Innovative Environmental Technologies, Inc. (IET) conducted a remedial design at an active dry cleaning facility in Memphis, TN. The following discussion concerns the efficacy of the remedial event that occurred February 13st and February 14th, 2012.

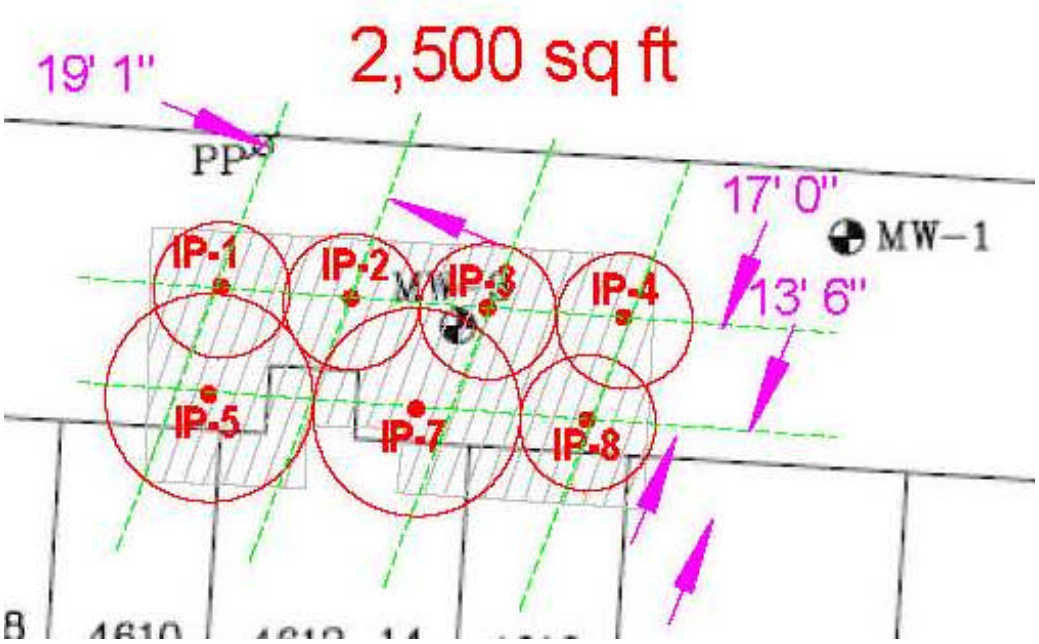

Figure 1. Injection Area

The injection program at the Dry Cleaning site consisted of one treatment area encompassing approximately 2,500 sq. ft. to depths ranging from 40-50 feet bgs. In the proposed injection areas IET injected 4,012 gallons of solution including 3,000 pounds of ZVI, 1,200 pounds of EHC®, 264 pounds of hydrolyzed kelp, 600 pounds of calcium propionate, 4,012.8 grams of vitamin B2, 576 grams of vitamin B12, 240 pounds of yeast extract and 360 pounds of nutrient and sodium sulfite across the site.

The injection event was designed to treat soil and groundwater contamination in the outlined area which surrounded one monitoring point; MW-3. The following discussion addresses the monitoring points that were sampled during the June and August 2012 sampling events.

MW-3

Monitoring well MW-3 is located within the treatment area near injection point IP-3. Based on the results of the June and August 2012 sampling events, MW-3 seems responsive to the injection program. Dissolved and total iron concentrations increased significantly from the baseline sampling event, indicating that the injection event successfully affected the proposed

radii. Dissolved iron concentrations increased from the baseline value of <0.05 mg/L to 5.6 mg/L in August 2012. Total iron concentrations have increased from 0.579 mg/L to 5.9 mg/L over the same period.

Field Parameters:

The groundwater field parameters are presented in Table 1 below. As it can be observed the mostly neutral pH value of 5.38 is acceptable for reductive processes to occur. Additionally, the redox potential was measured at -48 mV in the June 2012 sampling event, which may represent a major drop in redox potential based off of the average positive baseline ORP in the surrounding wells. No field parameters were measured during the August 2012 sampling event.

