



Oxygen Release Compound ADVANCED™

High Benzene Concentrations Reduced Using ORC Advanced – Sheboygan, WI

SITE SUMMARY

Elevated levels of petroleum hydrocarbons were discovered near the former dispenser island at a former service station in Sheboygan, WI. In hopes of reducing concentrations, soil excavation activities took place in June 2003. A total of 500 tons of hydrocarbon-impacted soils were removed and transported to a landfill for disposal. However, residual contamination continued to affect the groundwater after the excavation. By March 2004, benzene and ethylbenzene had risen to 2,500 ug/L and 1,300 ug/L, respectively. In situ bioremediation using ORC Advanced was chosen to reduce BTEX, naphthalene, and trimethylbenzenes. In the northwest corner of the site, the location of the former UST basin, a total of 480 pounds of ORC Advanced was injected. In the southeast corner, the area of highest contamination, a total of 2,370 pounds of ORC Advanced was injected.

REMEDIATION APPROACH

- ¾ **Remediation Objective:** Reduce concentrations of Benzene to cleanup goals at the entire site. See Table 1.
- ¾ **Application Type:** Grid
- ¾ **Product:** ORC Advanced
- ¾ **Quantity Applied:** 2,850 lbs
- ¾ **Application Rate:** NW Corner-4 lbs/ft; SE Corner-11.9 lbs/ft
- ¾ **Injection Spacing:** 10 ft
- ¾ **Product Cost:** \$24,225

Table 1. Cleanup Goals

Contaminant	Concentration
Benzene	5 ug/L
Toluene	1,000 ug/L
Ethylbenzene	700 ug/L
Xylenes	10,000 ug/L

SITE CHARACTERISTICS

General

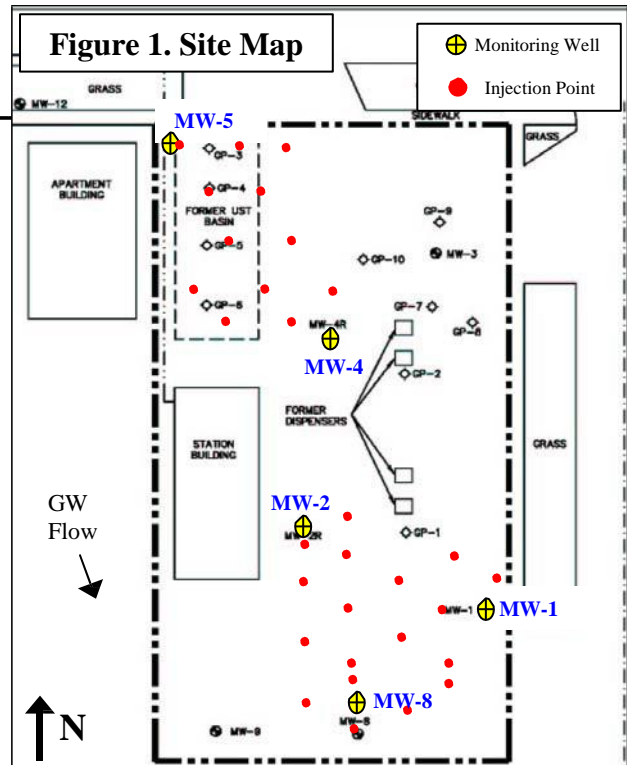
- ¾ **Name:** Former Marathon Unit #3697
- ¾ **Location:** Sheboygan, WI
- ¾ **Industry:** Service Station
- ¾ **Contaminants of Concern:**

Table 2. Well MW-8 Concentrations

Contaminant	Concentration
Benzene	1,700 ug/L
Toluene	530 ug/L
Ethylbenzene	1,300 ug/L
Xylenes	3,190 ug/L

Hydrogeology

- ¾ **Treatment Area:** NW Corner 1,200 ft²
SE Corner 1,800 ft²
- ¾ **Soil Type:** Silty sand lenses in clay matrix
- ¾ **Groundwater Flow Direction:** Southeast
- ¾ **Depth to Groundwater:** 12-15 ft



