390	ND
Toluene	17.1	ND	33.2	ND
Ethylbenzene	383	47.3	962	ND
Xylenes	704	33.6	4,000	ND

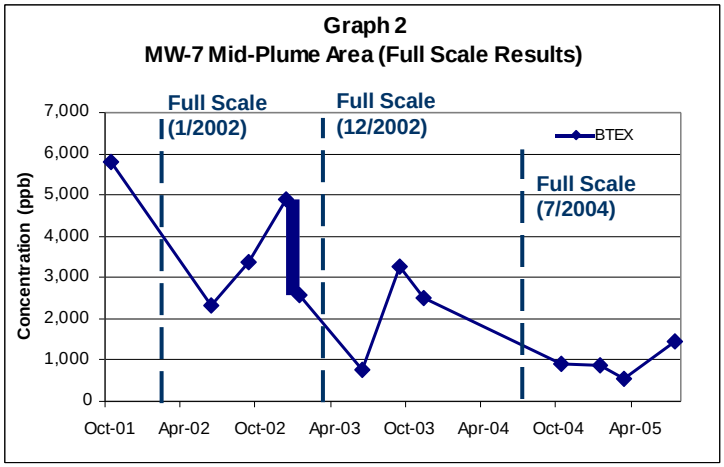
Concentrations vs. Time

Graph 1
MW-4 Source Area



A high groundwater event resulted in re-contamination of the aquifer due to significant smear zone contamination near MW-4. October 2001 shows an increase in BTEX by more than 4,300 ppb. The full scale application in January 2002 reduced concentrations to non-detect.

Graph 2
MW-7 Mid-Plume Area (Full Scale Results)



A continuous decrease in BTEX resulted in an overall contaminant mass reduction of 85%. The multiple ORC applications were successful at sustaining an aerobic environment to facilitate bioremediation within the plume.

Table 3. Benzene Reduction & Remaining Wells above the Cleanup Goal of 5 ppb		
Monitoring Well	Percent Reduction in Benzene	Final Benzene (ppb)
MW-5	96%	25.6
MW-7	99%	8.1
MW-9	98%	67.8
MW-10*	96%	<5.0
MW-12	78%	39.9
MW-14	77%	45.3

*Well MW-10 has reached the cleanup goal of 5 ppb

Five of the ten contaminated monitoring wells achieved the remedial objective for benzene as well as all other contaminants following the ORC and ORC Advanced injection. Benzene reduction for those wells that have not yet achieved the cleanup goal are listed in Table 3. Overall, a benzene mass reduction of over 95% was achieved. It is expected that the remaining contaminant concentrations will reach cleanup goals as monitoring continues.

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