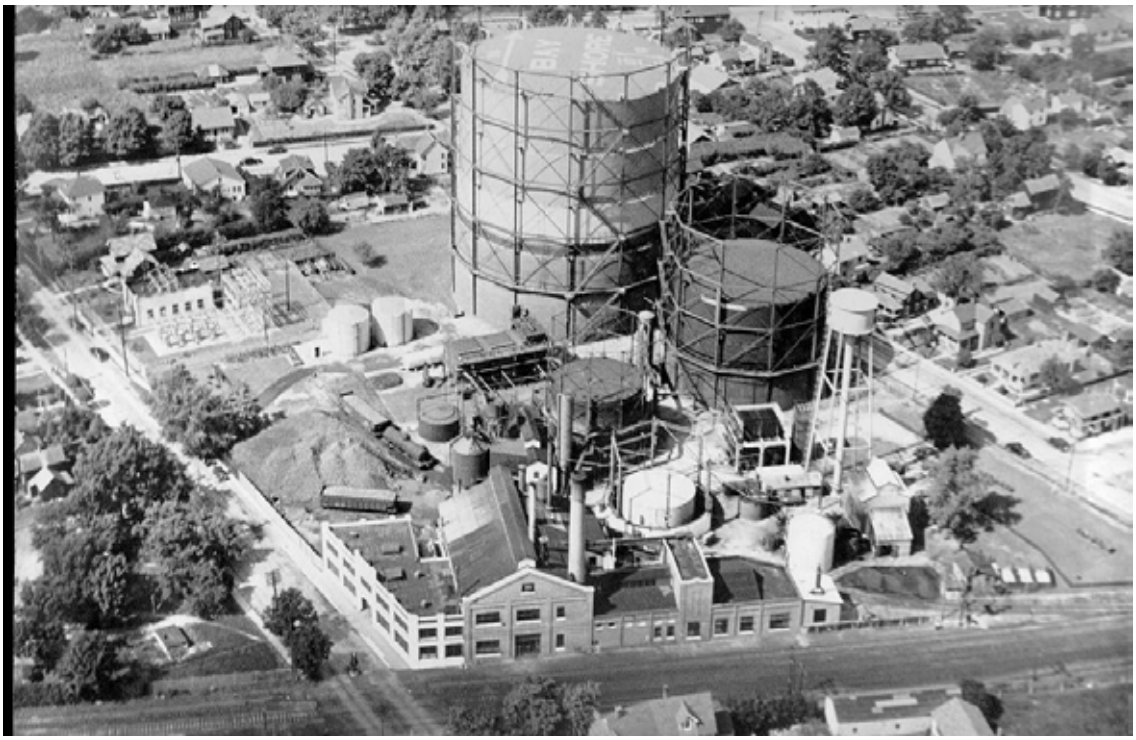
New York State's Approach to the Remediation of Former Manufactured Gas Plant Sites



Bay Shore, NY MGP

Division of Environmental Remediation
Department of Environmental Conservation

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Overview of Department Approach to Former MGP Site Remediation

To address the Manufactured Gas Plant (MGP) legacy in New York State, the Department of Environmental Conservation's Division of Environmental Remediation has established one of the most aggressive MGP site investigation and remediation programs in the country. The evolution of the Department program as well as a history and overview of MGPs is provided in Part 1. Part 2 will detail the Department's approach to the more technical aspects of the remediation of MGP sites.

While the existence of former MGPs was known, the potential numbers of these plants became apparent in the early 1990s. Initially, the New York State Department of Environmental Conservation (Department) viewed the remedial program for former MGP sites as consisting of limited removal actions or interim remedial measures, similar to the removal of underground petroleum storage tanks. With the passage of time the Department's understanding of the complexity of these sites grew, as investigations identified the extent of the contamination problems associated with many MGPs. Accordingly, the Department program was restructured. In 2000, additional staff were dedicated to the MGP remedial program and the focus shifted from the limited removal based approach to the more traditional Superfund site remedial approach, for nearly all MGP sites. The process starts with a site characterization, progresses to a remedial investigation, then to a feasibility study and continues into the design and construction of the remedy. This approach has proven successful. Projects continue to move forward through the remedial process, while the total number of sites under order or agreement has increased steadily from approximately 90 to more than 200 today.

The dedicated MGP group reflects a recognition of the need for a consistent approach between the eight utilities and MGP sites in general. This need is highlighted by the reality that most utilities have sites in two or more of the Department's regions. This group, in addition to fostering a consistent approach and decision-making, has developed a high level of expertise in the investigation and remediation of these sites. Staff are frequently consulted by other states and participate in conferences and work groups at national and international levels.

Historic Development of MGPs

MGPs have a long history in New York State, starting in 1826 with a small demonstration plant in New York City that produced gas from whale oil. From this modest beginning through the closure of the last active plant in1972, MGPs were a visible and important part of life throughout the State.

