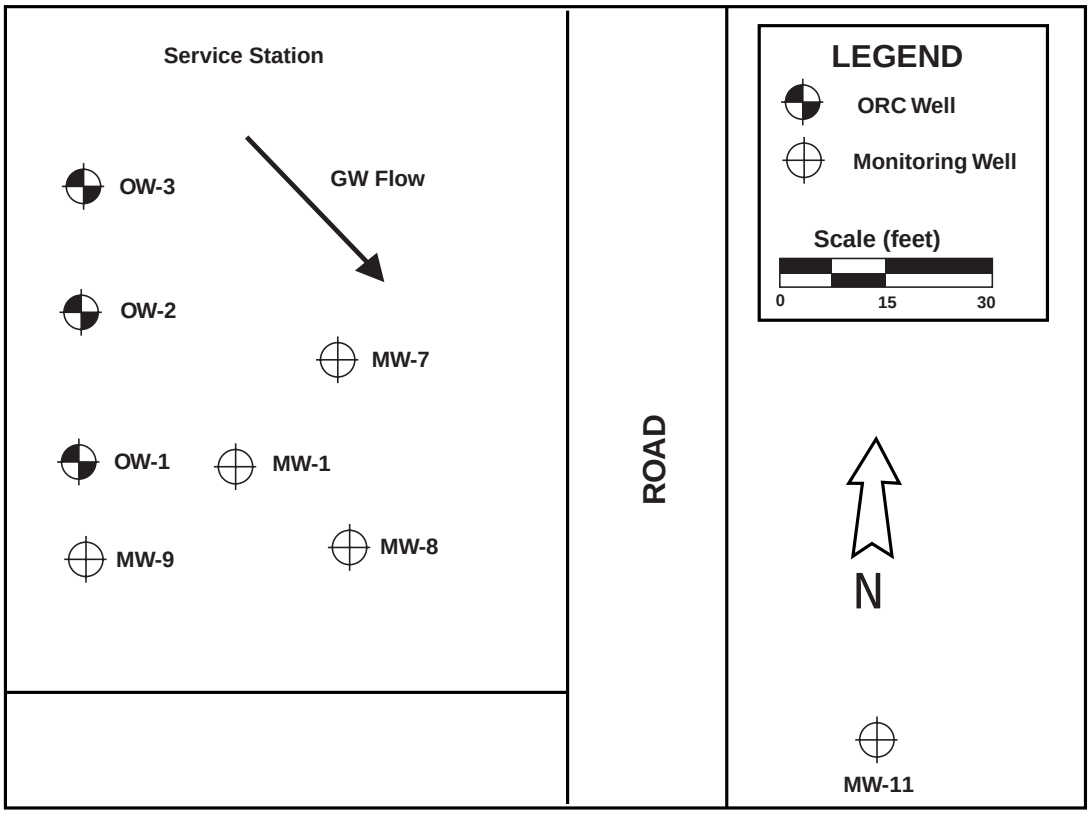
Risk Reduction BTEX Remediation Pilot Study in a Sandy Aquifer in Michigan

Contaminants	Application Method	Soil Type	Groundwater Velocity
BTEX	Risk Reduction	Sand	1.0 ft/day

A major oil company performed a series of ORC barrier technology tests in Michigan designed to help define a protocol for its nationwide use. Two sites were selected with diverse conditions - sand (this Technical Bulletin) and clay (Technical Bulletin 3.1.4).

Site Description and Remedial Design



The affected aquifer beneath the site is composed of sand. Pumping activity on the site generates a 1 foot per day groundwater velocity in a southeast direction. The water table is at 15 feet and the extent of the contaminated saturated zone thickness is about 10 feet. Free product is present on the site. The position of the ORC source wells and the monitoring well series are illustrated above. Thirty feet of 3 3/8" diameter ORC socks were installed in OW 1 to OW 3. Data on oxygen and BTEX were taken at 7 days, 30 days, 90 days and 180 days after socks were inserted. In addition to the analysis of individual well measurements, contouring with GOEAS was utilized to generate mass curves in the entire field.

