

50 Manufactured Gas Plant Site Management

Program Overview

Program Description

This program provides scientific data, methods, and tools for the efficient characterization, assessment, and stabilization of former manufactured gas plant (MGP) sites. The work includes containment or remediation of contaminated soil, sediment, and groundwater. Program products inform regulatory deliberations and help companies develop and implement cost-effective, environmentally protective management strategies for MGP sites or contaminated properties. The program also addresses ambient air quality issues in the vicinity of MGP sites arising from remediation activities, as well as indoor air quality issues resulting from soil vapor intrusion into buildings situated near MGP sites.

Industry Needs and Issues Addressed

- More than 1,500 MGP sites in the United States require either investigation or remediation; estimated cleanup costs range from \$1 million or more to tens of millions of dollars per site.
- Site managers need credible data and information on alternative remediation techniques, soil vapor intrusion, and indoor air quality.
- Information on environmental and health risks from exposure to polycyclic aromatic hydrocarbons (PAHs), including naphthalene, requires evaluation to determine site-specific cleanup criteria at MGP sites.

Impact

- Estimated savings by a member company of \$1 million per site by application of a software tool developed by the Electric Power Research Institute (EPRI) to demonstrate that natural attenuation was more cost-effective than active remediation
- Projected savings of more than \$2 million over the next decade targeting alternative background PAH cleanup levels
- Projected savings of \$3.5 million at one site by use of EPRI-developed improved methodologies for application of thermal desorption at a member site
- Estimated industrywide savings of \$37 million with development of a management strategy using a variety of information and tools developed by the EPRI research program

Key Accomplishments

- Developed best practices manual for site-specific vapor intrusion investigations and air monitoring techniques
- Conducted analysis of soil vapor intrusion impacts on residential indoor air quality
- Provided advanced guidance on monitored natural recovery and in situ stabilization
- Demonstrated successful rapid screening technologies
- Evaluated in situ chemical oxidation
- Obtained regulatory agency acceptance of background PAH information
- Assessed field monitors for hydrogen cyanide (HCN)

Current Year Objectives

- Assess and manage residential indoor air quality
- Investigate site characterization methods and alternative in situ remediation technologies
- Perform laboratory and field studies to resolve critical uncertainties
- Evaluate natural attenuation as an alternative to conventional remediation techniques

- Evaluate sediment capping techniques
- Identify Brownfields redevelopment performance indicators

Industry Involvement

- Estimated 2009 funding: \$1.8M

Program Technical Lead

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Summary of Projects

Project Number	Project Title	Value
P50.001	Air Monitoring and Soil Vapor Intrusion	Focuses on the development and delivery of information for perimeter air monitoring and emissions control during remediation. Addresses impacts on indoor air quality from vapor intrusion into buildings from subsurface contaminants. Research will determine key parameters that affect soil vapor intrusion into existing or future buildings.
P50.002	Sediment Remediation	Investigates background environments, primarily from fossil fuel (both pyrogenic and petrogenic) sources. Focuses on applying engineering controls such as alternative capping technologies. Evaluates toxicity screening methodologies to delineate extent of coal tar sources. Assesses the potential to achieve monitored natural recovery.
P50.003	Site Remediation Technologies	Delivers performance data on new remediation technologies for containment and control of contaminant plumes in groundwater. Evaluates the effectiveness and practicality of in situ chemical oxidation methodologies such as Fenton's reagent, persulfate, and advanced chemical oxidation technologies. Evaluates in situ stabilization techniques and thermal technologies.
P50.004	Property Restoration and Redevelopment	Develops a property evaluation and environmental risk management guidance document. Identifies management tools for abandoned, idle, or underused properties where redevelopment is complicated by real or perceived environmental risks.
P50.005	Risk Assessment Studies	Focuses on seven PAHs classified as probable human carcinogens (Category B2) by the U.S. Environmental Protection Agency's (EPA's) Integrated Risk Information System (IRIS). Collected data will in turn enable assessment of realistic risk from these MGP site contaminants. Specific attention will also focus on naphthalene, which is classified as a possible human carcinogen (Category C).
P50.006	MGP Site Contaminant Characterization and Source Attribution	Delivers innovative and improved methods for rapidly characterizing, screening, and delineating dense nonaqueous-phase liquids.

Project Descriptions

P50.001 Air Monitoring and Soil Vapor Intrusion (Q55813)

Issue

Release of volatile organic compounds (VOCs) from soils or groundwater at manufactured gas plant (MGP) sites can cause soil vapor intrusion (SVI) into buildings or can cause odor or VOC emissions during excavation of contaminated soils. These issues are receiving increased regulatory attention through guidance documents or permit requirements from regulatory and health agencies. Costly SVI investigations are being required on or near MGP sites, and mitigation is sometimes required. Perimeter air monitoring during remediation is also usually required, but uncertainty still exists on how to interpret the data obtained.