RESULTS

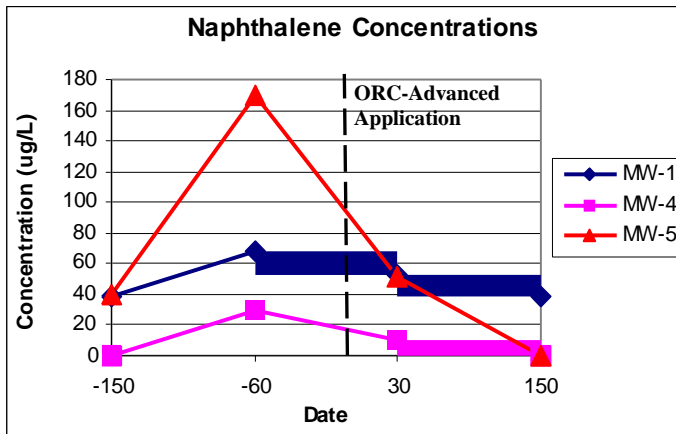
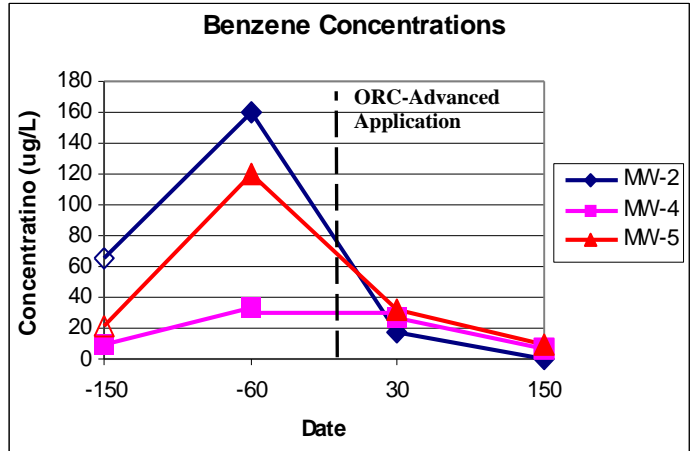
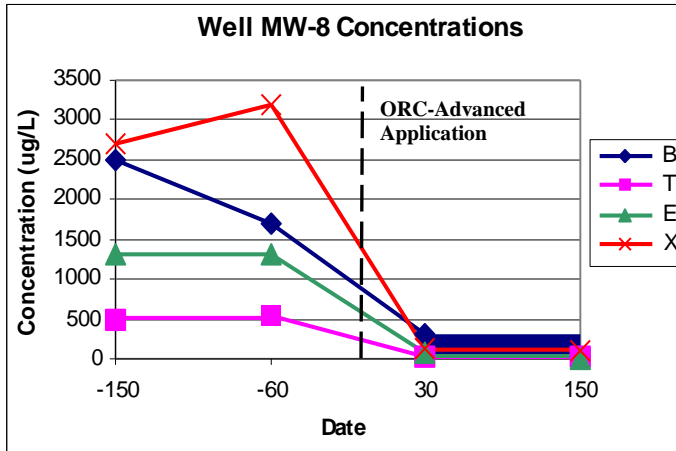
Percent Contaminant Reduction

Contaminant	Percent Reduction
Benzene	98%
Toluene	96%
Ethylbenzene	99%
Xylenes	96%

Post Treatment Concentrations

Contaminant	Concentration
Benzene	30 ug/L
Toluene	18 ug/L
Ethylbenzene	5.8 ug/L
Xylenes	115 ug/L

Concentrations vs. Time



Note: The significant decrease seen from day -60 is indicative of the gap between data points as concentrations most likely stayed their course, increasing, until ORC Advanced was injected and a new data point collected at day 30.

CONCLUSION

Groundwater sampling results after excavation activities show an increasing trend of contamination. On average, concentrations continued to increase up until the ORC Advanced application due to residual contamination. Concentrations peaked before ORC Advanced injection followed by a significant reduction across the plume. In well MW-5, benzene spiked to 160 ug/L while naphthalene rose to 170 ug/L and in well MW-4 BTEX, naphthalene and trimethylbenzenes all increased. Significant decreases of all contaminants were seen shortly after ORC Advanced injection. In well MW-8 total BTEX was reduced from 6,720 ug/L to 168.8 ug/L, a 97% reduction. Naphthalene concentrations were above the MCL of 20 ug/L in wells MW-1, MW-4, MW-5. ORC Advanced reduced concentrations to non-detect in wells MW-4 and MW-5, leaving 38 ug/L in well MW-1. Monitoring is on-going as concentrations continue to decrease towards MCLs.

CONTACTS

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