The original focus for the industry was to supply small amounts of gas for street lighting systems. This changed quickly with rapid growth experienced in the mid-1800s such that, by the "gaslight era" of the l880s and 1890s, gas was being widely used for lighting, heating and cooking. New plants were built and old ones expanded to meet the sharply growing demand. The plants required large amounts of water to operate. Accordingly, most of them were located along the shoreline of a water body. Networks of pipes and storage facilities made gas available throughout a town or city.
Most towns in New York State with populations of more than 5,000 had at least one gas plant. To date, more than 200 MGP sites have been found statewide, and it is estimated that up to 300 may exist. Smaller MGPs also operated during this time period, providing gas for individual factories or institutions. A trend toward regional consolidation took hold in the 1930s, in which small town MGPs

often closed and were replaced by short-distance pipelines to neighboring plants a few miles away. As World War II approached, longer interstate pipelines were built, making cheaper natural gas from the Midwest more widely available. Most New York MGPs had closed by the1950s, but a few remained in operation on standby status in areas where the pipelines could not meet peak demand. The last MGP in New York State ceased operations in 1972.

1874 Gas Holder in Troy, NY

The responsibility for most of the MGPs identified in the State can be tied to one of the nine gas utilities which still operate in the state. These companies either owned/operated the plants themselves or became successor companies to the original owners/operators through mergers or consolidations. It should be noted that some gas manufacturing companies (particularly in smaller towns) went out of business without being consolidated or taken over by larger utility companies. The New York State Department of Environmental Conservation continues its research efforts to locate these plants so they can be investigated and, if necessary, cleaned up. A table showing the distribution of MGP sites among the utilities and a figure showing their general locations across the State is included on page 7. Information relative to individual sites can be found on the Department website at:
http://www.dec.ny.gov/chemical/24921.html

The Gas Manufacturing Process

Two main processes were used to manufacture gas. The older and simpler process was coal carbonization in which coal was heated in closed retorts or beehive ovens. Volatile constituents of the coal would be driven off as a gas, which was collected, cooled and purified prior to being piped into the surrounding areas for use.

As the MGP industry developed and expanded after the Civil War, a new process was introduced which produced a gas mixture that burned hotter and brighter. This process, known as carburetted water gas (CWG), was first introduced in the 1870s. By 1900, most MGPs in New York State were using it. A variety of water gas processes were developed, all of which started by heating coke or coal in the presence of steam. This first step produced a flammable gas mixture of methane and carbon monoxide.

Petroleum products were then sprayed into the hot gas mixture creating more methane, which increased the heating and lighting value of the gas.

Potential Environmental and Public Health Impacts of MGP Sites

The production of manufactured gas created waste products which are resistant to natural decay and often result in potential effects on public health and the environment. Some of these wastes still remain at former MGP sites. The primary waste was a dense, oily liquid known as coal tar which condensed out of the gas at various stages during its production, purification and distribution. Although some of the tar was collected for sale or reuse, recovery was incomplete. In the decades during which many of these MGPs operated, substantial amounts of tar leaked from storage and processing facilities or was discharged into nearby water bodies. Soils, groundwater and sediments which came into contact with the tar became heavily contaminated, and in many cases remain contaminated today.

MGP on the bank of the Hudson River in Nyack, NY

The tar produced from the coal carbonization process was a fairly viscous material which had a wide variety of economic uses. Significant efforts were made to recover this tar for sale. Dyes, explosives and a wide variety of other chemical products were developed using "true" coal tar as a starting material. Tars from the water gas process were far less valuable and were much more difficult to recover and process. Separating the tar from the water emulsion in which it was produced was slow and difficult. Most of the "coal tar" we encounter at MGPs today is actually water gas tar, which was actually derived from liquid petroleum products, not coal. Water gas tar is less viscous than true coal tar and is therefore more likely to move as a liquid through subsurface soils.

Tars from both processes contain a family of chemicals known as polycyclic aromatic hydrocarbons or PAHs. These compounds do not readily dissolve in water, so they are rarely found to have migrated farther than the tar itself. The tars also contain a family of volatile organic compounds known as BTEX (an abbreviation for the individual compounds benzene, toluene, ethylbenzene and xylene). These compounds are more soluble than the PAHs and are often found as groundwater contaminants around MGP sites. Tars often contain enough benzene to meet the legal definition of a hazardous waste.

The gas purification process also produced a solid waste material. Known as "purifier waste" or "box

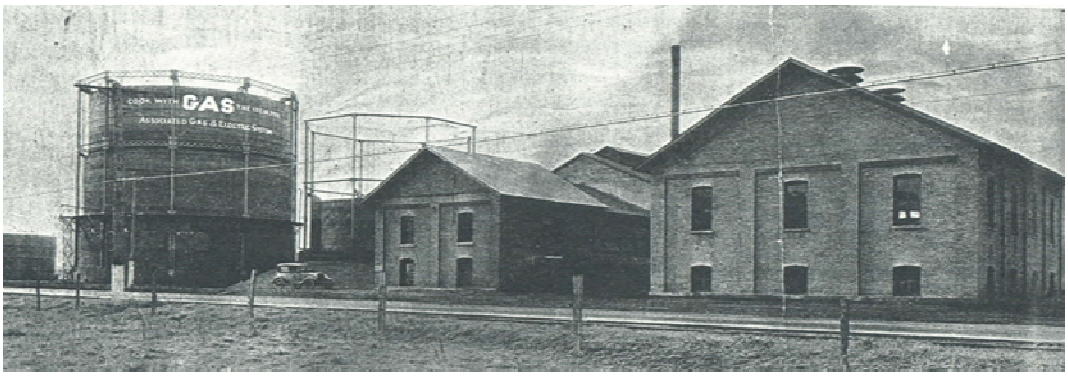
waste," it is typically a mixture of wood chips, iron filings and clumps of solidified tar. As a solid, it does not migrate through the subsurface the way liquid tar does. However, it can be a source of groundwater contamination and has a strong and offensive odor when exposed at the ground surface.

