PROPOSED REMEDIAL ACTION PLAN

TROY - SMITH AVENUE FORMER MGP SITE

Operable Unit No. 1, Former Plant Area

Troy, Rensselaer County, New York
Site No. 4-42-030

February 2007

Prepared by:

Division of Environmental Remediation
New York State Department of Environmental Conservation

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SECTION 1: SUMMARY AND PURPOSE OF THE PROPOSED PLAN

The New York State Department of Environmental Conservation (the Department), in consultation with the New York State Department of Health (NYSDOH), is proposing a remedy for the Troy - Smith Avenue Former MGP Site, Operable Unit No 1. The presence of hazardous waste has created significant threats to human health and the environment that are addressed by this proposed remedy. As more fully described in Sections 3 and 5 of this document, former coal gasification processes have resulted in the disposal of hazardous wastes, including volatile organic compounds, and polycyclic aromatic hydrocarbons. These wastes have contaminated the soil and groundwater at the site, and potentially contaminated adjacent Hudson River sediments and have resulted in:

- a significant threat to human health associated with the potential exposure to contaminated groundwater and contaminated soil;
- a significant environmental threat associated with the current impacts of contaminants to groundwater and soil; and,
- a potential environmental threat associated with the release of contaminants to the sediments of the Hudson River.

To eliminate or mitigate these threats, the Department proposes containment of grossly contaminated soil, removal of the contents of a former gas holder, capping, and imposition of institutional controls to limit the use and development of the property and to restrict the use of groundwater.

The proposed remedy, discussed in detail in Section 8, is intended to attain the remediation goals identified for this site in Section 6. The remedy must conform with officially promulgated standards and criteria that are directly applicable, or that are relevant and appropriate. The selection of a remedy must also take into consideration guidance, as appropriate. Standards, criteria and guidance are hereafter called SCGs.

This Proposed Remedial Action Plan (PRAP) identifies the preferred remedy, summarizes the other alternatives considered, and discusses the reasons for this preference. The Department will select a final remedy for the site only after careful consideration of all comments received during the public comment period.

The Department has issued this PRAP as a component of the Citizen Participation Plan developed pursuant to the New York State Environmental Conservation Law and Title 6 of the Official Compilation of Codes, Rules and Regulations of the State of New York (6 NYCRR) Part 375. This document is a summary of the information that can be found in greater detail in the "Remedial Investigation Report for the Troy (Smith Avenue) Site (RI)", May 1998, the "Supplemental Data Package" (April 14, 2005), and the "Feasibility Study Report for the Troy Smith Avenue) Site - OU1", January 2007 (FS), and other relevant documents. The public is encouraged to review the project documents, which are available at the following repositories:

Troy Public Library
100 2nd St.
Troy, NY
(518) 274-7071

NYSDEC
Division of Environmental Remediation
625 Broadway
Albany, NY 12233-7014
Attn: John Spellman, Project Manager
(518) 402-9662
(by appointment)

The Department seeks input from the community on all PRAPs. A public comment period has been set from February 21, 2007 to March 23, 2007 to provide an opportunity for public participation in the remedy selection process. A public meeting is scheduled for March 12, 2007 at the National Grid Service Center, Smith Avenue, Troy, New York beginning at 6:30 pm.

At the meeting, the results of the RI/FS will be presented along with a summary of the proposed remedy. After the presentation, a question-and-answer period will be held, during which verbal or written comments may be submitted on the PRAP. Written comments may also be sent to Mr. Spellman at the above address through March 23, 2007.

The Department may modify the proposed remedy or select another of the alternatives presented in this PRAP, based on new information or public comments. Therefore, the public is encouraged to review and comment on all of the alternatives identified here.

Comments will be summarized and addressed in the responsiveness summary section of the Record of Decision (ROD). The ROD is the Department's final selection of the remedy for this site.

SECTION 2: SITE LOCATION AND DESCRIPTION

The Troy - Smith Avenue Former MGP Site is located at the western end of Smith Avenue in Troy, Rensselaer County, New York (Figure 1). The site is adjacent to the southern approach to the Troy lock on the Hudson River. The site occupies a total of approximately five acres and is comprised of two properties. One property is owned by National Grid and occupies the southern and eastern portions of the site. This property is currently in use as a natural gas distribution and service facility. The other property is owned by the United States Army Corps of Engineers (USACE) and occupies the northwestern portion of the site. This property serves primarily to operate and maintain the Troy Lock and Dam. The site is located in an urban setting with mixed residential and commercial land use areas in the vicinity.

The majority of the site is flat, except for a saddle-shaped depression that exists on the western edge of the site adjacent to the sheet-pile approach wall for the lock (Figure 2). The approach wall provides a tie-up area for vessels waiting to proceed through the lock. South of the approach wall a moderately sloped and heavily vegetated bank adjoins the site to the Hudson River. The site is located within the 100-year floodplain, but out of the regulatory floodway. The presence of the Troy Dam and the tidal nature of the river downstream of the dam provide for a relatively controlled surface water elevation adjacent to the site.

Much of the National Grid property is paved. An office building and maintenance buildings support the service facility. In contrast, much of the USACE-owned portion of the site is covered by grass lawn. A building on USACE property serves as an office.

During site investigations, shale bedrock was found from approximately 38 to 59 feet below the ground surface. A thin layer (less than one foot thick) of loose and broken weathered shale exists on top of the bedrock. Overlying the shale is a glacial till ranging from less than one foot to ten feet thick. The till is a dense clayey silt with shale fragments and some sand and gravel inclusions. Coarse material overlies the

till; a fill layer of broken brick, ash, sand, gravel and cobbles is present at the surface to a depth of 10 to 34 feet. This is underlain by native sand and gravel glacial outwash at a thickness of 14 to 34 feet. Groundwater is present in both the bedrock and unconsolidated materials starting at a depth of approximately 16 feet. The water table aquifer flows west toward the Hudson River with a slight southern component. Although the river is tidally influenced, groundwater flow is not substantially influenced by surface water fluctuations.

