Remedial Investigation Report

for the

Troy (Smith Avenue) Site
Troy, New York

Prepared for

Niagara Mohawk Power Corporation

Volume 1 of 2

Prepared by

FOSTER WHEELER ENVIRONMENTAL CORPORATION

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ACOE	United States Army Corps of Engineers
AOCs	Areas of Concern
ASP	Analytical Service Protocols
bgs	below ground surface
BTEX	Benzene, Toluene, Ethylbenzene and Total Xylene
BUTL	Background Upper Tolerance Limit
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CGI	Combustible Gas Indicator
COPCs	Chemicals of Potential Concern
CLP	Contract Laboratory Program
CSF	Cancer Slope Factor
DNAPL	Dense Non-Aqueous Phase Liquid
DUP	Field Duplicate
FB	Field Blank
FS	Feasibility Study
FWIA	Fish and Wildlife Impact Analysis
HASP	Health and Safety Plan
HEAST	Health Effects Assessment Summary Tables
HNu	Photoionization Detector
HQ	Hazard Quotient
HSO	Health and Safety Officer
IRIS	Integrated Risk Information System
LEL	Low Effect Level
LNAPL	Light Non-Aqueous Phase Liquid
LOAEL	Lowest Observed Adverse Effect Level
MDL	Method Detection Limit
MGP	Manufactured Gas Plant
MGPSRF	Manufactured Gas Plant Standard Remedy Framework
MSL	Mean Sea Level
MW	Monitoring Well
NAPL	Non-Aqueous Phase Liquid
NCEA	National Center for Environmental Assessment
NCP	National Contingency Plan

NEI	Nytest Environmental, Inc.
NMPC	Niagara Mohawk Power Corporation
NOAEL	No Observed Adverse Effect Level
NWI	National Wetland Inventory
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OVA	Organic Vapor Analyzer
OPRHP	Office of Parks, Recreation and Historic Preservation
PAH	Polycyclic Aromatic Hydrocarbon
PCBs	Polychlorinated Biphenyls
PEF	Particulate Emission Factor
ppb	parts per billion
ppm	parts per million
PPE	personal protective equipment
PRGs	Preliminary Remediation Goals
PSA/IRM	Preliminary Site Assessment/Interim Remedial Measure
PZ	Piezometer
RAGS	Risk Assessment Guidance for Superfund
RAOs	Remedial Action Objectives
RCRA	Resource Conservation and Recovery Act
RECRA	RECRA Environmental, Inc.
RFCs	Reference Concentrations
RFDS	Reference Doses
RI	Remedial Investigation
RME	Reasonable Maximum Exposure
SB	Soil Boring
SCGs	Standards, Criteria and Guidance
SEL	Severe Effect Level
SVOCs	Semi-volatile Organic Compounds
SW	Surface Water
TAL	Target Analyte List
TB	Trip Blank
TBC	To Be Considered
TCL	Target Compound List
TCLP	Toxicity Characteristics Leaching Procedure

TIC	Tentatively Identified Compounds
TOC	Total Organic Carbon
TP	Test Pit
UFPO	Underground Facilities Protective Organization
UR	Unit Risk
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
VOCs	Volatile Organic Compounds

EXECUTIVE SUMMARY

This Remedial Investigation (RI) Report was prepared by the Foster Wheeler Environmental Corporation (Foster Wheeler), on behalf of the Niagara Mohawk Power Corporation (NMPC), to present the findings generated from the various tasks performed during both the Preliminary Site Assessment/Interim Remedial Measure (PSA/IRM) Study and the RI at the Troy (Smith Avenue) Site, "the Site."

Preparation of this Report is in response to and in accordance with the requirements set forth in the New York State Department of Environmental Conservation (NYSDEC) Order on Consent, Index #DO-0001-9210, executed on December 7, 1992; the NYSDEC-approved Preliminary Site Assessment/Interim Remedial Measure (PSA/IRM) Work Plan (May 1994); the NYSDEC-approved Remedial Investigation (RI) Work Plan (June 1997); and a letter from NMPC to the NYSDEC proposing minor modifications to the RI Work Plan dated August 20, 1997. Approval of these modifications was received from the NYSDEC in a letter dated August 20, 1997.

Site Background

The Troy (Smith Avenue) Site is located adjacent to the Hudson River at Smith Avenue in Troy, Rensselaer County, New York. Figure 1-1 depicts the Site location (USGS - North Troy Quadrangle). The Site occupies a total of approximately five acres and is comprised of two properties, one owned by NMPC and the other by the U.S. Government Army Corps of Engineers (ACOE) (see Figure 1-2). The southern and northeastern portions of the Site are owned by NMPC and are currently in use for operation of a natural gas distribution and service facility. The northwestern portion of the Site, bordering the Troy Lock on the Hudson River, is owned by the ACOE. This property includes an active ACOE field office that serves primarily to operate and maintain the Troy Lock and Dam. The areas immediately surrounding the Site are characterized by mixed residential and urban/commercial land use.

Site Assessment and Remedial Investigation

The PSA field program, performed between June 30, 1994 and December 15, 1995, consisted of drilling twenty-one (21) soil borings, installation and development of seven (7) monitoring wells, excavation of five (5) test pits, sampling of various media (surface soil, subsurface soil, and groundwater) for chemical and/or geotechnical analysis, and collection of groundwater level measurements. A soil gas survey was performed after measurement of high combustible gas levels during the soil boring program. A Fish and Wildlife Impact Analysis (FWIA) Step I was also conducted for the Site, and a preliminary evaluation of potential interim remedial measures was performed.

The RI field program, performed between July 31, 1997 and October 9, 1997, consisted of drilling seventeen (17) soil borings and four (4) bedrock cores, installation and development of ten (10) monitoring wells (including four screened within the bedrock underlying the Site), collection of six (6) sediment cores from the Hudson River, sampling of various media (soil, air and groundwater) for analytical and/or geotechnical testing, and the collection of groundwater level measurements. The RI Program also included preparation of a qualitative baseline human health risk assessment and FWIA Steps IIA and IIB.