Description

This work improves decisionmaking and risk management by providing state-of-the-art science and technology information on ambient and indoor air quality. The project characterizes air emissions and odors and investigates subsurface vapor intrusion to indoor air.

Value

- Improved methods for assessing SVI at MGP sites will help utility managers reduce costs and uncertainty in complying with regulatory or third-party requirements.
- Investigations into low-cost/low-technology SVI mitigation measures may reduce long-term costs and liability.
- Improved tools to measure and control odor and VOC emissions will reduce complaints and work delays and will provide important documentation to reduce postcleanup litigation.

How to Apply Results

MGP site owners and managers can use the results to make better evaluations of how odor is quantified and managed during remedial actions. MGP site managers can use the results of SVI data to evaluate the risks so that remedial action plans are more thoroughly managed with respect to exposure issues.

2009 Products

Product Title & Description	Planned Completion Date	Product Type
Field Studies of Subsurface Vapor Intrusion at MGP Sites: Soil vapor intrusion investigations will be conducted at several MGP sites. Factors affecting soil gas behavior, such as biodegradation rates for MGP hydrocarbons, moisture, and soil type, will be studied. Alternative mitigation strategies may be evaluated if appropriate.	4/30/2009	Technical Update
Case Study of Emission Control and Air Monitoring During MGP Site Excavation: Odor and emission control technologies and air monitoring methodologies will be evaluated in the field during MGP site soil excavation. Methods may include outdoor versus indoor air monitoring, fixed-point versus linear monitoring, use of nano carbon sorption tubes, and development of a predictive algorithm for downwind exposure.	12/31/2009	Technical Update

Future Year Products

Product Title & Description	Planned Completion Date	Product Type
Handbook on Improvements in Soil Vapor Investigation and Mitigation at MGP Sites: Results of SVI investigations at a variety of MGP sites will be evaluated and compiled into a handbook to document lessons learned. Special attention will be given to determining which long-term liability criteria are important. Methods and costs of conducting air monitoring during MGP site remediation will be evaluated.	2010	Technical Report

P50.002 Sediment Remediation (Q55284)

Issue

Remediation of coal tar–contaminated sediments remains an expensive and technically difficult problem for MGP site managers. There is a need to explore alternative remediation strategies such as monitored natural attenuation and recovery. Issues related to cleanup-level requirements remain tied to the toxicity of benthic and other aquatic organisms. It has been suggested by some agencies that point-source discharges may contribute to a watershed’s condition; therefore, background polycyclic aromatic hydrocarbon (PAH) or isotope studies may be needed. In situ technologies such as capping require further testing to be considered an alternative to dig-and-haul methods.

Description

This work directs decisionmaking by defining methods to delineate, evaluate, and remediate contaminated sediments. The work seeks to protect and restore aquatic environments. Millions of dollars of dredging costs may be avoided by using alternative means of capping and/or control. It considers capping alternatives to dredging, documents field performance of a range of sediment remediation technologies and establishes monitored natural attenuation using risk-based cleanup strategies

Value

- Biototoxicity and forensics analyses assist member companies with determining the location of “hot spots” in sediments.
- Installation of capping materials in lieu of dredging can potentially save hundreds of thousands of dollars in remediation costs.
- Use of isotope analysis and risk-based cleanup levels may help reduce excavation size.

How to Apply Results

Members can use this information to more efficiently and effectively distinguish between sediment contamination from MGP sites and those from other sources. The results of this work will provide site managers with capping and containment alternatives. Field pilot tests will be strongly considered. Results will be delivered to members in technical and peer-reviewed reports. Briefings and presentations to regulatory agencies will be available if necessary.

2009 Products

Product Title & Description	Planned Completion Date	Product Type
Background PAHs in Sediments: PAHs are widely present at relatively low concentrations in urban runoff from a number of natural and anthropogenic sources. This research will investigate runoff environments. Pyrogenic and petrogenic sources will be evaluated to distinguish between contaminants from MGP sites versus those from background sources.	12/31/2009	Technical Update

Future Year Products

Product Title & Description	Planned Completion Date	Product Type
Using Isotopes for Source Attribution of MGP Wastes: The radioisotopic measurement of sediment cores and PAHs will be used to calculate the time required for PAHs, especially those in ecologically active zones, to fall below levels of significant risk. This technology will provide site managers with an option to avoid expensive sediment remediation costs.	2010	Technical Update

P50.003 Site Remediation Technologies (Q55810)

Issue

Site managers are seeking remediation alternatives to dig-and-haul operations in places where there is limited ingress/egress or where buildings and roadways exist over a former MGP site. The use of in situ treatments such as chemical oxidation or solidification will be considered important technologies to investigate. Other in situ technologies, such as thermal, containment wall, barrier, or aquifer modification technologies, may require further evaluation.

