

ORC Injection/Filter Sock BTEX & TPH Remediation in Puerto Rico

Contaminants	Application Method	Soil Type	Groundwater Velocity
BTEX/TPH	ORC Injection/Filter Sock	Silt & Clay	Low

Introduction

BTEX and TPH contamination in groundwater caused by leaking underground storage tanks (USTs) was present at a service station located in Toa Baja, Puerto Rico. BTEX and TPH concentrations reached 10.37 and 31.54 ppm, respectively. There are three active USTs at the operating service station. These USTs include two twelve thousand gallon capacity gasoline tanks and one ten thousand gallon capacity diesel fuel tank. USTs previously in service at this location were confirmed to have discharged gasoline and diesel and diesel fuel at the site. A diagram showing the site layout is presented in Figure 1. The site is primarily flat and level at approximately 33 feet above Mean Sea Level. There are no drainage features within the boundary of the site. The site lies on alluvial deposits of Pleistocene age consisting primarily of silt and clay with some sand and gravel. Groundwater was observed to fluctuate from as shallow as 9.05' to 16.32'. The average groundwater level was 12.77'.

Application

Two pilot scale test plots were established at the site. The first test plot consisted of the installation of seven ORC filter socks in existing 2" PVC monitoring well MW-1 (Figure 1). The second plot was installed at existing monitoring well MW-4 into a series of five soil borings as an oxygen barrier. The soil borings lie along an arc aligned at an orientation to surround the subject well from the source area at a distance of ten feet on center in relation to the well. ORC was injected into the borings as a slurry, composed of 150 pounds of ORC powder and approximately 42 gallons of potable water. The slurry was pressure injected into the borings from 14 to 19 feet below ground surface. A monitoring point, designated GP-3, was installed approximately 5 feet from MW-4 between the oxygen barrier and MW-4 (Figure 1).

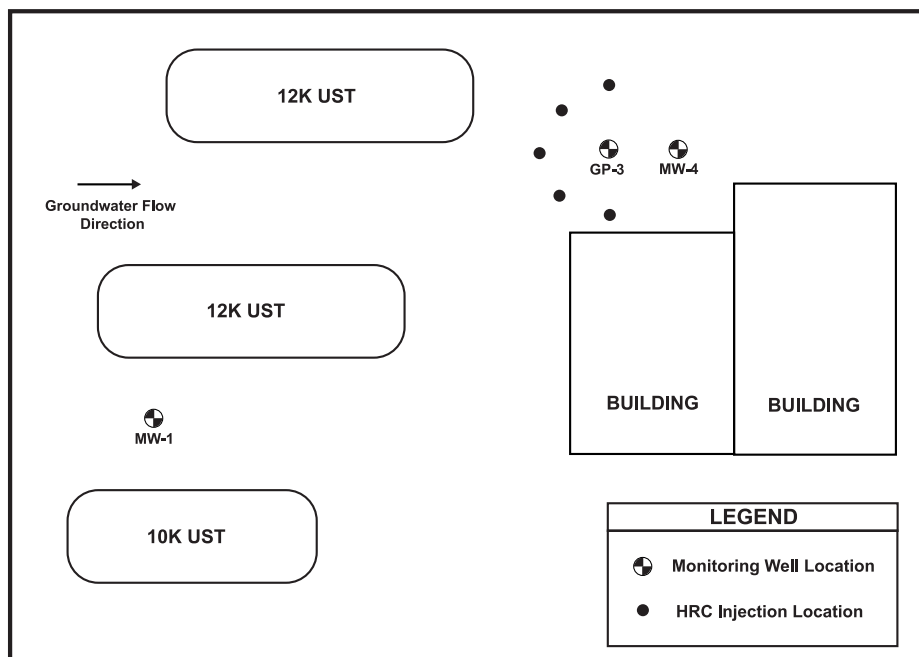


Figure 1: Site Map

Results

Overall reductions in BTEX and TPH are presented in Table 1. Following eight weeks of treatment, BTEX in MW-1 was reduced from 10.37 to 0.5 ppm - a reduction of 95%. BTEX in MW-4 was reduced from 31.54 to 3.61 ppm - a reduction of 89%. Following ten weeks of treatment, TPH in MW-1 was reduced from 47.06 to 11.59 ppm - a reduction of 75%. TPH in MW-4 was reduced from 187.85 to 37.87 ppm - a reduction of 80%. TPH in GP-3 was reduced from 1,774.39 to 63.6 ppm - a reduction of 96%.

Well	BTEX (baseline)	BTEX (week 8)	% BTEX Reduction	TPH (baseline)	TPH (week 10)	% TPH Reduction
MW-1	10.37	0.5	95%	47.06	11.59	75%
MW-4	31.54	3.61	89%	187.85	37.87	80%
GP-3	NS	NS	-	1,774.39	63.6	96%

Table 1

Dissolved oxygen (DO) was analyzed for and tracked throughout the study at all test locations and monitoring points. In the tropical environment, background DO levels are normally low as the solubility of oxygen in water decreased with higher temperatures. The results show the DO rising through weeks two and four from 1.53 to 4.45 ppm in MW-1 and from 0.28 to 1.54 ppm in MW-4. The DO then declined with the BTEX concentrations through week eight as the DO is consumed with the available BTEX (1.54 ppm at MW-1 and 0.97 ppm at MW-4). By week ten the DO rose again in the depleted BTEX condition to levels near the background concentrations.