Objectives

The objective of the PSA Program was to evaluate the nature and extent of MGP by-product impacts and non-MGP by-product impacts in the various media both on and off the Site, assess the potential impacts (if any) to public health and the environment, and evaluate the need to perform interim remedial measures and/or additional remedial investigations at the Site.

The objective of the RI Program was to generate sufficient data to further delineate (horizontally and vertically) the extent of hazardous constituents observed/detected at the Site during the PSA and to determine the potential human health and environmental risks. Additional data have also been obtained to support the engineering issues that will be addressed in the Feasibility Study (FS).

Conclusions

The combined results of the PSA and RI Programs at the Troy (Smith Avenue) Site are sufficient to characterize the nature and extent of hazardous constituents present on- and off-site and to determine the plausible and complete exposure pathways for evaluation of human health and ecological risk associated with Site-related constituents. Based on the data generated during the performance of the PSA and the RI, the following conclusions are presented for the Troy (Smith Avenue) Site.

Hydrogeological

- Four distinct geologic deposits are present beneath the Site. In descending order from the ground surface (with their range of measured thickness on the Site), they are: fill (10 to 34 feet); glacial-fluvial outwash deposits (14 to 34 feet); till (<1 to 10 feet); and bedrock (Normanskill Formation).
- Based on the water table contour maps, groundwater flow direction is to the west-southwest, toward the Hudson River.
- The water table aquifer discharges to the Hudson River, with water table elevations near the river falling within the tidal range of surface water elevations in the river.
- The water table gradient on-site on average was 0.013 to 0.018 feet/foot.
- MGP and petroleum residues were primarily observed/detected in the unconsolidated deposits. However, recovery of a dense non-aqueous phase liquid (DNAPL) along with groundwater sampled from the bedrock monitoring well MW-13 indicates localized migration of DNAPL into fractures within the underlying bedrock. DNAPL was also observed in sediments sampled from the Hudson River adjacent to the Site, indicating that DNAPL may have migrated either along the bedrock surface or within fractures in the upper portion of the bedrock.

NMPC Property (Commercial/Industrial Use)

Surface Soils

- No volatile organic compounds were detected in the surface soils at concentrations greater than NYSDEC soil clean-up objectives.

- Three semi-volatile organic constituents (benzo(a)anthracene, chrysene, and benzo(a)pyrene) were detected above NYSDEC soil clean-up objectives in the surface soils.
- No pesticides or PCBs were detected in the surface soils at concentrations above NYSDEC soil clean-up objectives.
- The concentrations of metals detected in surface soil samples were generally lower than or of the same order of magnitude as the concentrations of metals in background soils in the vicinity of the Site and/or the NYSDEC soil clean-up objectives, suggesting that these metal constituents may be naturally occurring or indications of background levels in urban soils in the area.
- All Chemicals of Potential Concern (COPCs) in surface soils were below the commercial/industrial PRGs for the NMPC property.

Subsurface Soils

- Three volatile organic compounds (benzene, toluene and xylenes) were detected above NYSDEC soil clean-up objectives.
- Thirteen semi-volatile constituents were present in the subsurface soils at concentrations above NYSDEC soil clean-up objectives. These SVOCs were acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)-pyrene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene.
- No pesticides or PCBs were detected above NYSDEC soil clean-up objectives in the subsurface soils.
- The concentrations of metals detected in subsurface soil samples were generally lower than or of the same order of magnitude as the concentrations of metals in background soils in the vicinity of the Site and/or the NYSDEC soil clean-up objectives, suggesting that these metal constituents may be naturally occurring or indications of background levels in urban soils in the area.
- Cyanide was detected in one NMPC property subsurface soil sample. NYSDEC has not recommended a soil clean-up objective level for cyanide.
- All volatile organic COPCs in subsurface soils were below the commercial/industrial PRGs for the NMPC property.
- Four semi-volatile constituents (benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, and dibenzo(a,h)anthracene) exceeded the PRGs identified for subsurface soil (based on the construction worker exposure scenario). However, the continued enforcement of the Site-specific HASP precludes dermal contact with or ingestion of these soils, thereby eliminating their contribution to health risks on the Site.

- Arsenic also exceeded the PRGs identified for subsurface soil (based on the construction worker exposure scenario). However, as for the semi-volatile constituents, enforcement of the HASP eliminates its contribution to health risks.

Groundwater

- Benzene, toluene, ethylbenzene and xylenes were detected in the groundwater beneath the NMPC property at concentrations greater than NYSDEC water quality standards.
- The following ten semi-volatile organic constituents were present above NYSDEC water quality standards: naphthalene, acenaphthene, fluorene, phenanthrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, and indeno(1,2,3-cd)pyrene.
- No pesticides or PCBs were detected above NYSDEC water quality standards.
- Nine metals (arsenic, barium, chromium, iron, lead, magnesium, manganese, sodium, and thallium) were present in the groundwater at concentrations greater than NYSDEC water quality standards.
- Cyanide, although detected in two of the NMPC property monitoring wells, was present below NYSDEC water quality standards.
- No COPCs exceeded the volatilization from groundwater to indoor air PRG. Under the current and future predicted land use, with inclusion of the HASP and the restriction against the use of groundwater as a drinking water source, the groundwater does not present a human health risk to Site workers.

ACOE Property (Governmental Use)

Surface Soils

- No volatile organic compounds were detected in the surface soils at concentrations greater than NYSDEC soil clean-up objectives.
- The following six semi-volatile constituents were detected at concentrations greater than NYSDEC soil clean-up objectives: benzo(a)anthracene, chrysene, benzo(b)-fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, and dibenzo(a,h)anthracene.
- No pesticides or PCBs were detected above NYSDEC soil clean-up objectives in the surface soils.
- The concentrations of metals detected in surface soil samples were generally lower than or of the same order of magnitude as the concentrations of metals in background soils in the vicinity of the Site and/or the NYSDEC soil clean-up objectives, suggesting that these metal constituents may be naturally occurring or indications of background levels in urban soils in the area.
- Cyanide was detected in two ACOE property surface soil samples. NYSDEC has not recommended a soil clean-up objective level for cyanide.