The significance of the site geology is that the coarse fill and outwash material allow for the relatively easy migration of deposited or released wastes existing in these layers. However, the downward migration is impeded once the dense till material is reached. The man-made lock approach wall restricts horizontal contaminant movement from the coarse material into the Hudson River, however the integrity of this wall below the water surface is unknown.

The subject of this document is the former manufactured gas plant area, which comprises both the National Grid and USACE properties. The former manufactured gas plant area has been designated Operable Unit No. 1 (OU1). An operable unit represents a portion of the site remedy that for technical or administrative reasons can be addressed separately to eliminate or mitigate a release, threat of release or exposure pathway resulting from the site contamination. Manufactured gas plant (MGP) waste was discovered in the City of Troy right-of-way at the western end of Ingalls Avenue, approximately 500 feet south of the site (Figure 3). A portion of the waste was removed in 1999, and the remaining waste was covered with gravel to reduce the potential for public exposure. Currently an investigation is proceeding to determine if there is any additional waste in the Ingalls Avenue area. Because the extent of the MGP contamination is not known at this area, a clean-up remedy for the Ingalls Avenue area cannot be proposed at this time. The Department has therefore designated the Ingalls Avenue area as Operable Unit No. 2 of the site.

The Department has designated the Hudson River sediments as Operable Unit No. 3. As more fully described in Section 5, MGP contamination lies against the approach wall on the upland side. MGP contamination may have migrated past the approach wall, or MGP wastes may have been conveyed by piping to the river during MGP operation. An investigation is currently underway to determine if extensive sediment contamination exists.

SECTION 3: SITE HISTORY

3.1: Operational/Disposal History

In 1886 the parcel immediately north of Smith Avenue was conveyed from Manufacturers National Bank of Troy to the Troy Fuel Gas Company, which later consolidated into the Troy Gas Company. By 1888, manufactured gas was being produced at the site. The plant used the carbureted water gas process to produce gas from coal for lighting, cooking and heating. At least seven additional parcels were purchased between 1889 and 1920, significantly increasing the site area. In 1928 the last gas was produced at the site. The site continued to be used for storing gas generated elsewhere for an undetermined time. In 1960 the last gas holder was removed from the site. While not part of the MGP operation, the Troy lock, dam and southern approach wall were constructed from 1913 to 1915, and thus were contemporary with the latter years of manufactured gas production.

It is not likely that waste disposal occurred at the site at predetermined periods. Rather, as operations required, wastes were removed from the system; the wastes may have been spilled or disposed of in the vicinity of the plant. As explained more fully in Section 5, from the data available, the Department concludes that a leaking gas holder foundation caused significant contamination of the subsurface.

3.2: Remedial History

There have been several environmental studies of the Troy Smith Avenue Former MGP Site over the last fifteen years. The following is a summary of those studies:

In 1991, without Department oversight, the USACE funded a study of the gas holder foundations adjacent to the approach wall on its property. An oily substance, consistent with manufactured gas production, was found within the subsurface foundation.

In 1992 Niagara Mohawk Power Corporation (Niagara Mohawk), currently a subsidiary of National Grid, entered into an Order on Consent with the Department for the investigation and, if necessary, the remediation of 21 former manufactured gas plant sites, including the Troy Smith Avenue Former MGP Site.

In 1994 Niagara Mohawk conducted a preliminary site assessment (PSA). The primary objectives of the PSA were to confirm the presence of MGP impacts and evaluate the need for interim remedial measures or additional site studies. An interim remedial measure is conducted at a site when a source of contamination or exposure pathway can be effectively addressed before completion of the environmental studies.

In 1997, based upon the information gathered in the PSA, the Department listed the site as a Class 2 site in the Registry of Inactive Hazardous Waste Disposal Sites in New York. A Class 2 site is a site where hazardous waste presents a significant threat to the public health or the environment and action is required.

SECTION 4: ENFORCEMENT STATUS

Potentially Responsible Parties (PRPs) are those who may be legally liable for contamination at a site. This may include past or present owners and operators, waste generators, and haulers.

The PRP for the site, documented to date, is National Grid.

As noted above, the Department and Niagara Mohawk entered into a Consent Order in 1992. A revised Consent Order was mutually agreed to on November 7, 2003 (Index # A4-0473-0000). The Order obligates the PRP to implement a full remedial program.

SECTION 5: SITE CONTAMINATION

As mentioned in Section 3 a remedial investigation/feasibility study (RI/FS) has been conducted to evaluate the alternatives for addressing the significant threats to human health and the environment.

5.1: Summary of the Remedial Investigation

The purpose of the remedial investigation was to define the nature and extent of any contamination resulting from previous activities at the site. Niagara Mohawk conducted a remedial investigation from 1997 to 1999. The objective of the remedial investigation was to generate sufficient data to delineate the horizontal and vertical limits of hazardous materials at the site and the potential public health and environmental impacts as a consequence of those materials.

A supplemental remedial investigation was conducted from 1999 to 2005. The objective of the supplemental program was to provide further information resulting from questions generated during the review of the initial remedial investigation.

A Feasibility Study followed the Department's September 2005 approval of the Supplemental Remedial Investigation Report for OU1.

The field activities and findings of the investigation are described in the Remedial Investigation and Supplemental Remedial Investigation Reports, collectively referred to hereafter as the remedial investigation (RI).

"Nature of contamination" means the chemical and physical properties of the disposed or released wastes at the site. "Extent of contamination" means the limits, or area and vertical bounds of the contamination resulting from that waste.

To determine the extent of contamination, the RI utilized knowledge of the gas manufacturing process and historic plans to target probable areas of the site where MGP wastes could have been generated, disposed or released. From those plans, small areas of the site were excavated and tested for the presence of MGP wastes. Soil borings were taken to obtain knowledge of deeper areas, beyond the reach of excavation. Samples of soil were collected from the borings and excavated areas, and were analyzed to determine the nature of contamination. Monitoring wells were installed to determine groundwater quality and the extent of the contaminant migration.

The RI also included a study of the approach wall. The study found the steel sheeting appeared to be in good condition with only minor corrosion, however, the upper and lower tieback wales were generally in fair to poor condition. Holes and gaps up to four inches wide were observed in the wall, but no visible contamination was observed emanating from these breaches. A tight key of the wall into the bedrock was not confirmed.