Table 1. Groundwater Field Parameters for MW-3

Well ID	Date	pH (S.U.)	DO (mg/L)	ORP (mV)	Conductivity (mS/cm)	Turbidity (NTU)
MW-3	December 2011	NA	NA	NA	NA	NA
	March 2012	6.16	1.86	-8.9	0.664	325
	June 2012	5.38	1.87	-48	0.761	53.3

Geochemical Analytical Parameters:

Table 2 below shows that the total and dissolved iron concentrations kept increasing as of the August 2012 injection event. As the hydrogen sources continue to be fermented and degraded by the natural bacteria in the subsurface, the redox potential should continue to drop. Strong reducing conditions should be created with the addition of the oxygen scavenger and the fermentation of the organic hydrogen donors; therefore IET expects to see ferrous iron concentrations continue to increase in the next sampling event.

Non-detect dissolved gas concentrations were measured as of March 2012. However the dissolved concentrations have increased above the detection limits during the June and August 2012 sampling events. That increase can be attributed to the degradation of the chlorinated solvents under the occurring reducing conditions. Interestingly, the concentration of methane in MW-3 remains fairly low in the subsurface. Methanogenesis does not appear to be the dominant biological process at MW-3, indicating that abiotic processes and other anaerobic biological pathways may be more prevalent at this time.

Table 2. Geochemical Groundwater Analytical Results for MW-3 (mg/L)

Well ID	Date	Methane	Ethane	Ethene	Sulfate	Dissolved Iron	Total Iron
MW-3	December 2011	<0.005	<0.005	<0.005	10.3	<0.05	0.579
	March 2012	<0.005	<0.005	<0.005	26	1.81	3.07
	June 2012	0.27	0.003	0.014	6.5	3.8	4.21
	August 2012	0.14	0.002	0.007	3.7	5.6	5.9

Volatile Fatty Acids

Generation of VFAs has occurred within MW-3 indicating that the metabolic processes that occur during the reductive dechlorination process have begun to accelerate. Specifically,

propionic acid has increased substantially due to the calcium propionate having been introduced as an organic hydrogen donor.

Table 3. Volatile Fatty Acids Analytical Results for MW-3 (mg/L)

Well ID	Date	Lactic Acid	Acetic Acid	Propionic Acid	Formic Acid	Butyric Acid	Pyruvic Acid	i-Pentanoic Acid	Pentanoic Acid	i-Hexanoic Acid	Hexanoic Acid
MW-3	December 2011	0.062 J	0.041 J	0.024 J	0.073 J	<0.050	<0.15	<0.15	<0.070	<0.050	<0.050
	March 2012	2	42	120	0.56	4.1	1	0.17	0.48	<0.050	1.1
	June 2012	4.4	26	30	.66 J	0.34	0.18	0.21	0.12	<0.050	0.055
	August 2012	<0.10	22	32	0.38	0.55	0.37	0.2	0.19	<0.050	<0.050

CVOCs

PCE and TCE have decreased substantially in concentration from the pre-injection sampling event of December 2011 to the 180-day August 2012 sampling event. PCE concentrations have decreased by 87.4% and TCE concentrations decreased by 66.3%.

The concentrations of daughter products cis-1,2-DCE and vinyl chloride have showed significant increase from the baseline sampling event, despite their original reduction following the remedial event. The concentration of cis-1,2-DCE and vinyl chloride increased from 2,230 µg/L to 3,800 µg/L and from 4.68 µg/L to 35 µg/L, respectively. The production of daughter products is initially expected; however the continued reducing environment should allow for the reductive dechlorination of the daughter products in subsequent sampling events. Due to the current concentration of PCE and TCE, the decrease in cis-1,2-DCE and vinyl chloride may take a few more sampling events before the conditions are ideal for conversation of cis-1,2-DCE and vinyl chloride to ethene and ethane.

Table 4. Chlorinated Volatile Organic Compounds in Groundwater for MW-3 (µg/L)

Well ID	Date	PCE	TCE	cis-1,2-DCE	trans-1,2-DCE	1.1-DCE	1,1-DCA	VC
MW-3	December 2011	4,990	504	2,230	8.49	4.3	2.7	4.68
	March 2012	3,240	364	1,620	11.9	2.31	1.73	3.29
	June 2012	801	826	3,790	18.3	4.47	1.72	3.99
	August 2012	630	170	3,800	8.6 J	6.6	<20	35