- No volatile organic or inorganic COPCs in surface soils exceeded the applicable commercial/industrial PRGs for the ACOE property.
- Surface soil PRGs were exceeded by concentrations of five semi-volatile COPCs: benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene.

Subsurface Soils

- Four volatile constituents (benzene, toluene, ethylbenzene and xylenes) were detected above NYSDEC soil clean-up objective levels.
- The following 18 semi-volatile organic compounds were detected in subsurface soils of the ACOE property at concentrations greater than NYSDEC soil clean-up objective levels: naphthalene, 2-methylnaphthalene, acenaphthylene, acenaphthene, dibenzofuran, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.
- No pesticides or PCBs were detected above NYSDEC soil clean-up objectives.
- The concentrations of metals detected in subsurface soil samples were generally lower than or of the same order of magnitude as the concentrations of metals in background soils in the vicinity of the Site and/or the NYSDEC soil clean-up objectives, suggesting that these metal constituents may be naturally occurring or indications of background levels in urban soils in the area. However, samples from soil boring SB-10 and test pit TP-3, which represent soil contained within the foundation of a former MGP structure, contained metal concentrations ranging from approximately 2.2 to 21 times greater than the comparison criteria (either NYSDEC soil clean-up objectives or maximum soil background).
- One volatile organic COPC in subsurface soils (benzene) exceeded the applicable commercial/industrial PRGs for the ACOE property.
- Ten semi-volatile COPCs exceeded PRGs: naphthalene, acenaphthylene, phenanthrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)-fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene.
- One inorganic COPC (arsenic) in subsurface soils exceeded the PRGs for the ACOE property.

Groundwater

- Four volatile organic compounds (benzene, toluene, ethylbenzene and xylenes) were detected in the groundwater at concentrations greater than NYSDEC water quality standards.
- Thirteen semi-volatile organic constituents were present above NYSDEC water quality standards, and these compounds are naphthalene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, and indeno(1,2,3-cd)pyrene.
- One pesticide (4,4'-DDT) was detected above NYSDEC water quality standards in the groundwater from ACOE monitoring well USMW-1.
- The following 16 metals were present in the groundwater beneath the ACOE property at concentrations greater than NYSDEC water quality standards: antimony, arsenic, barium, beryllium, cadmium, chromium, copper, iron, lead, magnesium, manganese, mercury, selenium, sodium, thallium, and zinc.
- One volatile organic (benzene) exceeded the commercial/industrial PRGs applied to the ACOE property. Due to the absence of NMPC control on groundwater use for the ACOE property, these PRGs account for health risks associated with ingestion of groundwater and inhalation of indoor vapor derived from groundwater use. However, groundwater is not currently used on the ACOE property, which is served by the municipal water supply. Therefore, benzene in groundwater does not currently contribute to health risks on the ACOE property.
- One PAH (benzo(a)pyrene) was found to exceed the commercial/industrial PRGs. However, as for benzene, benzo(a)pyrene in groundwater does not currently contribute to health risks on the ACOE property.
- Two metals (arsenic and chromium) were found to exceed the PRGs, but because groundwater is not currently used, do not present an actual health risk.

Off-Site (Douw Street) Property (Residential Use)

Surface Soils

- No volatile organic compounds were detected in the surface soils at concentrations greater than NYSDEC soil clean-up objectives.
- Benzo(a)pyrene was the only semi-volatile organic constituent detected above NYSDEC soil clean-up objectives in the off-site surface soils (SS-16).
- No COPCs in surface soils exceed the residential PRGs.

Subsurface Soils

- No volatile organic compounds were detected in the off-site subsurface soils at concentrations greater than NYSDEC soil clean-up objectives.
- Nine semi-volatile organic compounds were detected above NYSDEC soil clean-up objectives in the subsurface soils. These nine compounds were naphthalene, phenanthrene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, and dibenzo(a,h)anthracene.
- No pesticides or PCBs were detected above NYSDEC soil clean-up objectives in the subsurface soils.
- The concentrations of metals detected in off-site subsurface soil samples were generally lower than or of the same order of magnitude as the concentrations of metals in background soils in the vicinity of the Site and/or the NYSDEC soil clean-up objectives, suggesting that these metal constituents may be naturally occurring or indications of background levels in urban soils in the area.
- No volatile organic COPCs exceed the residential PRGs.
- The average concentrations of COPCs in subsurface soils exceed the PRGs for six semi-volatile compounds: naphthalene, benzo(a)anthracene, chrysene, benzo(b)-fluoranthene, benzo(k)fluoranthene and benzo(a)pyrene. However, the single subsurface soil sample responsible for these exceedances was collected from a depth of 44 to 46 feet bgs, well beyond the depths of potential exposure during residential land use. Therefore, COPCs in off-site (Douw Street) soils present no current or foreseeable future risk to human health.
- No inorganic COPCs in subsurface soils exceed the residential PRGs.

Groundwater

- No volatile organic, semi-volatile organic or pesticide/PCB compounds were detected in the groundwater at concentrations greater than NYSDEC water quality standards.
- Four metals (iron, lead, manganese, and sodium) were present in the off-site property groundwater at concentrations greater than NYSDEC water quality standards.
- No COPCs in groundwater exceeded the residential PRGs for the off-site property.

Hudson River

Sediments

- No volatile organic compounds were detected in the sediments at concentrations greater than NYSDEC sediment criteria.
- Concentrations of eight semi-volatile organic compounds were detected above NYSDEC sediment criteria, including acenaphthene, phenanthrene,

benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, and indeno(1,2,3-cd)pyrene.