A soil vapor investigation was not considered at the time the remedial investigation was conducted at the site and therefore soil vapor has not been evaluated despite the presence of volatile organic compounds on-site.

5.1.1: Standards, Criteria, and Guidance (SCGs)

To determine whether the soil and groundwater contain contamination at levels of concern, data from the investigation were compared to the following SCGs:

- Groundwater SCGs are based on the Department's "Ambient Water Quality Standards and Guidance Values".

- Soil SCGs are based on the Department's "Technical and Administrative Guidance Memorandum [TAGM] 4046; Determination of Soil Cleanup Objectives and Cleanup Levels." and 6 NYCRR Subpart 375-6 (Remedial Program Soil Cleanup Objectives).

Based on the RI results, in comparison to the SCGs and potential public health and environmental exposure routes, certain media and areas of the site require remediation. These are summarized in Section 5.1.2. More complete information can be found in the RI reports.

5.1.2: Nature and Extent of Contamination

As described in the RI reports, many soil and groundwater samples were collected to characterize the nature and extent of contamination. The main categories of contaminants that exceed their SCGs are certain volatile organic compounds (VOCs) and certain semivolatile organic compounds (SVOCs). For comparison purposes, where applicable, SCGs are provided for each medium. Chemical concentrations are reported in parts per billion (ppb) for water and parts per million (ppm) for waste and soil.

The manufactured gas was cooled and purified prior to distribution. Two principal waste materials were produced in this process: coal tar and purifier waste. Coal tar is a reddish brown oily liquid by-product which formed as a condensate as the gas cooled. Purifier waste was a mixture of iron filings and wood chips

which was used to remove cyanide and sulfur gases from the gas prior to distribution. Coal tar was found during the on-site (OU1) remedial investigations, while purifier waste was found at Operable Unit No. 2, but not on-site.

Coal tar does not readily dissolve in water. Materials such as this are commonly referred to as non-aqueous phase liquids, or NAPLs. The terms NAPL and coal tar are used interchangeably in this document. Although most coal tars are slightly more dense than water, the difference in density is slight. Consequently, they can either float or sink when in contact with water.

Unlike NAPL, purifier waste is a solid waste of oatmeal consistency. Purifier waste has the potential to leach cyanide and create acidic conditions in nearby surface water and/or groundwater. It contains high concentrations of sulfur and cyanide and has a characteristic blue color from complex ferrocyanides.

Specific volatile organic compounds (VOCs) of concern are benzene, toluene, ethylbenzene and xylenes. These are referred to collectively as BTEX in this document. Specific semivolatile organic compounds of concern are the polycyclic aromatic hydrocarbons (PAHs):

acenaphthene
acenaphthylene
anthracene
benzo(a)anthracene
benzo(a)pyrene
benzo(b)fluoranthene
benzo(g,h,i)perylene
benzo(k)fluoranthene
pyrene
chrysene
fluoranthene
fluorene
indeno(1,2,3-cd)pyrene
2-methylnaphthalene
naphthalene
phenanthrene
dibenzo(a,h)anthracene

Total PAH concentrations as referred to in this plan are the sum of the individual PAHs listed above. The italicized PAHs are probable human carcinogens. The sum of the italicized PAHs is referred to in this document as total carcinogenic PAHs (cPAHs).

Tars contain high levels of PAH compounds, often greater than 100,000 parts per million. Tars also exceed SCGs for BTEX by several orders of magnitude. In certain tar samples, enough benzene may be present to require that the material be managed as a hazardous waste.

Pesticides and metals were analyzed for in all media and determined not to be of concern. PCBs were not detected in any of the surface soil samples. PCBs were detected in two subsurface soil samples, but in concentrations below the SCG. Therefore, the Department concludes that PCBs are also not a contaminant of concern at this site.

As noted earlier, purifier waste was not found on-site, despite the finding of purifier waste south of the site. Cyanide was not found in soil in concentrations exceeding unrestricted use soil cleanup objectives (27 ppm). Also, cyanide in groundwater did not exceed SCGs. Therefore, cyanide is not a contaminant of concern for Operable Unit No. 1.

5.1.3: Extent of Contamination

This section describes the findings of the investigation for all environmental media that were investigated.

Waste Materials/Structures

The RI data support a conclusion that much of the tar presence resulted from leakage from former gas holder No. 2. Three tar settling tanks located adjacent to gas holder No. 2 existed at the time of the MGP, and may have contributed to the NAPL contamination.

NAPL in the overburden soils was found extensively in the area of gas holders No. 1 and No. 2. The RI data indicates that NAPL has migrated extensively to the north and south, generally on top of the till. The extent of NAPL contamination beneath the site at three depth intervals is shown on Figures 4, 5 and 6. Comparison of these figures shows that the NAPL is present only in the former holder area from zero to eight feet, has spread towards the river from 8 to 20 feet, and is present along approximately 700 feet of the shoreline at depths greater than 20 feet. NAPL migration to the east is limited (less than 80 feet from gas holder No. 2.). This may be due to the till and bedrock surface, which rises to the east in the area of the holders. NAPL migration to the west is restricted by the presence of the sheetpile approach wall (Figure 7). Some NAPL may be extending west into the Hudson River in the vicinity of wells MW-7D, MW-2A and MW-9D which are located south of the approach wall along the river, or under the approach wall; this hypothesis will be addressed during the Hudson River (OU3) investigation. The shallowest NAPL found outside of the foundation of gas holder No. 2 was nine feet below grade at soil boring SB-41.

Unlike gas holder No. 2, the foundations for gas holder Nos. 1 and 3 were slab-on-grade. No MGP contamination was found in the soil overlying the foundation of gas holder no. 1. Soil directly underneath the foundation of gas holder No. 1 was not investigated, but NAPL was found at depths greater than 20 feet in certain borings placed adjacent to the foundation (see Figure 6). The foundation for gas holder No. 3 lies three feet under a paved parking area. No contamination was found in soil sampled both above and below the foundation in concentrations exceeding soil cleanup objectives for either the protection of public health for restricted commercial use or protection of groundwater.

