

Project Summary

Dynamic NAPL Recovery and ISCO Injections at a Former Manufactured Gas Plant Site



Case Study 121

Location: Litchfield, IL

History: Former Manufactured Gas Plant (MGP) Site

Contaminants: Polycyclic Aromatic Hydrocarbons, Naphthalene, Methylnaphthalenes, and Phenanthrene

Treatment Area: ~35,000 ft<sup>2</sup>

Treatment Interval: 15 - 42 ft bgs

Lithology: clayey silts, silty sands

Remedy Approach:

- Surfactant solution injection (>81,000 gallons)
- Surfactant enhanced fluid recovery (>165,000 gallons)
- In-situ chemical oxidation (>70,000 gallons)

Remediation Results:

- Property redeveloped (public use)

INTRODUCTION

ISOTEC was selected to implement a combined remediation approach for treatment of soil and groundwater at a former manufactured gas plant (MGP) site located in Litchfield, Illinois, including MGP-related dense non-aqueous phase (DNAPL) impacts. The efficacy of in-situ chemical oxidation (ISCO), surfactant enhanced ISCO (S-ISCO), and surfactant enhanced product recovery (SEPR) were evaluated in multiple bench studies and pilot tests. Following field pilot testing conducted by ISOTEC in 2021, a full-scale remediation program designed and implemented in 2023.

TREATMENT PROGRAM AND IMPLEMENTATION

Vertical treatment intervals ranged from 15 to 42 feet below ground surface (bgs) across the approximately 35,000 square foot treatment area. Surfactant enhanced product recovery preceded in-situ chemical oxidation injections.

Remediation Preparation: ISOTEC served as the project's General Contractor. As part of Remediation Preparation, ISOTEC subcontracted and managed utility markout, surveying, erosion and sediment controls, and installation of 31 injection/extraction wells via Sonic drilling.



Phase I (Surfactant Enhanced Fluid Recovery): Concurrent injections of surfactant solution and product recovery from multi-phase extraction (MPE) wells were conducted from adjacent locations to first solubilize NAPL and extract hydrocarbon impacted groundwater until diminishing returns were realized. Collected fluids were analyzed for total petroleum hydrocarbons on-site using UVF-Trilogy to support the extraction strategy. More than 81,000 gallons of diluted surfactant solution (E-Mulse 10) were injected. Over 165,000 gallons of NAPL-water emulsion were extracted and processed in an aboveground treatment system.



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Extracting these contaminants reduced the overall oxidant demand required for the next phase of treatment, and increased the pore volume space available for oxidants to contact and treat contaminants.

Phase 2 (In-Situ Chemical Oxidation): Over 67,000 gallons of chemical oxidant solutions were injected at 211 DPT locations and 31 injection wells. Sodium persulfate activated by ferric iron (Provect-OX®) was selected based on the results of bench- and pilot-scale testing. The full-scale treatment applied more than 167,000 pounds of Provect-OX®. The heterogeneous, low permeability lithology posed a challenge, as some injections daylighted at particular well locations even at low injection pressures and flow rates. To optimize injection performance, ISOTEC modified its execution approach to utilize direct push technology (DPT) injection points to supplement the screened injection wells. These DPT locations allowed the target dosages of ISCO to be applied within the scheduled timeframe. The modifications significantly improved ISCO injection rates and increased the effective injection radius of influence at several locations. Despite low permeability clayey, silty lithology, most in-situ injections were completed using pressures of less than 25 pounds per square inch (psi).

## RESULTS

Over the course of 9 months, ISOTEC’s in-situ remedial efforts reduced contaminant concentrations sufficient to redevelop the property as a public parking lot.

ISOTEC served as the project’s General Contractor and delivered “turn key” services including bench scale laboratory testing, drilling, well installation, injection services, and site restoration activities. ISOTEC provided performance and payment bonds, and delivered “on time” results within the project’s \$5.5M budget.



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