

# Site Management Trends and Research Directions in the United States of America

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Coal and oil gasification to light America's streets and buildings began around 1816. Private enterprise plants were built in most major cities, and many of these plants continued operation until the 1950s. After plants were closed, they were often demolished, and the property was sold. We are only just now beginning to understand the extent and magnitude of the legacy left behind by this process. There may be as many as 2500 such sites which, while originally owned by the corporate predecessors of today's gas distribution companies, are now part of modern electric and gas utilities. These sites range from half an acre to over 100 acres in size and could cost between \$25–75 billion over the next thirty years to clean up or contain. Anyone who can determine cost-effective, environmentally protective means to lower these costs will have an enormous business opportunity in the MGP clean-up market place.

Until recently, there have been relatively few specific regulatory requirements for most of these sites because of the low health risk concerns at these sites, the many uncertainties surrounding the nature and extent of environmental contamination and the possible effects of remedial action, and the higher priority of other types of contaminated sites of more immediate regulatory and human health concerns. However, the potential for soil and groundwater contamination with organic chemicals, the commercial value of many of the properties, and the strict liabilities imposed by hazardous waste laws are all factors that are causing utilities to carefully evaluate, investigate and assess manufactured gas plant sites and, where necessary, to develop remediation/restoration plans.

Because of the need for research in large sectors of American private industry, collaborative research ventures have been created. For over 23 years, the Electric Power Research Institute (EPRI) and the Gas Research Institute (GRI) have sponsored a series of technical studies in a coordinated R&D response to the needs of utilities in MGP site management. The programs are a mix of applied and basic research designed to yield results of value for use in site characterization, risk assessment, site remediation, and control or restoration strategies. There is no state or federal financial support of efforts to work on manufactured gas plant (MGP) sites, despite the fact that regulatory agencies from both of these jurisdictions are increasingly likely to mandate clean-up.

Most utilities prefer to work proactively in consultation with appropriate state regulatory agencies to assess the contaminants at MGP sites, and determine and implement cost-effective remedial measures before mandated clean-ups are handed to them. But utilities must also be cost-conscious. The time needed to evaluate and restore sites and the number

of sites that exist indicate the necessity of a rational prioritization of steps based on relative risks. New technologies, tools and methods must be demonstrated and validated. Consideration must be given to the media in which contaminants and wastes are found. Soil, non-aqueous phase liquids, groundwater and purifier box wastes all present different contaminant, removal and treatment problems. Similarly, the removal, collection and treatment of volatiles, semi-volatiles and non-volatiles present unique management problems. Technologies, tools and methods need to be thought through from the standpoint of physical, chemical and biological behavior when containment, removal, immobilization and stabilization are considered. Finally, there is the issue of technical impracticability (i.e. it may not be possible to clean some sites cost effectively).

The primary challenges to field work at most MGP sites include the removal of non-aqueous phase liquids (D- and L-NAPLs), *in-situ* stabilization or containment strategies, and groundwater clean-up.

Coal tars found in the subsurface are often not easily pumpable or recoverable. New processes such as CROW<sup>R</sup> are being tested in the field to recover tars. However, results are still uncertain. Similarly, in situations where NAPLs and water have formed emulsions, the technical challenge remains to break-up the emulsions, recycle the NAPLs and treat the water.

Landfilling, which has been severely limited in other parts of the world for years, is likely to decline as an option over the next decade in America as land disposal restriction rules become increasingly strict. Because excavating, and then treating or disposing is very expensive, the need for effective *in-situ* methods is very strong. Bioventing, air sparging, soil vapor extraction, and other new *in-situ* technologies hold great promise for volatile and semi volatile chemicals, but have not yet been tried across a broad enough spectrum of site conditions or contaminants.

If materials test hazardous and special waste disposal is indicated, costs can skyrocket. The American utility industry has negotiated with regulators a strategy whereby voluntary clean-ups at MGP sites are encouraged by blending hazardous materials with fuel (e.g. coal) to render them non-hazardous for coburning in utility boilers. This and other innovative, cooperative strategies need to be forged with regulatory communities involved to assure that incentives exist for site owners, rather than deterrents.

Research is currently underway using utility boilers to co-burn tars and contaminated media. Initial results indicate that with low feed rates (i.e. between 3 to 5% of remediation

wastes with 95 to 97% coal), this is a viable option. You will hear papers in this symposium on the results of this experience. Environmental performance is being explored from incorporating coal tars and contaminated soils into asphalt, bricks and cement. Thermal desorption, biodegradation, *in-situ* stabilization, and other technologies are being tested for their feasibility and use over a variety of conditions. Hydraulic containment and on-site treatment of groundwater is in field scale demonstration at a number of sites.

The toxicity of MGP coal tars and residues is not well understood. Very little data exists in the literature. MGP residues contain polyaromatic hydrocarbons (PAHs) some of which are known to cause tumors. Current American regulation focus is on the role of benzo(a)pyrene. EPRI has sponsored a rigorous three-year health effects study, the results of which will be reported on later in this symposium by Dr. Larry Goldstein, that promises to deliver major toxicological data for assuring accurate health risk assessments and clean-up standards. You will see that chemistry and hydrology are very important factors in determining the availability of PAH for human exposure.

Cyanides, which are often associated with purifier box wastes, have been the focus of much research. The release and partitioning of hydrocarbons and cyanide from soils, and their ability to leach into groundwater with potential impact to ecological and human receptors is of great interest.

EPRI has brought many new products and methods to the marketplace as a result of research over the past five years.

For site characterization and assessment: volume estimation techniques, multi-level sampling devices, analytical methods comparisons, and field-screening techniques, such as the microscale solvent extraction (MSE), supercritical fluid extraction (SFE), and total benzene vs. toxicity characteristic leaching procedure (TCLP) have been developed. In addition, a number of models have been developed. For site management: PCTrans, MYGRT™, ROAM™, COFERS, and MAN-AGES have been developed. You will hear references to these products throughout some of the following presentations, and I will be presenting a paper on these later. Some of the models will be available for demonstration during the course of this symposium. Please feel free to stop by and view the computer demonstrations and discuss these methods.

In summary, I have tried to present to you the American perspective, approach, and opportunities posed by the challenges of MGP site clean-up. I look forward to sharing results and research in progress which EPRI has created or is developing during the course of this meeting. It is a great pleasure for me to be here in Prague and I look forward to meeting you individually. EPRI appreciates the opportunity to be a sponsor of the MGP '95 Symposium.

#### REFERENCES

Managing the gas light legacy. *EPRI Journal* (July/August 1989), 22-31.