NAPL was not found in the bedrock. NAPL was found, however, in weathered and fractured shale during the installation of monitoring wells MW-13 and MW-14, approximately 60 feet and 600 feet south of gas holder No. 2, respectively. For the purpose of this document, the Department considers the weathered shale to be overburden material lying immediately above the bedrock.

In 1994, floating NAPL less than 0.10 inch thick was observed in monitoring well MW-4A approximately 30 feet downgradient of the fuel island on National Grid property. No NAPL was observed in the same well in December 2004.

A sample of sand and gravel saturated with coal tar that was collected from within the gas holder No. 2 foundation was found to contain 390 ppm of benzene, over three orders of magnitude greater than the SCG of 0.06 ppm. The sand and gravel was likely used to fill in the holder when it was dismantled. The highest PAH concentration of 36,566 ppm was also located within the holder foundation.

A NAPL gauging program was initiated in 2005. After approximately one year of observation, only one well has produced a measurable amount of NAPL. Three to four inches of dense NAPL was found in monitoring well MW-13.

Waste identified during the RI/FS will be addressed in the remedy selection process.

Surface Soil

Approximately 22 surface soil samples were analyzed, including background samples. Samples were collected from either 0 to 2 inches in depth or 0 to 6 inches in depth. BTEX concentrations did not exceed their respective individual SCG values.

PAH concentrations of on-site surface soil samples ranged from not-detected to 125 ppm. Several samples exceeded their respective individual SCG values. Higher concentrations of carcinogenic PAHs (greater than 10 ppm) were limited to the grass area adjacent to the approach wall, which, in the area of former gas holder No. 1 and No. 2, do not represent the MGP-era surface soils (approximately one acre).

The majority of the site is paved, and the investigation supports the conclusion that the areal extent of surface soil contamination is limited. However, where surface soil contamination was identified during the RI/FS, despite not representing the MGP-era surface, it will nonetheless be addressed in the remedy selection process due to the subsurface contamination in the identified area.

Subsurface Soil

Higher concentrations of BTEX (greater than 10 ppm) were found in the vicinity of gas holder No. 2.

Higher concentrations of PAHs (greater than 500 ppm) were found in the vicinity of gas holder No. 2. Higher concentrations of PAHs were also found in NAPL-containing samples at 44 to 46 feet below ground surface in borings MW-14 and MW-9D, to the south of gas holder No. 2 along the Hudson River.

Subsurface soil contamination identified during the RI/FS will be addressed in the remedy selection process.

Groundwater

Not unexpectedly, groundwater contamination was found in the area where NAPL was identified. The highest concentrations of BTEX and PAHs were found on the USACE property in the areas of former gas holder No. 1 and No. 2.

In early investigations (prior to 2000), BTEX contamination in groundwater was also found at monitoring well MW-4A. Associated with the fuel island were three underground storage tanks, two containing gasoline and one containing diesel, with a combined capacity of 20,000 gallons. In 1995, the BTEX concentration at this well was 2,159 ppb. The groundwater SCG for individual BTEX compounds is 5 ppb (except for benzene, which is 1 ppb). In 1997 the BTEX concentration was reported at 663 ppb. On August 16, 2000, the tanks and fuel island were removed. In 2004, BTEX concentrations had again diminished downgradient of the former underground storage tanks to less than 10 ppb.

BTEX concentrations ranged from not detected in several wells to 46,200 ppb in well USMW-1. However, this well is located within the foundation of gas holder No. 2 and likely represents waste material within the former holder.

Outside of the holder, BTEX concentrations were found to be as high as 2,159 ppb at MW-4A and 2,001 ppb at MW-13.

Although NAPL was not found in the bedrock, groundwater in bedrock wells MW-12 (approximately 60 feet north of former gas holder No. 1) and MW-13 exceeded the SCG for individual BTEX compounds, indicating that dissolved contamination has migrated into the bedrock aquifer.

Groundwater contamination identified during the RI/FS will be addressed in the remedy selection process.

Soil Vapor

Soil vapor has not been evaluated at this site, therefore, the potential for exposures resulting from soil vapor intrusion into on-site or nearby off-site buildings is unknown. Since the majority of soil and groundwater contamination is on the western edge of the site bordering the Hudson River and the groundwater flow direction is towards the river, the potential for off-site migration of vapors to the east is not likely. In addition, the proposed remedy identified in Section 8 is expected to eliminate or reduce the potential for

vapor intrusion to occur. However, the soil vapor pathway would be investigated during the remedial design for the site.

5.2: Interim Remedial Measures

As noted earlier, an interim remedial measure (IRM) is conducted at a site when a source of contamination or exposure pathway can be effectively addressed before completion of the RI/FS.

There were no IRMs performed at Operable Unit No 1 during the RI/FS.

5.3: Summary of Human Exposure Pathways:

This section describes the types of human exposures that may present added health risks to persons at or around the site. A more detailed discussion of the human exposure pathways can be found in Section 6 of the RI report. An exposure pathway describes the means by which an individual may be exposed to contaminants originating from a site. An exposure pathway has five elements: [1] a contaminant source, [2] contaminant release and transport mechanisms, [3] a point of exposure, [4] a route of exposure, and [5] a receptor population.

The source of contamination is the location where contaminants were released to the environment (any waste disposal area or point of discharge). Contaminant release and transport mechanisms carry contaminants from the source to a point where people may be exposed. The exposure point is a location where actual or potential human contact with a contaminated medium may occur. The route of exposure is the manner in which a contaminant actually enters or contacts the body (e.g., ingestion, inhalation, or direct contact). The receptor population is the people who are, or may be, exposed to contaminants at a point of exposure.

An exposure pathway is complete when all five elements of an exposure pathway exist. An exposure pathway is considered a potential pathway when one or more of the elements currently does not exist, but could in the future.

The following exposure pathways are possible at the site:

- Trespassers and on-site workers could potentially come in contact with elevated PAHs in surface soil on a limited area of the USACE property.

- On-site workers and construction workers involved in sub-surface excavation may come in direct contact with MGP waste and may also inhale vapors and airborne particulates from these materials.

- The potential for future exposures to contaminants in on-site and off-site groundwater is unlikely due to the availability of a public water supply.

