EPRI-Sponsored Study:
ISCO Application at MGP Sites

OVERVIEW

In 2007, **XDD** completed a two-year study to evaluate the effectiveness of in-situ chemical oxidation (**ISCO**) technologies to remediate manufactured gas plant (**MGP**) residuals. The study, which was sponsored by the Palo Alto, CA-based **Electric Power Research Institute (EPRI)**, involved bench-scale testing and a field demonstration to determine the technical feasibility, economics and limitations of ISCO using **activated persulfate** at former MGP sites.

A specific objective of this project was to develop some general principles to guide managers of MGP sites when considering the application of ISCO. The purpose of the guidance principles is to aid managers in understanding what site-specific cleanup objectives ISCO may achieve and under which site conditions may ISCO be considered applicable as a cost-effective remedial alternative at MGP sites. The project report – published by EPRI in August 2007 – illustrates how ISCO technologies have the potential to treat soils contaminated with MGP residual in place and reach a range of site-specific remedial goals.

ACTIVATED PERSULFATE

The study involved bench-scale testing and a field demonstration using activated persulfate to remediate **TPH, PAHs and BTEX compounds** in soils at a former MGP site in New York state. This ISCO demonstration focused on persulfate as this oxidant has properties that are considered favorable for application at MGP sites and because application of this oxidant is not as well documented as other oxidants (*e.g.*, Fenton's reagent and ozone) for MGP sites. Activated persulfate is a flexible oxidant for application at MGP sites as a result of the combination of its stability and aggressiveness in the subsurface. The stability and persistence of the oxidant dictates its ability to transport in the subsurface and to sustain concentrations that are needed to treat low solubility MGP constituents.

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Project Name & Location

In-Situ Chemical Oxidation of Manufactured Gas Plant (MGP) Residuals

New York State Utility

- A two-year study sponsored by the **Electric Power Research Institute (EPRI)**

Oxidants Employed

- Iron-Chelate Activated Persulfate
- Alkaline-Activated Persulfate

MGP Contaminants of Concern

- TPH
- PAHs
- BTEX

Project Sponsor

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Completion Date

2007

Key XDD Personnel

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BENCH TEST RESULTS

Bench scale testing provided critical information for the design and success of the field demonstration that is generally not collected during site investigation work. The bench tests demonstrated both the importance of the soil properties on the applicability of ISCO and the flexibility of activated persulfate to degrade MGP residuals under a variety of soil conditions.

The collective results of the bench-scale tests conducted on soils from two MGP sites showed that iron-chelate-activated persulfate and alkaline-activated persulfate were effective in treating soils. Greater than 90 percent reductions in MGP constituents (e.g., PAHs and TPH) and total organic carbon (TOC) concentrations were observed due to oxidation by activated persulfate.

Due to the atypically high chemical oxygen demand (COD) in the soils and bench testing results from the selected field site, the objective and scope of the demonstration were adjusted to achieve approximately 50% mass reduction of PAHs and TPH by a *single* application of alkaline-activated persulfate.

Based on the bench testing results, **greater than 90 percent reductions** in PAHs and TPH can be achieved.

Activated Persulfate Single Application:
Baseline & Post-Application Data

mg/kg (ppm)	TPH	
	Baseline	Post-App
IP2 10-12'	6,100	2,100
IP2 12-14'	6,400	1,800

mg/kg (ppm)	PAHs	
	Baseline	Post-App
IP2 10-12'	2,542	978
IP2 12-14'	3,379	755

A copy of the complete report – "***In Situ* Chemical Oxidation of MGP Residuals: Field Demonstration Report** (Product ID: 1015411)" – can be purchased from **EPRI** at *http://my.epri.com* or (800) 313-3774.

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FIELD APPLICATION

A single application of alkaline activated persulfate was selected for the field demonstration to target the contaminants of concern (COCs) that were considered readily oxidizable, as supported through the bench-scale testing. A comparison of soil samples collected before and after the application indicated reductions in the average total PAH concentrations in the range of 55 to 63 percent, while TPH concentrations achieved reductions between 68 and 75 percent due to ISCO application. The measured reductions met the treatment expectations as defined through the bench-scale testing for a single application. The data also demonstrated that the leaching of COCs from the treated site soils decreased by 63 percent for PAHs relative to untreated site soils.

FINDINGS & CONCLUSIONS

Results of this study suggest that ISCO can be an efficient and cost-effective option for MGP sites, as activated persulfate degraded the wide suite of constituents found within MGP residuals. As expected based on the bench-scale test results, the single field application of activated persulfate destroyed the PAHs and TPH by approximately 55 to 75 percent. Based on the bench testing results, greater than 90 percent reductions in PAHs and TPH can be achieved with additional activated persulfate applications. Furthermore, the single application of activated persulfate reduced the leachability of PAHs and BTEX compounds by 63 and 26 percent, respectively.

A site manager who seeks to use ISCO is urged to have a very good understanding of site subsurface (*e.g.*, geology, lithology, soil/groundwater chemistry) and contamination (*e.g.*, concentrations, phases and distribution) before applying ISCO as a remedial technology.