Description

This work aims to reduce costs by providing information from performance data on remediation technologies. Research is aimed at saving companies millions of dollars where conventional dig-and-haul technologies cannot be applied. The project will pilot-test and evaluate in situ treatment technologies, improve chemical delivery methods and evaluate alternative product recovery methods

Value

- EPRI has already identified several reactive barrier additives that can cost-effectively remove MGP-related compounds from groundwater, thus reducing long-term operation and management costs.
- Selecting the appropriate in situ chemical oxidant and its delivery method can save hundreds of thousands of dollars per site with correct application.
- EPRI has documented that one innovative application of a thermal desorption process for treatment of heavily impacted MGP soils may save more than \$3 million for one utility.

How to Apply Results

The results of this work may be applied by site managers who want to determine whether an in situ technology can be used as an alternative remediation strategy. Briefings will be made to federal and state

regulatory agencies as appropriate or needed. Development of technologies for remediating MGP wastes may take several years from bench-scale to field-scale pilot tests.

2009 Products

Product Title & Description	Planned Completion Date	Product Type
Case Studies of Technical Impracticability: Technical impracticability (TI) is generally linked to problematic contaminants or complex hydrogeological conditions that limit the possibility of a full remediation. Obtaining a TI waiver for an MGP site includes documenting where TI is relevant based on documented case studies.	12/31/2009	Technical Update

Future Year Products

Product Title & Description	Planned Completion Date	Product Type
Heating of Coal Tar in the Subsurface: Data will be compiled from a few studies on the effect of heating soils containing coal tar in the subsurface. Thermal wells will be evaluated for their ability to increase the recovery rate of coal tar. Results related to the efficient thermal destruction of coal tar in the subsurface also will be reported.	2010	Technical Update

P50.004 Property Restoration and Redevelopment (067511)

Issue

Environmental criteria are important in addressing surplus property decisions, particularly if the properties have been contaminated by previous industrial activity. An environmental analysis of a company's MGP portfolio provides knowledge about environmental and regulatory conditions and impacts on each property's redevelopment potential. It is critical to understand the tradeoff between environmental challenges and market value when deciding where to invest in development projects or end-use strategies.

Description

This work will develop a property evaluation and environmental risk management guidance document for abandoned, idle, or underused properties where redevelopment is complicated by real or perceived environmental risk. The project will quantify parameters such as human health risk, contaminant concentrations, and regulatory requirements to determine best end-use strategies using a Multi-Criteria Decision Analysis (MCDA) approach. It also will populate a database of redevelopment or restoration examples.

Value

- Evaluates the cost of remediation on a site-specific basis, providing managers with dollars-per-ton or dollars-per-acre removal estimates, which can be used for better forecasting
- Provides a best practices example using management oversight review
- Provides site managers with alternative use assessments through case studies of completed projects requiring no further action
- Enables end-use evaluations using varying end-use visions

How to Apply Results

Utilities will receive comprehensive reports evaluating different properties/scenarios. These reports will help utilities increase the marketability, financial, and environmental ranking of their programs according to key parameters. The overall results of the MCDA approach will help explain the methods a company should use for optimum closure and reuse of its property portfolio. These results will be sufficient to enable the utility to take the next steps toward a better disposition of these properties.

2009 Products

Product Title & Description	Planned Completion Date	Product Type
Benchmarking MGP Programs: This document will serve as guidance on how MGP portfolios can be evaluated based on different perspectives within a utility's business (e.g., environmental policy, regulatory, environmental remediation, real estate, and risk management).	12/31/2009	Technical Update

Future Year Products

Product Title & Description	Planned Completion Date	Product Type
Developing an MCDA Framework for MGP Sites: An MCDA framework will be tailored for the utility industry. EPRI will modify existing software owned by Research Triangle Institute to evaluate certain MGP properties as potential Brownfields candidates.	2010	Software

P50.005 Risk Assessment Studies (058346)

Issue

Coal tar contains a number of polycyclic aromatic hydrocarbons (PAHs), exposure to which is associated with increased cancer incidence. Remediation endpoints for sites contaminated with coal tar are driven by the carcinogenicity of these compounds, which include benzo(a)pyrene and naphthalene. Conflicting data on the human carcinogenicity of some of these compounds have led to the development of conservative cleanup criteria. Cleanup levels that are risk based and that remain protective of human health may result in a significant reduction in remediation costs.