Blue-colored purifier waste chips
at the National Grid Harbor Point site in Utica, NY.
When exposed to air, the chips generate a corrosive leachate
which has corroded the concrete bin they are stored in.

Most MGP sites have been inactive for several decades, and many have been redeveloped for other uses. MGP wastes that were present on the surface when the plants were operational have often been removed or covered by buildings, pavement or soil. Consequently, MGP wastes are often not on the surface where people on the property will come into contact with them. However, if there are wastes on the ground surface, or if people dig into waste or contaminated soil and bring it to the surface, exposure through dermal contact and accidental ingestion can occur. People can be exposed to MGP contamination which includes tar, tar-contaminated soils, purifier waste, contaminated groundwater or surface water, contaminated dust and contaminated air or soil vapor. If there is no contact with wastes or potential for soil vapor intrusion, there is no exposure.

Making Gas versus Storing Gas

There are two types of sites where MGP contaminants are found. The first are the sites where gas was produced, known "MGPs" or "Works". Most of these sites have significant levels of tar contamination in the subsurface, both in buried structures and pipes and in the soils surrounding these structures. The most important of these structures were the gas holders where tar was held immediately after being produced. As the gas cooled, liquid tar would condense and form a distinct layer at the bottom of the holder, which was often 10 to 20 feet below the ground. Leakage of tar from these holder foundations is the most common source of contamination at MGP sites.



A typical MGP which served the Cortland/Homer Area in Central NY

Because the plants operated and leaked tar for long periods of time, it is common to find that the tar has migrated substantial distances away from the structures where it was initially released. MGPs were typically located along waterfronts, so it is also common to find tar in the sediments of water bodies near

where the plants once stood.

The second type includes sites where gas was stored in tanks located away from the production facilities. These are known as "distribution holders" or "holder stations". The gas stored in these remote holders had already been cooled and purified at the manufacturing plant, removing the tar before the gas was piped out. Thus, these remote holders are much less likely to be heavily contaminated with coal tar or other MGP wastes.

The construction of these holders was broadly similar to the holders found at MGP sites, and tar contamination has been found at some of them. In some cases, the moving parts of the holders themselves were lubricated with tar. In others, tar may have condensed in the pipes as it was being transported, with small amounts of tar accumulating in the holder foundation below the ground surface. Leakage from the holder foundation could then contaminate the surrounding soils. While holder stations receive a lower priority for investigation and cleanup, they still require investigation and remediation where impacts are identified.

Large Gas Holders
65th St. MGP, New York City

These are water seal holders, identifiable
by the open steel frame and moveable or telescoping cover.

Other Gas Technologies

As in any industry, there were attempts to develop new technologies for the production and storage of gas. Some of these alternative technologies produced little or no waste and are not considered significant sources of MGP-related contamination.

For example, some very small plants were built to produce acetylene gas, usually where limited volumes of gas were required on a seasonal or batch basis. These plants operated on the same principle as a 19th century miner's lamp, with calcium carbide pellets being placed in a reservoir of water to produce the gas. This process produced no tar, and the gas did not require purification, so no purifier waste was produced.

The technology of gas storage also evolved with time. By the mid-20th century, high-pressure spherical gas tanks known as "Hortonspheres" were in widespread use. A handful remain in service today. These tanks had no subsurface storage components and did not use tar as a lubricant. They were elevated by pedestals above the ground surface and have not been identified as sources of significant MGP-related contamination. Accordingly, the Department has not required that these Hortonsphere sites be investigated as typical MGP sites.

Hortonsphere
Water Street MGP site
Poughkeepsie, NY

MGP Sites Today

It is not common to find MGP wastes exposed on the ground surface today. In part, this is because most of the tar releases took place in subsurface structures at levels from 5-20 feet below grade. Compounding this, subsequent redevelopment of the MGP sites has often removed or buried the working surface of the plant so those wastes that may have once been exposed at the surface are now covered. However, exposed wastes are sometimes found, and on some sites coal tars may migrate upward to the ground surface from below.

Former MGP sites have found a variety of uses in the years since they ceased operations. Many are still owned by the utility companies and are used as electric substations, storage yards, truck garages, office buildings and generating stations. Due to their central locations on the gas pipeline networks, many also still contain gas-regulating facilities. Other uses range from abandoned industrial property to commercial/retail properties, to schools and residences.