- People in on-site buildings could be exposed to MGP associated soil vapors in indoor air. However, this pathway has not been evaluated at this time but is planned during the remedial design.

5.4: Summary of Environmental Assessment

This section summarizes the assessment of existing and potential future environmental impacts presented by the site. Environmental impacts include existing and potential future exposure pathways to fish and wildlife receptors, as well as damage to natural resources such as aquifers and wetlands.

The Fish and Wildlife Impact Analysis, which is included in the RI report, presents a detailed discussion of the existing and potential impacts from the site to fish and wildlife receptors.

Operable Unit No. 1 of the site is located within a highly developed and industrialized portion of the City of Troy, with buildings or pavement occupying the majority of the area.

The following environmental exposure pathways and ecological risks have been identified:

- The Hudson River sediments adjacent to the site are currently being investigated for the presence of MGP contamination as part of OU3. However, regardless of the conclusions of that investigation, the sediment quality depends in large part on the integrity of the existing sheetpile approach wall, which is an element of OU1. A current or future failure of the approach wall in terms of its ability to contain the land-side NAPL would create a potential for aquatic and benthic organisms to be exposed to MGP contamination.

- Site contamination has adversely impacted the groundwater resource in the overburden and upper bedrock so as to render the aquifer unuseable without treatment. In the absence of this contamination, the aquifer would be useable.

SECTION 6: SUMMARY OF THE REMEDIATION GOALS

Goals for the remedial program have been established through the remedy selection process stated in 6 NYCRR Part 375. At a minimum, the remedy selected must eliminate or mitigate all significant threats to public health and the environment presented by the hazardous waste disposed at the site through the proper application of scientific and engineering principles.

The remediation goals for this site are to eliminate or reduce to the extent practicable:

- exposures of persons at or around the site to MGP contaminants in soil and groundwater;

- the release of contaminants from soil into groundwater that may create exceedances of groundwater quality standards; and

- the migration of contaminants from site soil and groundwater into the Hudson River water and sediment through NAPL flow, groundwater movement and surface soil erosion.

Further, the remediation goals for the site include attaining to the extent practicable:

- ambient groundwater quality standards

SECTION 7: SUMMARY OF THE EVALUATION OF ALTERNATIVES

The selected remedy must be protective of human health and the environment, be cost-effective, comply with other statutory requirements, and utilize permanent solutions, alternative technologies or resource recovery technologies to the maximum extent practicable. Potential remedial alternatives for the Troy - Smith Avenue Former MGP Site, Operable Unit No 1 were identified, screened and evaluated in the FS report, which is available at the document repositories established for this site.

A summary of the remedial alternatives that were considered for this site is discussed below. The present worth represents the amount of money invested in the current year that would be sufficient to cover all present and future costs associated with the alternative. This enables the costs of remedial alternatives to be compared on a common basis. As a convention, a time frame of 30 years is used to evaluate present worth costs for alternatives with an indefinite duration. This does not imply that operation, maintenance, or monitoring would cease after 30 years if remediation goals are not achieved.

7.1: Description of Remedial Alternatives

The following potential remedies were considered to address the contaminated soil and groundwater at the site.

Alternative 1: No Action

Present Worth: $0
Capital Cost: $0
Average Annual Costs: $0

The No Action Alternative is evaluated as a procedural requirement and as a basis for comparison. It would allow the site to remain in an unremediated state. This alternative would leave the site in its present condition and would not be protective of human health or the environment.

Alternative 2: Institutional Controls

Present Worth: $200,000
Capital Cost: $18,000
Average Annual Costs: $12,000

This alternative would be a control of the site through institutional controls; no physical remediation would occur. Alternative 2 would include a deed restriction and environmental easement to restrict future use of the site to its current commercial or industrial use. A deed restriction would be placed on USACE property. An environmental easement would be placed on National Grid property. A site management plan (SMP) would be developed and implemented. The SMP would include the controls and procedures necessary to (i) manage contaminated soils that may be excavated from the site during future activities, including the procedures for soil characterization, handling, health and safety of the workers and the community as well as, disposal/reuse in accordance with applicable Department regulations and procedures, (ii) maintain use restrictions regarding site development or groundwater use (iii) require the periodic certification that the above controls are in-place and effective. The groundwater would also be monitored as part of the SMP.

This alternative would immediately reduce the potential for human health exposure through the use of a deed restriction, environmental easement and a site management plan. However, because no effort would be made to physically remove, isolate or treat any contamination, a potential for exposure would exist if any provisions of these institutional controls were violated. Also, because no effort is made to physically remove, isolate or treat any contamination, this alternative would not meet the environmental goals identified in Section 6.

Alternative 3: Asphalt and Soil Cover

Present Worth: $1,000,000
Capital Cost: $320,000
Average Annual Costs: $50,000

This alternative would include the construction of a cover over approximately 2.5 acres of the western portion of the site. The existing grass area, approximately 3/4 acre, would be covered with a minimum two-foot thick soil cover. A demarcation layer would be installed, to identify the presence of the contaminated soil beneath the clean cover. An approximate 250 feet by 300 feet area on National Grid property would be paved with asphalt as shown in Figure 8. However, no consolidation of contaminated soil would occur nor would active measures to address groundwater contamination be undertaken. In addition, this alternative would include a deed restriction, environmental easement and site management plan as described in Alternative 2. Alternative 3 would take approximately six months to design and three months to construct.

Alternative 4: Containment, Cap and NAPL Recovery

Present Worth: . . . . . $4.4 million
Capital Cost: . . . . . $3.5 million
Average Annual Costs: $68,000

With the exception of the soil cover, this alternative would include all the components of Alternative 3 as well as the construction of a containment area around gas holders No. 1 and No. 2. NAPL recovery wells would also be installed.

Alternative 4 includes a 4-sided, fully enclosing sheet pile wall driven into bedrock or till, extending approximately 350 feet parallel with the Hudson River with a perimeter length of approximately 1,000 feet, at an average depth of 50 feet. The sheet pile would be sufficiently corrosion resistant material or have cathodic protection. The FS recommended a three-sided wall along the river approximately 350 feet long with 100-foot wing walls at each end. The Department believes a fully enclosing containment wall is required to prevent a build-up of groundwater within the cell that could potentially drive NAPL and dissolved contaminants through the bedrock under the wall, into the river. Additional measures such as groundwater extraction may be necessary to maintain an inward gradient across the wall. Therefore, the Department has modified the FS and has estimated that the additional wall length would cost approximately $1.1 million.

