



## ISCO Treatment Program: VOCs, PAHs and TPH

### Site

- Nyack MGP Site; Nyack, New York.

### Contaminants of Concern

- VOCs  
6 ppm (GW), 8,500 ppm (NAPL phase)
- PAHs  
1,200 ppm (GW), 36,000 ppm (NAPL phase)
- TPH  
900,000 ppm (NAPL phase)

### Geology/ Hydrology

- Fractured bedrock.

### ISCO Treatment Program

- Modified Fenton's Reagent (MFR) with downgradient groundwater/ NAPL extraction and treatment.
- 36,000 cubic yards.
- 20 foot vertical interval treated.
- One injection event conducted over 39 working days utilizing 20 bedrock injection wells.

### Results

- Successfully treated a large portion of the free phase NAPL present in the bedrock.
- The entire project was completed ahead of the schedule and under the budget (total cost of the treatment program was approx. \$300,000).
- The project was given an "Award of Merit" by the New York Construction Journal.

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## ISOTEC Case Study No. 29

### ISCO TREATMENT PROGRAM: VOC, PAH AND TPH IMPACTED BEDROCK

Nyack MGP Site

Nyack, New York

### INTRODUCTION

The subject site is a former MGP site located in Nyack, New York. Past business activities at the site resulted in soil, groundwater and soil gas contamination with both light non-aqueous phase liquid (LNAPL) and dense non-aqueous phase liquid (DNAPL) and MGP-related compounds. The New York State Department of Environmental Conservation (NYSDEC) in consultation with the New York State Department of Health



(NYSDOH) had selected a four-phased remedy for the entire site. ISOTEC's in-situ chemical oxidation (ISCO) technology was chosen as the second phase of the remedy to address the impacted bedrock, the source of the site contamination. The applicable remedial action objectives for the bedrock remedy as described in the Record of Decision (ROD) for the site are to eliminate or reduce to the extent practicable: 1) the presence of NAPL and MGP-related contaminants as the sources of soil, groundwater and soil gas contamination; and 2) the migration of NAPL and MGP-related contaminants that would result in soil, groundwater, or soil gas contamination.

The size of the impacted bedrock volume was estimated to be 36,000 cubic yards with an assumed impacted bedrock thickness of 20 feet and the total pore volume of the impacted

bedrock was estimated to be 145,000 gallons. Based on contamination investigation performed at the site, approximately 24% of the pores and fractures within the impacted zone were estimated to be NAPL or “sheen” impacted, though not necessarily saturated. Target contaminants of concern (COCs) are the NAPL/MGP-related constituents including volatile organic compounds (VOCs), polynuclear aromatic hydrocarbons (PAHs) and total petroleum hydrocarbons (TPH). Levels of the COCs reached 6 ppm for VOCs and 1,200 ppm for PAHs in dissolved phase and exceeded 8,500 ppm for VOCs, 36,000 ppm for PAHs and 900,000 ppm for TPH in NAPL. Prior to the ISCO treatment program, a total of 36 liters of LNAPL and DNAPL had been recovered from some of the bedrock wells.

### **LABORATORY TREATABILITY STUDY**

An ISOTEC **laboratory study** was initially completed revealing varying degrees of COC destruction in samples from the overburden soil, tar soil and NAPL. Using modified Fenton’s reagent, COC reduction reached up to 65% for PAHs, 45% for TPH and >99% for VOCs. The study results indicated that the requirements of the ROD for this remedial action at the site can be satisfied by ISOTEC’s ISCO technology using modified Fenton’s reagent (MFR) by applying sufficient reagent in a volumetric contact with the impacted bedrock zone.

### **ISCO TREATMENT PROGRAM AND IMPLEMENTATION**

The objective of the ISCO treatment program was to inject between 50%-100% of the effective pore volume of the bedrock system with concurrent groundwater extraction of downgradient wells, treatment and re-injection/disposal. The ISCO treatment program was implemented over 39 working days. A total of 87,190 gallons of 17% MFR was injected into the subsurface via 20 injection wells on the site. A total of 34,826 gallons of groundwater was recovered and treated over a span of 42 working days. Air monitoring was performed during the ISCO program at the perimeter of the site to ensure safety of the community.

### **RESULTS**

The bedrock monitoring well network was monitored for several weeks following the completion of the reagent injection. Although it was impossible to quantify the amount of NAPL destroyed due to the difficulty in measuring the before and after conditions in the hidden fractures of the bedrock, the absence of NAPL in the monitoring wells indicated that the treatment program was successful in treating a large portion of the NAPL present in the bedrock. No exceedances were encountered during the perimeter air monitoring.

### **CURRENT PROJECT STATUS**

No further injection events were proposed for the site. The injection of MFR to treat the impacted bedrock was just one portion of a multi-phased remediation project planned for the site. At the time of writing this case study, implementation of the additional phases of remediation had either begun or been completed, in order to redevelop the site as part of the Nyack waterfront revitalization effort. The project was given an **“Award of Merit”** by the New York Construction Journal.