MGP Sites Currently Identified in New York State

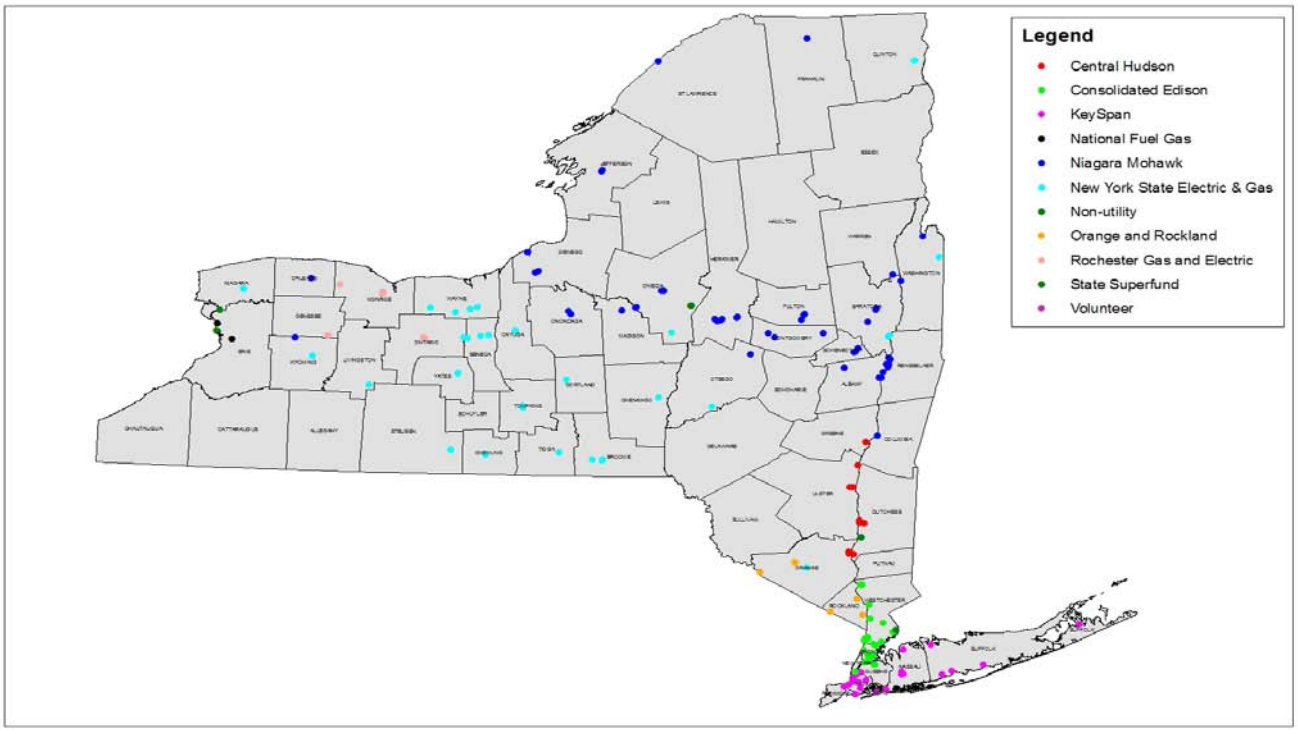
Since the problems associated with the former MGP sites were identified, the Department has been working with the utilities on a statewide basis to identify, investigate and clean up MGP sites. To date 235 MGP-related sites have been positively identified and it is estimated that up to 300 may have operated in NYS during the historic MGP period. Of the sites found so far a current NYS utility has been identified as the responsible party, and entered into an order or agreement for the investigation and cleanup, for 202 of these sites. Of the 202 identified utility sites, cleanup has been completed or a determination of no further action has been made at 21 sites. The Department will either seek to identify a responsible party or address the remaining identified former MGP sites under either the State Superfund or one of the Department brownfield programs. In addition, the Department will continue to work to identify, investigate and clean-up any "orphan" MGP sites which are not the responsibility of present-day utility companies using the State Superfund.

The following table and map present the MGP and MGP-related sites that have been identified in NYS to date and the number of sites where a current NYS utility has been identified as a responsible party:

Table 1: MGP Sites by Responsible Utility

UTILITY	MGP Sites Currently Identified	Under Order/ Agreement	Complete/ No Further Action
Central Hudson G & E	**7**	**6**	**0**
Con Edison	**51**	**51**	**5**
KeySpan (former BUG/LILCO)	**43**	**41**	**2**
NYS Electric & Gas	**38**	**37**	**6**
National Grid (former Niagara Mohawk)	**51**	**51**	**7**
Orange & Rockland	**7**	**7**	**1**
Rochester Gas & Elec.	**10**	**8**	**0**
National Fuel Gas	**4**	**3**	**3**
Non Utility	**30**	**3**	**1**
Totals	**241**	**207**	**25**

Figure 1: Distribution of MGP Sites in NYS



Note the distribution and concentration of MGPs in Metropolitan New York, the Hudson Valley and along the Erie Canal corridor, where population was concentrated in the late 1800s and early 1900s.

