

Manufactured Gas Plant Site Management - Program 50

Program Overview

Program Description

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

The Electric Power Research Institute's (EPRI's) MGP site management research includes projects that assess site investigation methods and cost-effective alternatives for 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 arising from remediation activities in the vicinity of MGP sites, as well as indoor air quality issues resulting from SVI into buildings situated near MGP sites.

Research Value

Using MGP site investigation and remediation research and development early in the process helps reduce cost, time, and uncertainty over the life of the project. With development of an MGP site management strategy using a variety of program information and tools, research results estimate significant industrywide savings. Research results project savings of more than \$2 million over the next 10 years, targeting alternative background PAH cleanup levels. Use of improved methodologies for application of thermal desorption resulted in projected savings of \$3.5 million at one member site. In addition, a software tool demonstrating that natural attenuation was more cost-effective than active remediation saved a member company an estimated \$1 million per site.

Approach

- The MGP site management program provides scientific data, methods, and tools for the efficient characterization, assessment, and remediation of former MGP sites. The program helps site owners improve control of emissions/odor issues, evaluates alternative methods for remediating and potentially redeveloping MGP sites, and monitors key health risk issues. This program delivers unique collaborative membership workshops and industrywide symposia;
- more than 20 years of EPRI and peer-reviewed publications and documentation, and a large network of experts;
- field studies assessing the viability of SVI investigation methods employing innovative techniques such as microbial genetic methods, forensic chemistry, moisture monitoring, and sorption sampling;
- modeling techniques such as the Remedial Assessment Options Model (ROAM), which has been used to evaluate MGP site O&M costs, and the Model for the Assessment and Remediation of Sediments (MARS), for assessing impacted sediment issues;
- methods for rapid screening of MGP sites, providing for more cost-effective and thorough site investigations; and
- evaluations of site remediation alternatives, including thermal treatment, in-situ chemical oxidation, and coburning.

Accomplishments

MGP site management program research advances the state-of-the-art investigation, assessment, and remediation of former MGP site impacts on soil, sediment, and groundwater. Models such as MARS and ROAM help site managers evaluate cleanup alternatives, and the program responds quickly to emergent regulatory issues such as SVI and naphthalene risks. The program also assesses alternative site remediation measures, providing clear and issue-specific guidance to site managers on feasible options for specific site requirements. Program accomplishments include the following:

- Reviewed current vapor intrusion methods and proposed a field-based research program
- Conducted analysis of indoor air results from vapor intrusion studies at MGP sites
- Demonstrated successful rapid screening technologies
- Identified signature metabolites of monocyclic aromatic hydrocarbon (MAH) and PAH biodegradation in soil and sediments
- Examined the source of PAHs in urban background soils
- Provided guidance on MGP-impacted sediment remediation, including monitored natural recovery and sediment capping
- Continued evaluation of methods for assessing the performance of solidification of MGP soils and provided resources for determining the applicability, implementation, and assessment of soils solidification

Current Year Activities

Program R&D for 2010 will focus on air monitoring, SVI investigation, and evaluation of remediation technologies. Specific efforts will include

- assessment and management of air emissions from remediation of MGP sites,
- identification of optimal methods to conduct SVI investigations,
- investigation of sediment characterization methods for assessing sources and weathering of PAHs,
- development of software for evaluating MGP site redevelopment potential,
- continued risk assessment evaluations of naphthalene, and
- assessment and guidance concerning methods for in-situ treatment of coal tar by heating.

Estimated 2010 Program Funding

\$1.3M

Program Manager

Babu Nott, 650-855-7946, BNOTT@epri.com

Summary of Projects

Project Number	Project Title	Description
P50.001	Sediment Remediation	Investigate MGP sediment sites with new methods to ensure effective and appropriate cleanups.
P50.002	Risk Assessment Studies	This research evaluates evidence that naphthalene is a possible human carcinogen and evaluates EPA's IRIS program results.
P50.003	Air Monitoring and Soil Vapor Intrusion	Air monitoring and soil vapor intrusion studies will provide tools for utility managers to control potential hydrocarbon emissions from MGP sites both during remediation as well as during subsequent use or development of the property.
P50.004	Site Remediation Technologies	This research provides information on the feasibility, effectiveness, regulatory acceptance, and costs associated with alternative MGP site remediation technologies.
P50.005	MGP Site Contaminant Characterization and Source Attribution	The research carried out in this project seeks to make site characterization and remedial assessments more effective and more acceptable to the regulatory agencies.
P50.006	Property Restoration and Redevelopment	This project will demonstrate methods for conducting property evaluations considering the environmental aspects of the site so that market values can be determined.