The containment cell would isolate nearly all of the NAPL, with the exception of the thin lenses of NAPL which extend to the north and to the south of the approach wall at depths greater than twenty feet. The cell would also isolate the bulk of contaminated groundwater. A small area (approximately one-half acre) of groundwater exceeding the SCGs would exist outside of the cell.

The design of the containment area would be coordinated with the USACE to minimize impacts to lock operations as well as any plans to rehabilitate the existing approach wall. If the remedial design provides justification to support the three-sided containment system recommended in the FS, the system could be modified accordingly.

Recovery wells would be placed within the containment cell and south of the cell to provide a means of removing NAPL that accumulates behind the barrier and monitoring groundwater quality.

An engineered cap would be used over the containment area. The engineered cap would consist of a low-permeability layer to prevent exposure to contaminants within the containment area, mitigate potential odors and minimize infiltration. In addition, the engineered cap would include drainage and protective layers to manage precipitation, protect the low-permeability layer, and provide a base for vegetation or asphalt pavement. Asphalt pavement would be used to restore the site surface to the approximate limits shown in Figure 9.

Alternative 4 would take approximately 18 months to design and 9 months to construct. This alternative would also include the SMP requirements for Alternative 2 including additional provision for the operation/monitoring of the NAPL recovery wells and maintenance of the cap/cover.

Alternative 5: Removal of Gas Holder Contents, Containment, Cap and NAPL Recovery

Present Worth: . . . . . $5.7 million
Capital Cost: . . . . . $4.7 million
Average Annual Costs: $68,000

This alternative would include all the components of Alternative 4 plus provide for the removal of all material within the foundation of former gas holder No. 2. Removed material would be disposed or treated off-site. The volume of material within the foundation is approximately 3,500 cubic yards (cy). The

excavation would be dewatered and shored as needed to complete the removal. The foundation bottom is approximately 12 feet below grade, but could vary as the shape of the bottom has not been ascertained. Prior to capping, the removal area would be backfilled with clean soil. This alternative would require a deed restriction, environmental easement and similar site management requirements as identified in Alternative 2.

Alternative 5 would take approximately 18 months to design and ten months to construct.

Alternative 6: Removal of Gas Holder Contents and Shallow Soil, Containment, Cap and NAPL Recovery

Present Worth: . . . . . $10.3 million
Capital Cost: . . . . . $9.4 million
Average Annual Costs: $65,000

This alternative would include all of the components of Alternative 5 plus the removal of all soil exceeding TAGM 4046 recommended soil clean-up values within and in the vicinity of the approach wall to a depth of 16 feet, which is the approximate water table depth in this area. An estimated 18,000 cy would be removed and disposed at an approved off-site facility. The removal area would be backfilled with soil that meets TAGM 4046 requirements.

Alternative 6 would take approximately 18 months to design and one year to construct. Contaminated soil below the water table would remain.

Alternative 7: Remove All Soil Exceeding Recommended Soil Clean-up Objectives

Present Worth: . . . . . $64 million
Capital Cost: . . . . . $64 million
Annual Costs: . . . . . $0.

This alternative would restore the site to pre-disposal soil and groundwater conditions. All soil with contaminants exceeding individual TAGM 4046 recommended soil clean-up objectives would be removed and disposed off-site. The site would be brought back to the existing contour with soil that satisfies TAGM 4046. Weathered shale bedrock containing NAPL would be included in the removal.

Under this alternative approximately 210,000 cy of soil would be removed. Excavation would reach 57 feet in depth. The existing sheetpile wall would be used in conjunction with a temporary sheet pile wall approximately 1,300 feet in length to provide excavation stability and construction dewatering control. The gas regulator station would be relocated.

The groundwater would not be specifically addressed. However, overburden groundwater would be expected to meet SCGs through time as most of the contaminated groundwater would be removed from the site through construction dewatering. Bedrock groundwater which exceeds SCGs would be expected to exceed groundwater SCGs initially after the removal, but would also be expected to meet SCGs over time, as the source of the contaminants would be removed.

Alternative 7 would take an estimated four years to design and seven years to construct. This alternative would satisfy all of the remediation goals described in Section 6.

7.2 Evaluation of Remedial Alternatives

The criteria to which potential remedial alternatives are compared are defined in 6 NYCRR Part 375, which governs the remediation of inactive hazardous waste disposal sites in New York A detailed discussion of the evaluation criteria and comparative analysis is included in the FS report.

The first two evaluation criteria are termed "threshold criteria" and must be satisfied in order for an alternative to be considered for selection.

1. Protection of Human Health and the Environment. This criterion is an overall evaluation of each alternative's ability to protect public health and the environment.

2. Compliance with New York State Standards, Criteria, and Guidance (SCGs). Compliance with SCGs addresses whether a remedy will meet environmental laws, regulations, and other standards and criteria. In addition, this criterion includes the consideration of guidance which the Department has determined to be applicable on a case-specific basis.

The next five "primary balancing criteria" are used to compare the positive and negative aspects of each of the remedial strategies.

3. Short-term Effectiveness. The potential short-term adverse impacts of the remedial action upon the community, the workers, and the environment during the construction and/or implementation are evaluated. The length of time needed to achieve the remedial objectives is also estimated and compared against the other alternatives.

4. Long-term Effectiveness and Permanence. This criterion evaluates the long-term effectiveness of the remedial alternatives after implementation. If wastes or treated residuals remain on-site after the selected remedy has been implemented, the following items are evaluated: 1) the magnitude of the remaining risks, 2) the adequacy of the engineering and/or institutional controls intended to limit the risk, and 3) the reliability of these controls.

5. Reduction of Toxicity, Mobility or Volume. Preference is given to alternatives that permanently and significantly reduce the toxicity, mobility or volume of the wastes at the site.