Part 2: Technical Considerations in MGP Site Remediation

Special Technical Considerations at MGP Sites

Experience in the MGP Program has identified several technical areas requiring special consideration in the development of a remedial program for MGP sites:

MGP Sources of Contamination Source areas include gas holder foundations, tar wells, tar/water separators, other MGP structures and subsurface piping (> 2 inches in diameter). Heavily contaminated soils surrounding these structures are considered part of the source area. Identifiable, unweathered tar is often found to have migrated away from the areas of disposal or discharge; this material affected by migrating tar is also considered a source as well. Because of the distinctive appearance and odor of MGP tars, these source areas are typically easy to identify. Some of the petroleum feed stocks for the water gas process are also found near MGP sites and soils visibly affected by these feed stocks may also be considered sources. Source areas can also exist at some sites where purifier waste disposal occurred.

Non- aqueous phase liquid (NAPL) mobility Movement of NAPL (including both petroleum and coal tar) is a principal cause for concern at MGP sites. Whenever MGP-related NAPL is found in native soils beyond the immediate vicinity where it was released, it is clear that the NAPL was mobile, at least in historic times. In many cases, this movement appears to have stopped, leaving the NAPL plume stationary. However, several case histories demonstrate that apparently immobile NAPL can be remobilized by activities on surrounding properties. The extent to which this NAPL remains mobile, or subject to remobilization, must be determined by the site investigation. Factors to consider when investigating NAPL include:

- The presence of high-permeability features (either natural or anthropogenic) in the subsurface
- Perturbations of the groundwater system such as well pumpage or tidal action: and
- Construction activity or other sources of ground vibration

Tar mobility demonstrated by tar movement through sand seams in a split spoon sample. Gastown MGP site

Monitoring wells should be designed with screens and sand packs that present minimal impediments to NAPL entry and should in most cases provide an adequate sump where NAPL can accumulate. NAPL which is sufficiently mobile to enter a monitoring well should be removed, and the well should then be monitored periodically to determine whether NAPL will continue to accumulate. The existence of wells that persistently accumulate NAPL is considered a primary indicator of present-day NAPL mobility.

Interim Remedial Measures (IRMs) MGP sites typically contain buried structures or other areas of highly concentrated wastes which are good candidates for interim remedial measures.

The Department MGP Program often conducts removals of gas holder foundations, tar wells, and/or other MGP-related structures as an initial step while more detailed evaluations are under way elsewhere on the site. Where possible, IRMs are intended to achieve final remedial criteria to minimize the need to revisit an area during the final site remedy. Thus, the IRMs seek to remove not only the contents of buried structures, but also the structures themselves and any contaminated soils immediately surrounding and beneath the structure. However, site conditions do not always permit this. Some sites where NAPL contamination is found to extend to great depths beneath the MGP structures may not be appropriate candidates for IRMs.

Relief holder removal IRM
Port Chester, NY MGP

Community Health and Safety The MGP program implements the NYSDOH Community Air Monitoring Plan (CAMP) requirements for all investigations and remediations. These measures are intended to prevent any potential for health effects in the communities surrounding the site. These measures may include performing all work within a containment structure where air emissions need to be closely controlled. In addition, nuisance odor control measures are routinely employed as described below.

Sprung structures for odor control
Metropolitan Works MGP
Brooklyn, NY

Work inside a sprung structure
Johnstown MGP
Johnstown, NY

Odor Control MGP tars contain significant amounts of benzene, napthalene and other volatile compounds, so health-based monitoring and control of vapors is an important component of all investigative and remedial activities. Nuisance odors, however, often present a far greater potential effects on the surrounding community. In short, MGP wastes have such a high odor potential that most people will complain about the smell long before the vapors reach health-based levels of concern. A variety of control measures are available, including spraying of active excavations and stockpiles with detergents or odor-suppressing foams. These are generally effective, but in areas where occupied buildings are close by, or where large areas of MGP-affected soils are to be excavated, work may be conducted inside a temporary structure

equipped with air-purification equipment.

Use of foam
on exposed contaminated soil
for nuisance odor control

Remedial Approach for MGP Sites

MGP site remedies typically include actions to address one or more of the following forms of waste present at the site and/or affected environmental media:

Source Area Removal Consistent with the Department Part 375 regulations, removal of sources of contamination must be considered to the extent feasible, even in cases where the final remedy may call for containment measures for the site. MGP specific sources/source areas were identified above and typically include the piping and/or MGP structures encountered, as well as contamination in and around them and buried purifier waste.

Removal of a holder foundation
Port Chester, NY MGP

Coal tar in the holder foundation
represents a source area

Surface Soil Remediation As noted above while source removal, containment and/or treatment is to be an element of all site remedies, lower non-source levels of MGP constituents also must be addressed by the remedy for a site where they represent an exposure. If not removed as part of the source removal, this lower-level MGP contamination may be covered or capped to reduce exposure, with such caps or covers designed based upon achieving remedial action objectives and the intended use of the site. At sites where engineering controls (caps and covers, etc.) are required to prevent exposure to surface soils, appropriate institutional controls (environmental easements) will also be required to limit future use of the site and to assure the engineering controls remain in place and effective.

Unrelated to the MGP process but also a consideration in surface soils are areas of elevated lead resulting from the repeated painting of the large metal gas holders or paint flaking off the structures during their demolition.