- Nine pesticides and one PCB compound were detected above NYSDEC sediment criteria. These constituents were beta-BHC, delta-BHC, heptachlor, heptachlor epoxide, 4,4'-DDE, 4,4'-DDD, 4,4'-DDT, endrin aldehyde, gamma-chlordane, and Aroclor-1242.

- No metals were detected above the Severe Effect Levels for sediments.

Surface Water

- No volatile organic compounds, pesticides or PCBs were detected in the surface water samples.

- Bis(2-ethylhexyl)phthalate was detected above NYSDEC surface water quality standards for the semi-volatile constituents.

- One metal (selenium) was present in the Hudson River surface water samples at a concentration which exceeded NYSDEC water quality standards.

RECOMMENDATIONS

Based on the data generated during performance of the PSA and the RI, and the conclusions outlined above, the "maximum remedial alternative" evaluated during the feasibility study (FS) for the Troy (Smith Avenue) Site should include all environmental media for which the concentrations of Site-related constituents exceed NYSDEC clean-up objectives. However, on the basis of the human health and ecological risk assessment and PRG development presented in Sections 6 and 7, a lesser remedial alternative should include evaluation of only the following Areas of Concern, within which the concentrations of COPCs exceed human health and/or ecological risk-based PRGs.

- The subsurface remnants of the former gas holder on the southern portion of the ACOE property, which are represented by soil samples from SB-10 and TP-3 and by groundwater samples from USMW-1.

- Subsurface soils on NMPC property with COPC concentrations in excess of NYSDEC clean-up objectives. Although no human health or ecological risks are associated with soil at the NMPC property under current or projected future land use scenarios, the potential for future impacts to off-site groundwater will be evaluated.

- Surface and subsurface soils within the ACOE property, primarily those along the western border of the property, e.g., in the vicinity of SB-3, SB-18, SB-21 and SB-22.

- Groundwater beneath the ACOE property.

- Sediments within the Hudson River adjacent to the Site.

1.0 INTRODUCTION

This document, herein referred to as the Remedial Investigation (RI) Report for the Niagara Mohawk Power Corporation (NMPC) Troy (Smith Avenue) Site "the Site," has been prepared by the Foster Wheeler Environmental Corporation (Foster Wheeler) on behalf of NMPC. Preparation of this Report is in response to and in accordance with the requirements set forth in the New York State Department of Environmental Conservation (NYSDEC) Order on Consent, Index #DO-0001-9210, executed on December 7, 1992; the NYSDEC-approved Preliminary Site Assessment/Interim Remedial Measure (PSA/IRM) Work Plan (May 1994); the NYSDEC-approved Remedial Investigation (RI) Work Plan (June 1997); and a letter from NMPC to the NYSDEC proposing minor modifications to the RI Work plan dated August 20, 1997. Approval of these modifications was received from the NYSDEC in a letter dated August 20, 1997. Applicable requirements set forth in the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) [42 USC 9601 et seq], as amended; the National Contingency Plan (NCP) of March 8, 1990 [40 CFR Part 300]; and the United States Environmental Protection Agency (USEPA) guidance document entitled Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA (October 1988) have been incorporated, where appropriate.

The PSA field activities commenced in June 1994 and were completed in December 1995. The PSA/IRM Report was submitted to the NYSDEC in April of 1996. The RI Program was proposed to address written NYSDEC comments (received November 18, 1996 and April 11, 1997) on the PSA/IRM Report, as well as telephone discussions between NMPC, Foster Wheeler and the NYSDEC on June 1, 1997 and June 23, 1997. The primary objective of the RI Program was additional delineation of detected/observed manufactured gas plant (MGP)-related constituents, including potential migration into the Hudson River surface water and sediments, and into the bedrock underlying the Site.

Foster Wheeler initiated the RI field activities at the Site on August 6, 1997. RI field activities were completed on October 8, 1997.

1.1 PURPOSE OF REPORT

The purpose of this Report is to summarize the activities conducted as part of the PSA and RI Programs at the Troy (Smith Avenue) Site. The purpose and scope of the PSA Study was to collect sufficient data such that initial evaluations could be made regarding the following:

- The nature and extent of hazardous substances, if any, including MGP by-products in the various media both on and off the Site;
- The potential impacts (if any) to public health or the environment;
- The need to perform interim remedial measures and/or additional remedial investigations at the Site; and
- The options available for interim remediation (if necessary) of contaminant source areas.

The purpose of the RI Program is to further define the extent of the MGP by-product impacts and to address those issues outlined above, so that NMPC can complete the investigation phase and move forward toward the performance of the Feasibility Study (FS) at the Site.

1.2 PROJECT OBJECTIVES

The objective of the PSA Program was to evaluate the nature and extent of MGP by-product impacts and non-MGP by-product impacts in the various media both on and off the Site, assess the potential impacts (if any) to public health and the environment, and to evaluate the need to perform interim remedial measures and/or additional remedial investigations at the Site.

The objective of the RI Program was to generate sufficient data to further delineate (horizontally and vertically) the extent of hazardous constituents observed/detected at the Site and to determine the potential human health and environmental risks. Additional data have also been obtained to support the engineering issues that will be addressed in the FS.

1.3 SITE BACKGROUND

Relevant information concerning the present and historical status of the Troy (Smith Avenue) Site is provided in this subsection. This information includes a description of the Site and surrounding areas, and a historical summary of former MGP operations at the.

1.3.1 Description of Site and Surrounding Areas

The Troy (Smith Avenue) Site is located adjacent to the Hudson River at Smith Avenue in Troy, Rensselaer County, New York. Figure 1-1 depicts the Site location (USGS - North Troy Quadrangle). The Site occupies a total of approximately five acres and is comprised of two properties, one owned by NMPC and the other by the U.S. Government Army Corps of Engineers (ACOE) (see Figure 1-2) The southern and northeastern portions of the Site are owned by NMPC and are currently in use for operation of a natural gas distribution and service facility. The northwestern portion of the Site, bordering the Troy Lock on the Hudson River, is owned by the ACOE. This property includes an active ACOE field office that serves primarily to operate and maintain the Troy Lock and Dam. The areas immediately surrounding the Site are characterized by mixed residential and urban/commercial land use.