P50.001 Sediment Remediation (Q55284)

Key Research Question

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 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.

Approach

This work directs decision making 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. The research 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. Activities will include:

- assessing coal tar weathering in sediments, Phase 2; and
- using isotopes for source attribution of MGP wastes.

Impact

- Biotoxicity 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.

2010 Products

Product Title & Description	Planned Completion Date	Product Type
Assessing Coal Tar Weathering in Sediments-Phase 2: This work will expand existing methods to allow laboratory analysis of complex PAH mixtures. Such analysis can discern the effects of biodegradation versus dissolution, evaporation, and sorption. The methods can be used for purposes of evaluating remediation alternatives as well as, potentially, for monitoring sites after closure.	12/31/10	Technical Update

Future Year Products

Product Title & Description	Planned Completion Date	Product Type
Assessing Coal Tar Weathering in Sediments-Phase 3: This research will complete development of assessment methods and conduct field trials at impacted sediment sites.	12/31/11	Technical Update
Using Isotopes for Source Attribution of MGP Wastes: The radioisotopic measurement of sediment cores and PAHs will be used to evaluate possible sources of PAHs, including those that may occur in urban runoff. This information could be very important in evaluating natural resources damage claims at MGP sites.	12/31/11	Technical Update

P50.002 Risk Assessment Studies (058346)

Key Research Question

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.

Approach

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.

Impact

- Improves understanding of health risks associated with contaminants at MGP sites, leading to a more informed regulatory process for the U.S. Environmental Protection Agency (EPA) and others that set standards and cleanup-level requirements
- Improves risk-based decision making 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.

2010 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.	12/31/10	Technical Update

P50.003 Air Monitoring and Soil Vapor Intrusion (Q55813)

Key Research Question

Release of volatile organic compounds (VOCs) from soils or groundwater at 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.

Approach

This work improves decision making 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.

Impact

- 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 predict, measure, and control odor and VOC emissions during MGP site remediation will reduce complaints and work delays and will provide important documentation to reduce postcleanup litigation.
- Improved air monitoring methods will provide more complete and temporal analytical data to evaluate potential off-site emissions.

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.

2010 Products

Product Title & Description	Planned Completion Date	Product Type
<p>Comparison of Predicted and Observed Air Emissions from Remediation of MGP Sites: Air emissions during an MGP site remediation will be predicted based on the Manufactured Gas Plant Site Emission Estimation Program (MGPSEEP) software and will be measured using both commercially available and newly developed methods (e.g., carbon nanotube adsorbents, FTIR). Building effects (outdoor and indoor concentrations) will be evaluated if host sites can be found.</p>	10/01/10	Technical Update

Future Year Products

Product Title & Description	Planned Completion Date	Product Type
<p>Handbook on Improvements in Soil Vapor Investigation and Mitigation Methods 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 sampling and analytical methodologies are important to reduce SVI investigation costs. Mitigation methods will be considered if problem sites are identified.</p>	12/31/11	Technical Report

P50.004 Site Remediation Technologies (Q55810)

Key Research Question

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.

Approach

This work aims to reduce costs by providing information regarding 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. Work will include research on heating of coal tar in the subsurface.

Impact

- 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.

2010 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.	12/31/10	Technical Update

P50.005 MGP Site Contaminant Characterization and Source Attribution (Q55325)

Key Research Question

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 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. In addition, characterization of soils in difficult-to-access locations, such as under buildings, remains problematic.

Approach

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. Work will include research on under-building characterization techniques.

Impact

- This work improves risk management and decision making 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.

2010 Products

Product Title & Description	Planned Completion Date	Product Type
Under-Building Characterization Techniques: This product will include an assessment of alternative characterization methods for difficult-to-access sites such as underneath buildings, roadways, etc. It will also include evaluations of combining horizontal stratigraphic assessments with trenchless technologies with alternative sampling equipment for screening purposes.	12/31/10	Technical Update

P50.006 Property Restoration and Redevelopment (067511)

Key Research Question

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.

Approach

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 multicriteria decision analysis (MCDA) approach. The project also will populate a database of redevelopment or restoration examples. Work will include software for developing an MCDA framework for MGP sites.

Impact

- 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.

2010 Products

Product Title & Description	Planned Completion Date	Product Type
Developing an MCDA Framework for MGP Sites: This document will provide the framework for software that can be used to determine how MGP site 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).	12/31/10	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.	04/30/11	Software