Subsurface Soil Remediation While removal of concentrated hot spots/source areas is required to the extent feasible, as noted above, deep or inaccessible source areas or areas with lower levels of contamination can be addressed by in-situ treatment or stabilization or may be

contained via barrier walls. Appropriate engineering controls and/or institutional controls are employed to address potential exposure to these remaining contaminants.

Sheet pile barrier wall installation
along the Mohawk River
Amsterdam MGP Site

Non-Aqueous Phase Liquid Collection and Disposal NAPLs (both light and/or dense) are targeted for removal to the extent technically feasible. If the NAPL is determined to be immobile under current site conditions, the potential for future remobilization must be considered, and measures must be implemented to limit this possibility. NAPLs which are not removed will be controlled, contained or treated in-situ.

Groundwater Remediation Decisions regarding site groundwater remedies will be made in accordance with Part 375-1.8 considering source control (as discussed above) as the first priority in addressing groundwater contamination. The second consideration is plume containment, which address what remains on the site and includes measures to address groundwater contamination migrating off of the site. The third consideration is plume remediation which considers the Department's groundwater strategy. In addressing groundwater, it is recognized that the soluble constituents of MGP wastes, in this case BTEX compounds and naphthalene, are often amenable to natural decay processes. If there are no unacceptable exposures, and it appears unlikely that they will develop in the near future, active groundwater remediation may not to be required. Containment or natural attenuation of
on-site groundwater may be considered, provided the source of the contamination is removed, contained or treated as a part of the remedy.

Sediment Remediation Sediment in water bodies contaminated with tars or NAPLs will be removed to the extent feasible. Sediment contaminated with PAHs, lead and other MGP constituents will be further delineated and characterized to allow and determination of environmental and/or public health effects. To characterize ecological exposures, the *NYSDEC Technical Guidance for Screening Contaminated Sediments* is used to define the contaminated area, and appropriate methods such as toxicity testing and benthic community analysis should be used to document ongoing effects. The final remedial action objectives will be determined on a site-specific basis, taking into account results of the biological studies, background levels and the technical feasibility of the remedial action. Contamination that cannot be removed may need to be capped or covered to prevent unacceptable exposure to humans or aquatic biota. For any such proposal, the cap must be shown to be a permanent remedy and determined by the Division of Fish, Wildlife and Marine Resources (DFWMR)to be consistent with other laws and regulations regarding protection of habitats and the placement of fill in waterways. The DFWMR is consulted throughout the process of evaluating sediments, as is the NYSDOH should

health effects resulting from contaminated sediments be identified.

Remedial Decision-making at MGP Sites

Remedy Selection Remedy selection will be undertaken and documented in accordance with the requirements of the applicable site consent order or agreement and the requirements of the remedial program under which the remediation is taking place. An evaluation of alternatives is required where coal tar waste or NAPL will not be fully remediated or if contamination has migrated off-site. The decision-making process will be documented in either a Record of Decision or a decision document as required by the remedial program under which the remediation is being conducted.

Citizen Participation (CP) in the MGP Program CP for MGP sites will be conducted as appropriate for the program under which the remediation is being conducted, with a minimum of one meeting held to explain the remedy and remedy-selection process. In general due to the complex nature of these sites and extensive remediation, CP activities will exceed the minimum requirements of all programs.

Cleanup Levels Cleanup levels will be based upon applicable standards, criteria and guidance (SCGs). If it is not technically feasible to attain site-specific SCGs, this will be documented in accordance with the remedy selection process for the site remedial program. The 6NYCRR 375-6 Soil Cleanup Objectives will be considered where appropriate.

New Technology Use The Department has a long-standing commitment to the use of innovative or emerging technologies throughout all of its remedial programs. This is particularly true at MGP sites, where consideration of such technologies is even more important due to limitations in the use of conventional remedies in some settings. Such technologies however, often require bench or pilot testing to verify the effectiveness of the proposed technology under realistic local conditions which may increase the time needed to evaluate or design a site remedy. The Department is actively engaged with the utility industry in the identification, evaluation and full-scale implementation of promising technologies.

Engineering Controls An engineering control is any physical barrier or method employed to actively or passively contain, stabilize or monitor contamination, restrict the movement of contamination to ensure the long-term effectiveness of a remedial program or eliminate potential exposure pathways to contamination. Engineering controls include, but are not limited to, pavement, caps, covers, subsurface barriers, vapor barriers, slurry walls, building ventilation systems, fences, access controls, provision of alternative water supplies via connection to an existing public water supply, adding treatment technologies to such water supplies and installing filtration devices on private water supplies. Where engineering controls are part of the remedy (i.e. containment) institutional controls are necessary to ensure the engineering controls remain effective.

Institutional Controls Institutional controls are any non-physical means of enforcing a restriction on the use of real property that limits human or environmental exposure, restricts the use of groundwater, provides notice to potential owners, operators or members of the public, or prevents actions that would interfere with the effectiveness of a remedial program or with the effectiveness and/or integrity of operation, maintenance or monitoring activities at or pertaining

to a remedial site. Institutional controls may include, without limitation, restrictions on the use of structures, land and groundwater.