Results

As noted in Figure 1, the rapid seven-fold increase in the oxygen mass in the first seven days was reduced to about half in 90 days as 66% of the BTEX mass was reduced. A rebound effect is seen between 90 and 180 days due to the high contaminant mass and groundwater velocity at the site. However, with the well spacing at 15' this is still a good result, and a full 180 days of control might have been achieved with closer 5-8 foot ORC well spacings. This result is a reflection of total mass rather than compliance at a point downgradient. Figures 2 and 3 document the changes in D.O. and BTEX at MW-8 (42' DG) and MW-11 (130' DG). This is a classic example of enhanced natural attenuation. The BTEX levels in the ORC treatment wells are on the order of 5-6 ppm and attenuate to 4 ppm at 42' and .1 ppm at 130'. After ORC treatment the BTEX level is reduced at 42' to .1 ppm at 90 days with rebound to 2.9 ppm at 180 days - with the suboptimal dose of ORC used. At 130' downgradient the BTEX levels are attenuated to ND at Day 90 and stay there through the last measurement at Day 180. Thus, ORC placed close to the contaminant source reduces risk and can achieve compliance at a point closer to the source.

Figure 1

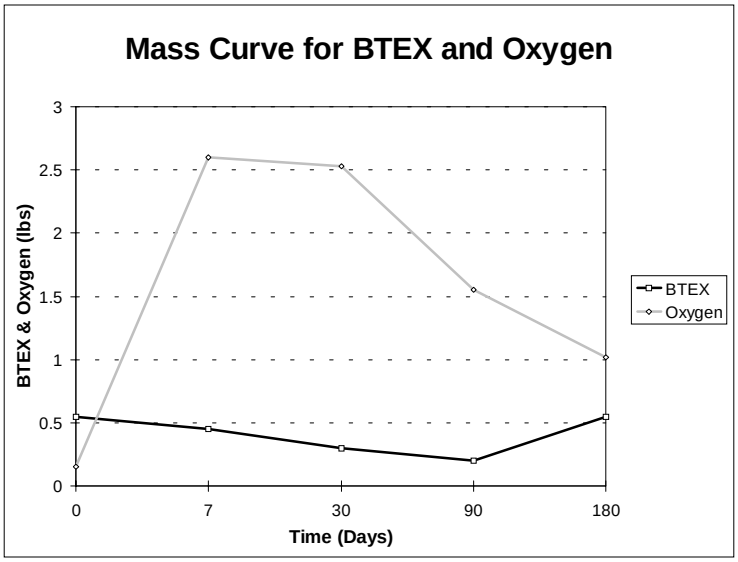


Figure 2

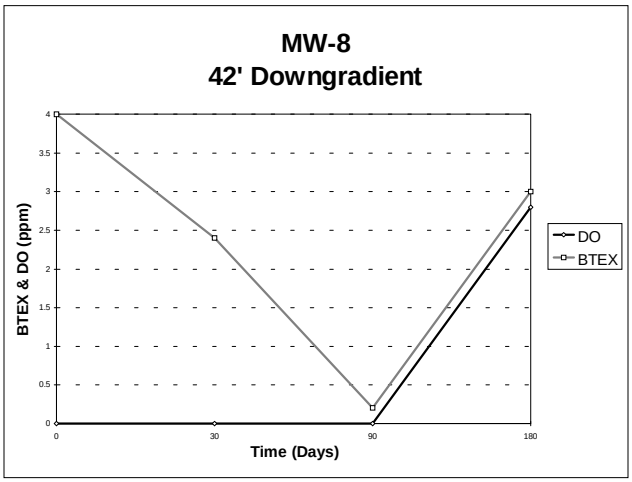
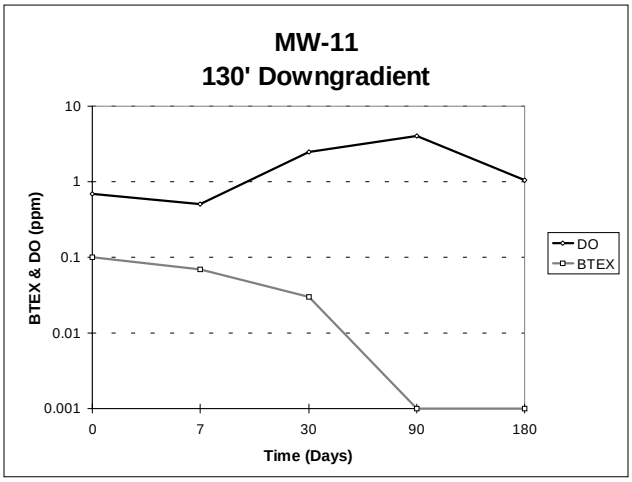


Figure 3



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