A majority of the NMPC property is paved. The south side of the Site includes an office building with a paved parking lot extending to the fence line to the east and west and to within approximately 20 feet of the fence line to the south. To the north are two steel-sided buildings used for maintenance and storage and one brick-sided garage building (see Figure 1-2). Four gasoline dispensing pumps are located west of the brick garage building near the center of the Site. The northern portions of the NMPC property, bordering the property lines, are areas of open equipment storage. A relatively small unpaved area near the center of the Site, immediately north of Smith Avenue, is covered by gravel. The only vegetated areas are a wooded strip along the Hudson River and a grassy strip along the southern boundary of the Site.

The ACOE-owned portion of the former MGP Site is entirely covered by either grass lawn or buildings. The lower portion of the Troy Lock forms the western boundary of this property (see Figure 1-2).

A small building that is used as an office is present in the northwestern corner of the ACOE property. Figure 1-2 also shows the former locations of historical MGP structures and oil/tar tanks.

1.3.2 Site History

In response to the NYSDEC Order on Consent, a search and review of historical background data was conducted for the Troy (Smith Avenue) Site by NMPC. Available resources used to accomplish this task, included, but are not limited to:

- NMPC records and files;
- Sanborn Fire Insurance Atlases, Hopkins' Atlases, and other historical maps;
- Deeds and site surveys;
- Manufactured gas industrial publications;
- Brown's Directory of American Gas Companies;
- NMPC personnel interviews;
- Syracuse University Library historical documents; and
- NYSDEC files.

A series of Hopkins Atlases, Sanborn and Manufacturers Mutual Maps covering the period from 1881 through 1971 are presented in Appendix A. The results of the historical review are summarized below:

In 1858, the Site consisted of vacant land in the City of Troy’s Thirteenth Ward. By 1876, the area of the Site contained some residential development.

The first commercial development of the Site was present in 1881, at which time the “Spring Works,” a large brick building, was present to the north of Smith Avenue (Hopkins Atlas, 1881) and the J.B. Carr & Company Chain Factory was present to the south of Smith Avenue.

In 1885, the Troy Fuel Gas Company purchased an exclusive license to use the Lowe water gas process to produce gas in Troy (Troy Fuel Gas Company minutes, 1885). Also in 1885, the Spring Works building was closed and two “tar kettles” were present in the J.B. Carr & Company building (Sanborn, 1885).

In 1886, the land parcel immediately north of Smith Avenue was conveyed from Manufacturers National Bank of Troy to the Troy Fuel Gas Company. The property contained an engine and boiler in the former spring works (Record of Deed, 10/1/1886). By 1888, the water gas equipment began operation at the Smith Avenue Site (Troy Fuel Gas Company Minutes). In 1889, the Troy Fuel Gas Company consolidated into the Troy Gas Company and purchased three additional parcels north of Smith Avenue (Records of Deed; 10/21/1889, 11/15/1889, 11/15/1889).

By 1903, there were two gas holders west of the gas plant on the bank of the Hudson River, and a third gas holder and three oil tanks west of the plant. The plant consisted of a purifying house, two coal sheds, nine water gas generators, a condenser, a black smith shop, an engineering room, a store house and an office (Sanborn, 1903).

Between 1915 and 1916, the Troy dam and lock was relocated north on the Hudson River to a point adjacent to the northwestern side of the Site (Map of Troy, 1916). Also in 1915, the J. B. Carr & Company American Chain Cable Works, located to the south of Smith Avenue, was purchased by the Troy Gas Company (Record of Deed, 3/29/1915). Between 1915 and 1920, the Troy Gas Company purchased four additional parcels that bordered the Site (Records of Deed; 3/29/1915, 4/21/1915, 4/13/1917, 12/2/1920).

In 1925, the Smith Avenue gas plant ceased operation when the Hudson Valley Coke and Products Corporation gas plant began operation on Water Street in Troy to supply gas to the Troy Gas Company. The Smith Avenue gas plant was maintained on standby for emergencies (NYP&L Report to NYSPSC, 1931).

By 1928, there was a third gas holder on the former Carr property south of Smith Avenue and three tar settling tanks along the Hudson River (NYP&L property map, 1928; see Figure 1-2).

In 1928, the last gas was produced at the Smith Avenue gas plant. Thereafter, the Site was only used for gas storage (NYP&L Report to NYSPSC, 1934).

By 1951, the two large gas holders west of the gas plant had been removed. The smaller holder and oil tanks east of the plant were replaced by a garage (Sanborn, 1951).

In 1960, the last 1000 million cubic foot gas holder was removed from the Site (NMPC letter, 9/29/1959).

In 1965, NMPC conveyed a 0.64 acre parcel along the Hudson River, west of the former gas plant, to New York State which then later transferred the property to the U.S. Government (New York State Department of Public Works, Acquisition of Property, 6/19/1965).

By 1986, the main gas building north of Smith Avenue had been removed from the Site (Aerial Photo, 1986).

In 1991, the ACOE conducted an investigation of their portion of the former MGP site and found "severely contaminated" soils in test borings (Empire Soil Investigation, August 1991).