Use of Institutional Controls The use of an institutional control is considered only after the responsible party has demonstrated that the controls can be put in place and that compliance with the them can be assured. The most appropriate applications are in cases where the former MGP site is owned or otherwise controlled by the responsible party. Properties not owned by the responsible party may be remediated using institutional controls provided a mechanism can be established with the current property owner to allow implementation of the controls necessary to support the remedy. The use of a site may not be more restrictive than that allowed by applicable zoning or otherwise be inconsistent with 6 NYCRR 375-1.8(g).

Environmental Easements An environmental easement is the required form of institutional control in most of the Department remedial programs. It is required for the property defined as "the site" subject to the requirements of the remedial program. An environmental easement is an interest in real property, created under and subject to the provisions of ECL article 71, title 36 which contains a use restriction and/or a prohibition on the use of land in a manner inconsistent with engineering controls; provided that no such easement shall be acquired or held by the state which is subject to the provisions of Article 14 of the constitution of the State of New York.

Prioritization of Site Remedial Activities at MGP Sites

In consultation with NYSDOH, the Department has sole discretion in prioritizing the remedial programs at the sites under order or agreement for each individual utility. This includes operable units of those sites and/or IRMs at a site. Prioritization may be necessary to achieve a balanced program and to reflect the finite resources available to both the state and the utilities undertaking the remediation of MGP sites.

Prioritization of remedial activities is an ongoing process for each MGP site. Ranking may be revised as the understanding of the nature and extent of contamination changes, as nearby land use changes or as the threat posed by a particular site changes. The following are the considerations which will govern prioritization of MGP sites at the various phases of the remedial program.

Site Characterization At this point in the project, little information is typically available on which to base prioritization decisions. Often, only the location of the site, its status as a holder station or an MGP and the current use of the surrounding properties are known. Prioritization of site characterization is made with the following priorities:

- Existing residential use or institutional (schools, etc.) use of the site
- Existing residential or mixed residential use of properties adjacent to or in close proximity to the site
- Reliance on private water supply wells by the public in close proximity to the site
- Public water supply wells in close proximity to the site
- Scope of MGP-related activities at the site (such as whether the site is a true MGP or a less likely source of contamination such as a holder station)
- Sensitive environmental resources such as Class A or B surface waters, sole source aquifers or endangered aquatic species habitats
- Public recreational lands

- Potential for reuse of the property
- Active commercial/industrial property or
- Abandoned commercial/industrial

Remedial Investigation/Feasibility Study (RI/FS) When the Site Characterization has been completed, a site may be re-prioritized based upon the findings of this investigation relative to significant threat and the nature and extent of contamination. Once an RI/FS is started, the site priority will generally not be reconsidered until the RI/FS is complete and the remedy is selected. The next decision point for priority is the Remedial Design.

Remedial Design When a Record of Decision or other decision document is issued for a site, the priority of the site may be re-evaluated, along with those of other MGP sites (or operable units of sites) for which an individual utility is responsible. At this time, a decision on the priority for beginning design and construction of the remedy can be made. Consideration will be given to partial implementation of the selected remedy, based upon the degree of exposure potential the site represents to human health and/or the environment.

Based upon this evaluation, design of a site remedy may be accelerated, or otherwise sequenced to allow the utility to develop a balanced remedial program that distributes project starts over time, while ensuring continued progress on all sites for which a utility is responsible. Design starts and completions will proceed at a sufficient pace to assure that the overall remedial program will not lag if an individual project is delayed. There must always be a site ready to begin remedial construction, in order to maintain the utilities' implementation schedule for all sites in their MGP program. These schedules are established to assure a consistent level of effort by the utility from year to year. Factors considered in prioritizing sites at this stage are:

- Human health exposure from the site
- Environmental effects from the site
- Surrounding land use
- Complexity of the remedy
- Cost of the remedy
- Redevelopment potential of the site
- Size of the site
- Availability of a limited technological resources

As always, any prioritization decisions must be made with protection of human health and the environment as the first priority, with the remaining factors considered on a program-wide basis balancing the above factors. For instance, the ranking of a small, otherwise low-priority site may be increased if it represents a quick cleanup or if it can fill a small window of inactivity.

Enforceable Schedule for Remediation at MGP Sites

There will be an enforceable schedule for all sites with the Department, based upon the prioritization decisions. The Department currently has multi-site orders or agreements with eight utilities, as well as numerous individual site orders. These are managed and scheduled on a utility-by-utility basis (as opposed to individual sites) in recognition of the large number of sites involved. Through annual meetings with each utility, goals and priorities are established for the individual sites which are reflected in a holistic program schedule, which is then revised

as necessary throughout the year.

Nothing herein limits the Department's authority to require remedial work on any or all sites as provided by statute or regulation.

Appendix A: Some Commonly Used MGP Terms

The following are some commonly used MGP terms, which are also available on the MGP page of the Department's website.

Benzene is a common organic chemical compound made up of six carbon atoms arranged in a hexagonal ring, with hydrogen atoms attached to each corner. Benzene is a widely used chemical in industry and is often found in gasoline. Benzene has been found to cause cancer in laboratory animals, and has been designated by USEPA as a known human carcinogen as well.