6. Implementability. The technical and administrative feasibility of implementing each alternative are evaluated. Technical feasibility includes the difficulties associated with the construction of the remedy and the ability to monitor its effectiveness. For administrative feasibility, the availability of the necessary personnel and materials is evaluated along with potential difficulties in obtaining specific operating approvals, access for construction, institutional controls, and so forth.

7. Cost-Effectivness. Capital costs and annual operation, maintenance, and monitoring costs are estimated for each alternative and compared on a present worth basis. Although cost-effectiveness is the last balancing criterion evaluated, where two or more alternatives have met the requirements of the other criteria, it can be used as the basis for the final decision. The costs for each alternative are presented in Table 1.

This final criterion is considered a "modifying criterion" and is taken into account after evaluating those above. It is evaluated after public comments on the Proposed Remedial Action Plan have been received.

8. Community Acceptance - Concerns of the community regarding the RI/FS reports and the PRAP are evaluated. A responsiveness summary will be prepared that describes public comments received and the manner in which the Department will address the concerns raised. If the selected remedy differs significantly from the proposed remedy, notices to the public will be issued describing the differences and reasons for the changes.

SECTION 8: SUMMARY OF THE PROPOSED REMEDY

The Department is proposing **Alternative 5: Removal of Gas Holder Contents, Containment, Cap and NAPL Recovery** as the remedy for this site. The elements of this remedy are described at the end of this section.

The proposed remedy is based on the results of the RI and the evaluation of alternatives presented in the FS. Alternative 5 is being proposed because, as described below, it satisfies the threshold criteria and provides the best balance of the primary balancing criteria described in Section 7.2. It would achieve, to the extent practicable, the remediation goals for the site by removing the easily accessible coal tar from the former gas holder No. 2 foundation, and containing most of the deeper NAPL that is present outside of the foundation. Alternatives 4, 6 and 7 would also comply with the threshold selection criteria but to either a lesser degree (Alternative 4) or with a disproportionately higher cost (Alternatives 6 and 7).

Alternative 1 (no action) and Alternative 2 (institutional controls) would not produce any results that are physically different from the current conditions. While the existing approach wall retards the movement of upland contamination into the Hudson River, it is not designed specifically for contaminant containment, and its lifetime is limited. If the approach wall is not maintained, or if the remedial action is not undertaken, then contaminant migration into the river would be expected to increase over time. Thus, the presence of uncontrolled contamination that currently threatens human health and the environment would continue uncontrolled into the future. Therefore, Alternatives 1 and 2 would not be protective of human health or the environment and are rejected as candidates for a potential remedy.

Alternative 3 (asphalt and soil cover) would reduce human health exposures with more certainty than Alternatives 1 and 2. However, placement of a cover would offer little environmental improvement: the prevention of NAPL migration into the Hudson River would rely primarily on the condition of the existing 90 year-old approach wall, with no guarantee that breaches in the wall would be repaired in an environmentally sound manner. Further, Alternative 3 does not address the deteriorated groundwater state. For these reasons, Alternative 3 would not be protective of the environment, and is thus rejected from further consideration.

Alternatives 4 through 7 would undertake active measures which, to varying degrees, would be protective of human health and the environment. In addition, Alternatives 4 through 7 would comply with the SCGs to the extent practicable. Because Alternatives 4 through 7 satisfy the threshold criteria, the five balancing criteria are particularly important in proposing a remedy for the site.

Alternative 4 would immediately satisfy the remediation goals of eliminating or reducing to the extent practicable human and environmental exposures. In addition, through the provision of a containment wall, this Alternative would immediately reduce the migration of contaminants into the Hudson River. However, Alternative 4 would only provide minimal improvement in groundwater quality because the contaminant source would remain.

Alternatives 5 through 7 would undertake increasingly more rigorous measures to address the contamination at the site as compared to Alternative 4 (cap and containment). Specifically, Alternative 5 (removal of holder contents, cap and containment) would remove a spatially pre-defined and known hot-spot source of contamination, which would provide further assurance that the containment system would prevent NAPL migration to the Hudson River. Alternative 5 would be expected to provide a slight improvement to groundwater quality over a period of time, as NAPL within the foundation would be removed. Alternative 6 (shallow soil removal, cap and containment) builds upon Alternative 5 by removing contaminated soil in addition to the coal tar source within the holder foundation. Alternative 7 (remove soil exceeding SCGs) would restore the site to pre-disposal condition by removing all MGP-related contaminants.

Not surprisingly, Alternative 7 would provide the greatest reduction of toxicity, mobility, and volume of contaminants, followed by Alternatives 6, 5 and 4. Alternative 7 would remove approximately 210,000 cy of contaminated soil, as compared to the next greatest removal alternative, Alternative 6, with an estimated removal of 18,000 cy. In addition, Alternative 7 would provide the greatest long term effectiveness and permanence because there would be no containment cell, cap or recovery wells to monitor and maintain, and no land use restrictions.

However, Alternative 7 would have significant short term impacts. By removing approximately eleven times the volume of soil from over three times the depth as compared to Alternative 6, Alternative 7 would impose a significant disruption of the current service station operations, and relocation of the gas regulator substation.

The short-term impacts would be increasingly severe with the volume of soil removed, due to the increasing length of the construction season and the number of trucks needed to be driven over public streets to remove contaminated soil and import clean soil. Thus, there is increasingly potential short term adverse impacts with Alternatives 5, 6 and 7 as compared to Alternative 4.

Alternatives 4, 5, and 6 would all involve construction of a sheet pile wall along approximately 350 feet of the Hudson River as the western wall of the containment cell . Conceptually, this wall would be installed to the west (outside) of the lock approach wall, which would enable it to be installed without significant disturbance of the approach wall's tiebacks. However, the specific design of this wall would have to be closely coordinated with the USACE.