1.4 ORGANIZATION OF REPORT

Section 1, the Introduction, describes the purpose of the Report. The Site background, which includes a Site description and a review of the Site history is also presented to familiarize the reader with these aspects of the Site. Section 2 presents the scope-of-work performed as part of the PSA and RI field investigation programs. Monitoring well installation, in addition to soil boring and test pit excavation procedures, are described. Sampling of the various media, and performance of a soil gas survey and land survey are also summarized. The chemical sampling program is outlined, describing the sampling locations, sample type, and analytical parameters. Section 3 describes physical characteristics of the Site and region, including topography, surface and groundwater hydrology, and geology. Section 4 summarizes the analytical results of the samples collected during the PSA and RI Programs. The type and concentration of the constituents of concern detected in each media are described. Section 5 details the fate and transport of compounds detected in each media. This section includes summaries of potential routes of migration, persistence of each contaminant, and migration. Section 6 presents the qualitative baseline human health risk assessment for the Troy (Smith Avenue) Site, which includes assessments based on health, exposure, and toxicity. An analysis of potential impacts to fish and wildlife is also provided in this section, based on the Fish and Wildlife Impact Analysis, Step I through Step IIA-B, completed at the Site. Additionally, Preliminary Remediation Goals (PRGs) for each affected media are detailed. Section 7 provides the preliminary remediation objectives for each media. Section 8 presents a summary, and the conclusions and recommendations for the Site. This section includes a review of the extent of both on- and off-site contamination. References used to prepare this Report are presented in Section 9.

Appendices include historical maps, soil boring logs, monitoring well and piezometer construction diagrams, test pit excavation records, analytical data, geotechnical data, risk assessment data, survey data and the soil gas investigation report.

2.0 SCOPE OF WORK

2.1 INTRODUCTION

This section describes the tasks performed as part of the PSA and RI field programs, the associated methods and/or procedures which were utilized, and any modifications to the NYSDEC-approved Work Plans. Detailed descriptions of the scopes of work and field methods approved by the NYSDEC are presented in the Work Plans for the PSA (May 1994) and for the RI (June 1997), and in NMPC's letter of August 20, 1997 to NYSDEC which outlines minor modifications to the approved RI scope of work. Approval of these modifications was received from the NYSDEC in a letter dated August 20, 1997.

2.2 SUMMARY OF SCOPE OF WORK

The PSA field program consisted of drilling twenty-one (21) soil borings, installation and development of seven (7) monitoring wells, excavation of five (5) test pits, sampling various media (surface soil, subsurface soil, and groundwater) for chemical and/or geotechnical analysis, and collection of groundwater level measurements. Groundwater level measurements and samples for chemical analysis were also collected from five existing monitoring wells on the ACOE property. A soil gas survey was performed after measurement of high combustible gas levels during the soil boring program. A Fish and Wildlife Impact Analysis (FWIA) Step I was also conducted for the Site, and a preliminary evaluation of potential interim remedial measures was performed.

The RI field program consisted of drilling seventeen (17) soil borings and four (4) bedrock cores, installation and development of ten (10) monitoring wells (including four screened within the bedrock underlying the Site), collection of six (6) sediment cores from the Hudson River, collection of soil and groundwater samples for analytical and/or geotechnical testing, and the collection of groundwater level measurements. Groundwater level measurements and samples for chemical analysis were also collected from five existing monitoring wells on the ACOE property. The RI Program also included preparation of a qualitative baseline human health risk assessment and FWIA Steps IIA and IIB.

2.3 PRE-INVESTIGATION ACTIVITIES

2.3.1 PSA Activities

Prior to the commencement of field activities, the Underground Facilities Protective Organization (UFPO) was contacted to mark out underground utilities at the Site. In addition, NMPC gas and electric personnel marked out subsurface utilities in the vicinity of the sampling locations.

On June 30, 1994, the initial Site reconnaissance task was performed, including the identification and marking of all soil boring, monitoring well, and sampling locations on NMPC property. Each location was evaluated with respect to overhead and underground obstructions. A metal detector was utilized to screen sampling locations for the presence of metallic objects (i.e., tanks, pipes, etc.). Also during the reconnaissance, a staging area for equipment and materials, office space, and a sampling equipment storage area were identified.

A Site reconnaissance was performed on the ACOE property on September 15, 1995. This task included the identification and marking of all soil boring, monitoring well, and sampling locations on the ACOE property adjacent to the lock. A metal detector was utilized to screen sampling locations for the presence of buried objects (i.e., tanks, pipes, etc.). Some sample locations were adjusted to avoid potential buried utilities and/or historical MGP structures.

2.3.2 RI Activities

Prior to the commencement of field activities, the UFPO was again contacted to mark out underground utilities at the Site. In addition, NMPC gas and electric personnel marked out subsurface utilities in the vicinity of the proposed RI sampling locations.

A Site reconnaissance for the RI field program was conducted on July 31, 1997, and included the identification and marking of all soil boring, monitoring well, and sampling locations on NMPC and ACOE property. Each location was evaluated with respect to overhead and underground obstructions. A metal detector was utilized by NMPC personnel to screen sampling locations for the presence of metallic objects (i.e., tanks, pipes, etc.). Several sampling locations were either moved or omitted from the field program as a result of safety concerns due to their proximity to underground gas lines. Also during the reconnaissance, a staging area for equipment and materials, office space, and a sampling equipment storage area were identified.

2.4 SUBSURFACE SOIL INVESTIGATION

2.4.1 PSA Soil Borings

Mobilization for the subsurface soil investigation commenced on July 7, 1994. At this time, the drilling subcontractor mobilized its equipment and supplies to the Site. In addition, a decontamination pad was constructed, and all drilling equipment and tools were decontaminated in preparation for field work. Due to a delay in agreement on property access, the subsurface investigation on the ACOE property portion of the Site was conducted between October 9 and October 18, 1995.

Eleven soil borings were drilled at on-site locations (as illustrated in Figure 1-2) between July 11 and July 25, 1994, including both soil borings (SB) and monitoring well borings (MW). Soil boring SB-5 was not drilled because of extensive underground utilities in the proposed sampling area. Five other soil borings (SB-1, SB-3, SB-10, MW-5S, and MW-5D) were drilled between October 9 and October 16, 1995.