BTEX is an abbreviation for a group of chemical compounds: Benzene, Toluene, Ethylbenzene and Xylene. BTEX compounds are commonly found in MGP wastes and are also used as anti-knock compounds in gasoline. They are commonly found as groundwater contaminants near gas stations, MGP sites and other industrial facilities.

Cyanides are a class of chemical compounds that contain a carbon-nitrogen triple bond. Free cyanide, in which the cyanide ion is found by itself (not complexed with other ions) is highly toxic. In most cases, MGP wastes such as purifier waste contain complexed cyanides in which other ions are tightly bound to the cyanide. This complexation appears to lower the toxicity significantly, but there are some concerns that complexed cyanide compounds may be able to decompose and release free cyanide.

DNAPL or Dense Non-aqueous Phase Liquid means a non-aqueous phase or immiscible liquid which remains as a separate phase or layer and has a specific gravity greater than water. A DNAPL has the potential to sink through a formation until it pools on a confining unit or is immobilized as a residual. Unlike LNAPLS, DNAPLS may flow down the slope of the aquifer bottom in directions which are not the same as the direction of groundwater movement.

Emulsion refers to a physical mixture of two liquids which will not fully dissolve in each other. Some emulsions (common examples include vinegar/oil salad dressing) will readily separate when they are allowed to stand undisturbed. Other emulsions (such as raw milk) may remain mixed for considerable lengths of time.

Gas Holder (also known as a gasometer) is a large, expandable tank used to store gas at an MGP. The earliest gas holders were housed in circular brick buildings built around a deep pit foundation which was kept full of water. A steel tank (open at the bottom) would rise and fall according to how much gas was being stored at the time. The water formed a seal at the bottom of the tank to keep the gas from escaping. Later, larger water-seal gas holders were built with an external steel frame to guide the tank as it rose and fell but with no brick building surrounding the tank. Most MGPs contained at least one water seal holder, and many MGPs had several. As a group, these holders are referred to as pit holders or in-ground holders.

Larger MGPs often had at grade holders where the walls of the tank were fixed and did not move up and down. Instead, the roof of the tank would rise and fall like a piston to accommodate the changing volume of gas being stored. Although these holders generally did not leak tar into the subsurface as profusely as water-seal holders did, they may in some cases still be sources of tar contamination. In some, the piston-like roof was kept lubricated by circulating tar around the edge of the roof. This tar could leak during operation and might have been left in place when the holder was demolished.

Gas holders are typically the most contaminated structures on former MGP sites. Water-seal holders often accumulated large quantities of tar, especially in relief holders where freshly manufactured gas was held and cooled prior to purification. Much of the tar held in these holders eventually leaked out

the bottom. Furthermore, when MGPs ceased operations, it was a common practice to bulldoze the debris from the MGP plant buildings into the circular foundation of the water-seal holders. It is common to find tar-soaked demolition debris in these holder foundations today, decades after the plants closed down.

Groundwater means water below the land surface in a saturated zone of soil or rock. This includes perched water separated from the main body of groundwater by an unsaturated zone.

IRM or Interim Remedial Measure means a discrete set of activities to address both emergency and non-emergency site conditions which can be undertaken without extensive investigation and evaluation, to prevent, mitigate or remedy human exposure and/or environmental damage or the consequences of human exposure and/or environmental damage attributable to a site.

LNAPL or Light Non-aqueous Phase Liquid means a non-aqueous phase or immiscible liquid which remains as a separate phase or layer and has a specific gravity less than water. Because LNAPLs are less dense than water, they tend to float on top of the water table and are also commonly referred to as a floating product. Typically, LNAPLs will move through the subsurface in the same direction that the groundwater moves.

Monitoring wells are wells (often small-diameter wells) drilled for the purposes of measuring water levels and testing water quality. Monitoring wells are not typically used to supply water for drinking or other uses.

NAPL or non-aqueous phase liquid means an immiscible liquid which remains as a separate phase or layer in the environment.

Purifier waste (also known as box waste) is a solid MGP waste which was produced during purification of the manufactured gas. It is typically found as a dark mixture of wood chips with a very strong, unpleasant burnt odor. Once exposed at the ground surface, the waste will often develop an iridescent blue color known as Prussian blue. Pieces of solidified tar may be mixed in with the waste, but it is unusual to find liquid tar. Some purifier waste is made of lime instead of wood chips; however, this material has not been commonly found at New York State MGP sites.

Receptor means any humans or organisms which are, or may be expected to be or have been, exposed to or affected by a contaminant from a site.

Sediment means soils or organic material in water, as found in lakes, rivers, streams and other water bodies and in, or in close proximity to, wetland areas.

Soil gas refers to the air and other gases found in the pore spaces of soils above the water table. (below the water table, these pore spaces are filled with water). In some cases, vapors from MGP wastes can migrate into soil gas and enter buildings through cracks in basement walls or floors.

Tar well refers to any sub-surface tank or vessel used to accumulate or store tar. It is common to find these structures, partially or totally full of tar, during MGP investigations.

Tar/water separator refers to a structure used for settling the tar/water emulsions which often accumulated in MGP gas holders. Since most MGP tars were more dense than water, the tar could often be allowed to simply settle to the bottom of the separator, where it could be drawn off for sale or disposal.