The implementation of the excavation components of Alternatives 5, 6 and 7 would be increasingly difficult as compared to Alternative 4. Alternatives 6 and 7 would require the demolition of the existing gas holder foundation to access deeper soil. The demolition of the foundation at the site would be more difficult as compared to the demolition of typical subgrade holder foundations because: a) of tiebacks in the vicinity of the holder, b) the topography (ten foot elevation change) and proximity (approximately 50 feet) to the approach wall could preclude the use of heavy equipment on a portion of the circumference, c) the foundation footer could exist at a depth of 15 feet or more, at the water table. Alternatives 6 and 7 would require bracing of the existing approach wall and potentially hand removal of contaminated soil near the tie backs to the wall. Alternative 7 would require extensive dewatering over several construction seasons as excavations up to 40 feet below the water table would occur adjacent to the Hudson River. Due to structural limitations, the feasibility of excavating to this depth along the river is questionable.

A remedy is cost-effective if its costs are proportional to its overall effectiveness. Alternative 7 would cost approximately six times Alternative 6. The majority of the Alternative 7 cost however, is associated with the removal of soil that, while exceeding SCGs, is not a source of significant groundwater contamination, or contaminant mobility, such as those soils containing NAPL. Alternative 7 would also require a significant cost (greater than $5 million) just in removing the active gas infrastructure and providing temporary shoring, which provides no environmental benefit. Thus, the cost to remediate to a pre-disposal condition would be excessive compared to the limited additional environmental benefit gained. Therefore, Alternative 7 is rejected as a proposed remedy.

Alternative 5 would require an additional $1.2 million, or approximately 25% of additional cost compared to Alternative 4. Alternative 5 would remove the bulk of accessible NAPL in the shallow subsurface, and in doing so would assure greater success of the containment system by reducing the NAPL quantity and overall depth, which contribute to NAPL mobility. The cost of Alternative 6 is approximately double the cost of Alternative 5. Yet, Alternative 6 would not provide much additional environmental benefit as compared to Alternative 5 since the additional 14,500cy of soil removed would contain little additional NAPL or contaminant mass.

In summary, Alternatives 1, 2 and 3 are not proposed because they would not be protective of public health or the environment. Alternative 7 is not proposed because it would not be cost effective. Alternative 6 is not recommended, primarily due to the high proportional cost of implementing an excavation proximate to the USACE's active lock approach wall and tiebacks, with little additional contaminant mass removed. Alternative 4 is not recommended because it does not provide for the reduction of toxicity, mobility and volume, nor provide for optimum long term effectiveness which would result from the removal of the holder contents included in Alternative 5.

The estimated present worth cost to implement the remedy is $5.7 million. The cost to construct the remedy is estimated to be $4.7 million and the estimated average annual costs for 30 years is $68,000.

The elements of the proposed remedy are as follows:

1. A remedial design program would be implemented to provide the details necessary for the construction, operation, maintenance, and monitoring of the remedial program. The remedial design program would also include an evaluation of potential soil vapor intrusion impacts from the site.

2. Removal of the contents of former gas holder No. 2. The excavation would be dewatered and shored as needed to complete the removal.

3. A subsurface containment wall fully enclosing the area in the vicinity of former gas holders No. 1 and No. 2. The wall would key sufficiently into competent bedrock or till to form a seal that would prevent contaminant migration to the river. The wall material would consist of approximately 1,000 linear feet of sheet pile of sufficient corrosion resistant material or with cathodic protection.

4. An engineered cap would cover the containment area. The engineered cap would consist of a low-permeability layer to prevent exposure to contaminants within the containment area, mitigate potential odors and minimize infiltration. In addition, the engineered cap would include drainage and protective layers to manage precipitation, protect the low-permeability layer, and provide a base for vegetation or asphalt pavement. Backfill and cap materials would satisfy Part 375-6 regulations for imported backfill material for commercial use and for the protection of groundwater.

5. Outside of the containment area the asphalt pavement would be restored to the approximate limits shown on Figure 9.

6. A NAPL recovery system would be installed in overburden materials. A minimum of nine new extraction wells would be provided.

7. Imposition of an institutional control in the form of an environmental easement for the National Grid property and deed restriction for the USACE property that would require (a) limiting the use and development of the property to commercial use, which would also permit industrial use; (b) compliance with the approved site management plan; (c) restricting the use of groundwater as a source of potable or process water, without necessary water quality treatment as determined by NYSDOH; and (d) National Grid to complete and submit to the Department a periodic certification of institutional and engineering controls.

8. Development of a site management plan which would include the following institutional and engineering controls: (a) management of the final cover system to restrict excavation below the soil cover's demarcation layer, pavement, or buildings. Excavated soil would be tested, properly handled to protect the health and safety of workers and the nearby community, and would be properly managed in a manner acceptable to the Department; (b) continued evaluation of the potential for vapor intrusion for any buildings developed on the site, including provision for mitigation of any impacts identified; (c) monitoring of groundwater; (d) identification of any use restrictions on the site; (e) fencing or other means to control site access; (f) NAPL removal from the containment system; and (g) provisions for the continued proper operation and maintenance of the components of the remedy.

9. National Grid would provide a periodic certification of institutional and engineering controls for the site, prepared and submitted by a professional engineer or such other expert acceptable to the Department, until the Department notifies the property owner in writing that this certification is no longer needed. This submittal would: (a) contain certification that the institutional controls and engineering controls put in place are still in place and are either unchanged from the previous

certification or are compliant with Department-approved modifications; (b) allow the Department access to the site; and (c) state that nothing has occurred that would impair the ability of the control to protect public health or the environment, or constitute a violation or failure to comply with the site management plan unless otherwise approved by the Department.

Since the remedy results in untreated hazardous waste remaining at the site, a long-term monitoring program would be instituted. This program would allow the effectiveness of the containment, cap, and NAPL recovery to be monitored and would be a component of the site management.

TABLE 1

REMEDIAL ALTERNATIVE COSTS

Remedial Alternative	Capital Cost ($)	Annual Costs ($)	Total Present Worth ($)
1 No Action	0.	0.	0.
2 Institutional Controls	18,000.	12,000.	200,000.
3 Asphalt and Soil Cover	320,000.	50,000.	1.0 million
4 Cap and Containment	3.5 million	68,000.	4.4 million
5 Remove Holder Contents, Cap and Containment	4.7 million	68,000.	5.7 million
6 Remove Holder Contents and Shallow Soil, Cap and Containment	9.4 million	65,000.	10.3 million
7 Remove Soil > Recommended Soil Clean-Up Objectives	64 million	0.	64 million