The soil borings were advanced using hollow-stem augers until unweathered (competent) bedrock and/or refusal was encountered. At that point, the soil borings were abandoned in accordance with the Sampling and Analysis Plan. The soil boring logs provided in Appendix B include soil descriptions, analytical sampling intervals, field instrumentation readings and observations of any olfactory and/or visual contamination. The data summarized on the soil boring logs were utilized to construct several geologic cross sections of the Site. These geologic cross sections are presented in Section 3.0. Approximately 80 percent of the soil samples were analyzed for MGP indicator compounds (BTEX, PAHs and cyanide) and Total Organic Carbon (TOC). The remaining samples were analyzed for Target Compound List (TCL) organics, Target Analyte List (TAL) inorganics, TOC and geotechnical parameters. The analytical testing program and analytical data from the subsurface soil investigation are discussed in Section 4.0.

2.4.2 RI Soil Borings

A total of 17 soil borings were advanced by hollow-stem auger during the RI. Soil borings were drilled to the top of the bedrock surface at a total of eight locations (SB-11, SB-14, SB-21, SB-22, MW-7D, MW-8, MW-9D and MW-16). With the exception of soil boring MW-16, which was advanced solely for installation of a monitoring well screened in the deep overburden, four subsurface soil samples were collected from each borehole. Two samples were collected at depths between 2 and 8 feet bgs, one sample was collected from immediately above the bedrock surface and one sample was collected from an intermediate depth based on visual and instrumental field screening. Approximately 80 percent of the soil samples were analyzed for MGP indicator compounds (BTEX, PAHs and cyanide) and TOC. The remaining samples were analyzed for TCL organics, TAL inorganics, TOC and geotechnical parameters. A sample was also collected for TCLP and RCRA hazardous characteristics analysis if concentrated MGP residues were encountered. As indicated by the boring location designations, monitoring wells (MW-7D, MW-8, MW-9D and MW-16) were subsequently installed in four of the eight deep soil borings. The remaining soil borings were abandoned by grouting in accordance with the RI Work Plan.

Two borings (MW-7S and MW-9S) were advanced by hollow-stem auger solely for installation of monitoring wells screen across the groundwater table. No soil samples were collected from these boreholes.

A total of seven soil borings (SB-13, SB-15, SB-16, SB-17, SB-18, SB-19 and SB-20) were advanced by hollow-stem auger to a depth of eight feet to provide additional delineation of subsurface constituents of concern within this depth interval. Two subsurface soil samples were collected from each of the shallow boreholes for chemical analysis on the basis of visual and instrumental field screening. Approximately 80 percent of the samples were analyzed for BTEX, PAHs, cyanide and TOC. The remainder were analyzed for TCL organics, TAL inorganics, TOC and geotechnical parameters. The boreholes were then abandoned by grouting in accordance with the RI Work Plan.

2.4.3 Subsurface Background Samples

Soil samples were also collected from 1 to 2 feet bgs at three locations (SS-17, SS-18 and SS-19; see Figure 1-2). These subsurface samples were collected using a decontaminated stainless-steel spoon after removing the overburden (0 to 1 foot bgs) using a stainless-steel bucket auger. These samples were analyzed for TCL organics, TAL inorganics and TOC to provide additional control on subsurface background soil quality. Excavated overburden was returned to the borehole.

2.5 TEST PIT EXCAVATIONS

In accordance with the PSA/IRM Sampling and Analysis Plan, five test pits were excavated: TP-2, TP-4 and TP-5 on July 7-8, 1994; and TP-1 and TP-3 on October 17, 1995 as illustrated on Figure 1-2. The test pit excavations were used to document and delineate historic MGP structures, and evaluate the nature of MGP residues or by-product material associated with the former MGP operations at the Site. The test pits were excavated to a maximum depth of 10 feet below the ground surface or to the top of the water table, whichever was encountered first. Based on the below grade structures encountered, the depth of TP-4 was limited to approximately six feet below ground surface and TP-5 was limited to approximately three feet below ground surface. Soil samples were collected for chemical analysis (TCL organics and TAL inorganics) from each test pit excavation. Based on instrumentation screening and visual/olfactory inspection, a soil sample was collected from each distinct suspected MGP-related by-product or other residue type encountered in the test pit. Each soil sample was collected from the backhoe bucket. The analytical data associated with these samples are discussed in Section 4.0, and the test pit excavation records are provided in Appendix D. The test pits were backfilled with the excavated material and compacted with the backhoe bucket. The ground surface was graded smooth and the asphalt, where applicable, was patched.

2.6 SURFACE SOIL INVESTIGATION

2.6.1 PSA Surface Soil Samples

Six surface soil samples (SS-5 through SS-10; 0 to 6 inch depth) were collected at on-and off-site locations on July 7, 1994. An additional four surface soil samples (SS-1 through SS-4; 0 to 6 inch depth) were collected on the ACOE property on October 10, 1995 (as shown in Figure 1-2). All ten surface soil samples were collected in accordance with the Sampling and Analysis Plan (Appendix A of the NYSDEC approved Work Plan). Approximately 80 percent of these soil samples were analyzed BTEX, PAHs, cyanide and TOC. The remaining samples were analyzed for TCL organics, TAL inorganics and TOC. The analytical testing results are discussed in Section 4.0.

2.6.2 RI Surface Soil Samples

A total of 12 additional surface soil samples (0 to 2 inch depth) were collected to provide additional delineation of constituents of concern in surface soils and to provide supplemental characterization of off-site background surface soil quality. Surface soil samples SS-11, SS-12, SS-13 and SS-14 were collected from the ACOE property. Samples SS-15, SS-16, SS-20, SS-21 and SS-22 were collected from NMPC property. Surface soil samples SS-16, SS-17, SS-18, and SS-19 were collected at off-site locations (see Figure 1-2). Approximately 80 percent of these soil samples were analyzed BTEX, PAHs, cyanide and TOC. The remaining samples were analyzed for TCL organics, TAL inorganics and TOC.