Description

This work develops data to establish scientifically sound risk-based cleanup levels. This research will inform the regulatory process by delivering accurate and credible scientific data regarding the environmental and health risks from MGP site contaminants. It will focus on naphthalene research to evaluate evidence that naphthalene is a possible human carcinogen and evaluate EPA's Integrated Risk Information System (IRIS) program results.

Value

- Improves understanding of health risks associated with contaminants at MGP sites, leading to a more informed regulatory process for EPA and others that set standards and cleanup-level requirements
- Improves risk-based decisionmaking and reduces long-term costs
- Supports public interest research

How to Apply Results

MGP site owners and managers will gain value from this research through an improved understanding of how to evaluate and manage the risks of certain PAH compounds. Site managers will gain value from this work by considering how the impact of certain compounds such as naphthalene will play a role in determining specific risk-based cleanup criteria in soil and groundwater. Members should ensure that findings from the project are communicated widely, sending results to key stakeholders, making sure that stakeholders understand the findings, and suggesting that the findings be considered in the development of environmental policy. Members should also use this information to communicate with various public groups as necessary. In addition, EPRI staff will hold periodic briefings for members and key stakeholders, including regulatory and other government agencies, as appropriate.

2009 Products

Product Title & Description	Planned Completion Date	Product Type
Interim Update on Naphthalene: The exact form and focus of this deliverable will depend on the results of the 2008 deliverable, the emerging scientific literature, and the regulatory environment at the time.	12/31/2009	Technical Update

Future Year Products

Product Title & Description	Planned Completion Date	Product Type
Risk Assessment Update: The exact form and focus of this deliverable will depend on the results of the 2009 deliverable, the emerging scientific literature, and the regulatory environment at the time.	2010	Technical Update

P50.006 MGP Site Contaminant Characterization and Source Attribution (Q55325)

Issue

Gaining regulatory acceptance of some rapid characterization screening techniques to determine the physical and chemical extent of coal tar in soils still remains a challenge for site managers. More data are needed from some rapid characterization techniques to prove that they are acceptably rigorous in meeting regulators' requirements. The assessment of the effectiveness of the in situ stabilization (ISS) process for containment of polycyclic aromatic hydrocarbons (PAHs) from treated MGP soils also poses significant challenges to site managers. There is a need to develop and demonstrate an alternative assessment methodology for ISS materials containing PAHs.

Description

This work will deliver new and improved methods for rapidly characterizing and delineating coal tar in soil. It will evaluate steady-state conditions and study mobility of coal tar as well as evaluate rapid characterization techniques for delineating the presence of coal tar in the subsurface. The ISS work will lay the foundation for several peer-reviewed publications and facilitate ongoing development and acceptance of the ISS methodology for MGP sites. It will create a novel mass transfer-based leaching protocol for ISS and provide members with a uniform, science-based approach for evaluating leaching of in-place ISS treated materials.

Value

- This work improves risk management and decisionmaking by delivering more cost-effective methods for delineating the extent of contaminated soils.
- Contaminated soils from MGP sites treated with cementitious binders and disposed in situ prior to capping and rehabilitation of a site can provide an alternative cost-effective solution to remediation.
- An EPRI background-PAH project gained regulatory acceptance in Illinois and is predicted to save millions of dollars over the next decade.

How to Apply Results

Members participating in this work will be able to use the results to better evaluate and delineate contaminant source areas, saving companies money on excavation costs. Results will help site managers provide preremedial design alternatives. Results also may be used by site managers to apply more-appropriate cleanup strategies based on background data. Results will be delivered primarily through publications and peer-reviewed literature. Participants in this work are encouraged to distribute results widely to regulators as warranted.

2009 Products

Product Title & Description	Planned Completion Date	Product Type
Leaching Methods for In-situ Stabilization: This research will describe the bench-scale work and the alternative assessment approach for testing the leaching characteristics of solidified MGP materials. This work will also define leaching behavior parameters.	4/30/2009	Technical Update
Investigating Coal Tar Impacts Beneath Buildings in Urban Settings: A guidance document will be produced to outline the process of investigating the nature and extent of coal tar impacts under engineering controls such as buildings and roadways at former MGP sites.	12/31/2009	Technical Update

Future Year Products

Product Title & Description	Planned Completion Date	Product Type
Summary of Rapid Screening Methodologies: This project advances a dynamic site investigation framework using rapid screening techniques, based on an adaptive sampling and analysis strategy. A field-based gas chromatography/mass spectrometry instrument, data analysis software, and methods will be described and summarized in this work.	2010	Technical Report