2.7 HYDROGEOLOGIC INVESTIGATION

2.7.1 PSA Monitoring Well Installation and Development

Five monitoring wells (MW-1 through MW-4, MW-6) were installed in the water table aquifer at on-site locations as illustrated in Figure 1-2. The wells were installed between July 11 and August 17, 1994, and were screened across the water table surface (with the exception of MW-6, which was screened just above the top of the bedrock, as per the NYSDEC-approved PSA/IRM Work Plan, to evaluate the vertical groundwater flow gradient). Monitoring wells MW-5S and MW-5D were installed on the ACOE property between October 9 and October 13, 1995. MW-5D was added to the field program per NMPC authorization following observation of MGP residues in the soil boring for MW-5. MW-5D was screened within a zone below the water table surface where suspected potential MGP residues were observed. MW-5S was installed adjacent to MW-5D and was screened across the water table surface, as per the Work Plan. All seven monitoring wells were installed in accordance with the Sampling and Analysis Plan (Appendix A of the NYSDEC approved Work Plan). The wells were installed to provide points for collection of groundwater samples and hydrologic measurements. In addition, the monitoring wells were utilized to evaluate the nature of MGP residue sources, as well as to contribute to Site-specific geologic and hydrogeologic characterization. The monitoring well construction diagrams are provided in Appendix C.

MW-1 through MW-4 and MW-6 were developed between August 25 and September 2, 1994, and MW-5S and MW-5D were developed between October 16 and 18, 1995. Development was performed prior to the collection of a groundwater sample using the pump and surge method, then pumped at a low flow rate with a submersible pump until the turbidity measurements reached 50 NTUs or less or until no further reduction in turbidity was observed. This modified development procedure was accepted by the NYSDEC in a letter to NMPC dated August 1994. The development water was containerized on the Site and sampled by Foster Wheeler. Following analytical testing of the water, it was disposed of by NMPC in accordance with NYSDEC guidelines.

Using an oil/water interface probe, two rounds (September 8, 1994 and December 13, 1995) of water level and separate phase liquid measurements were collected from the monitoring wells and documented in the field logbook. This information is summarized in Table 3-1.

2.7.2 RI Monitoring Well Installation and Development

A total of 10 monitoring wells were installed and developed during the RI field program. As discussed in Section 2.4.2, four monitoring wells (MW-7D, MW-9D, MW-8 and MW-16) were installed with their screened interval within the deep overburden. Pursuant to NYSDEC requirements, these wells were installed with a two-foot sump immediately overlying the bedrock surface, followed by a 10-foot screened immediately above the sump. Two monitoring wells (MW-7S and MW-9S) were screened across the groundwater table surface. These shallow overburden wells also included a two-foot sump below the screened interval. Four monitoring wells (MW-12, MW-13, MW-14 and MW-15) were screened within the shale bedrock underlying the Site. The 0 to 8 feet bgs interval of each of these borings was advanced by hollow-stem auger to facilitate collection of two subsurface soil samples for chemical analysis. These samples were analyzed as discussed in Section 2.4.2. A six-inch temporary spin casing was then advanced through the unconsolidated overburden and approximately two feet into competent bedrock. A permanent 4-inch carbon steel surface casing was grouted into the bedrock surface and ‘HQ’ rock cores were advanced a total of 11 feet into the competent bedrock. Two-inch PVC monitoring wells were installed with a 1-foot sump at the base of the bedrock core hole followed by a five-foot screened interval. Details of the monitoring well construction specifications are presented in the NYSDEC-approved work plans (PSA/IRM, 1994 and RI, 1997). Monitoring well construction diagrams are presented in Appendix C.

Development was performed a minimum of 48 hours after the well installation was completed using the pump and surge method, then pumped at a low flow rate with a submersible pump until the turbidity measurements reached 50 NTUs or less or until no further reduction in turbidity was observed. The development water was containerized on the Site and subsequently sampled and disposed of by NMPC in accordance with NYSDEC guidelines.

Using an oil/water interface probe, water level and separate phase liquid measurements were collected on September 30, 1997, from 21 existing and newly installed monitoring wells (Figure

1-2) located both on- and off-site. The measurement results were documented in the field logbook and are summarized in Table 3-1. The water level data were utilized to construct a water table contour map, which is presented in Section 3.0.

2.8 GROUNDWATER SAMPLING

2.8.1 PSA Groundwater Samples

Two rounds of groundwater samples were collected from 11 monitoring wells on October 25 to 27, 1995 (Round 1) and December 13 to 15, 1995 (Round 2). In addition to six of the seven wells installed by Foster Wheeler (Per the PSA/IRM Work Plan, MW-6 was installed to evaluate the vertical groundwater flow gradient, thus was not sampled), five existing monitoring wells on the ACOE property were sampled. These samples were collected to characterize groundwater quality beneath the Site and to assess the potential for off-site migration of MGP-related contaminants. All eleven groundwater monitoring wells were purged and sampled using dedicated disposable bailers and polypropylene line. The purge water was containerized on-site and subsequently sampled and disposed of by NMPC in accordance with all NYSDEC guidelines. All groundwater samples were analyzed for TCL organics, TAL inorganics and conventional water quality parameters. Analytical results are discussed in Section 4.0.

2.8.2 RI Groundwater Samples

A complete round of groundwater samples was collected from all existing and newly installed monitoring wells with the exception of USMW-1 (a total of 21 monitoring wells). USMW-1 was not resampled due to the high levels of contamination measured during the previous two rounds of groundwater sampling (e.g., October and December, 1995). Groundwater purging and sampling was conducted, when possible, using a “low-flow” pumping methodology that employed a Grunfos positive displacement submersible pump with electronic speed control. The purge water was containerized on-site and subsequently sampled and disposed of by NMPC in accordance with all NYSDEC guidelines. All groundwater samples were analyzed for TCL organics, TAL inorganics and conventional water quality parameters. Analytical results are discussed in Section 4.0.

2.9 SOIL GAS SURVEY

A soil gas survey was performed during the PSA field investigation on July 18 and July 19, 1994, to investigate the possibility of hazardous subsurface conditions during the drilling operation. High combustible gas indicator readings resulted in abandonment of the original monitoring well borings MW-2 and MW-4. Twenty-four soil gas samples were collected from thirteen sampling locations, at depths between 3.5 and 10 feet bgs, and analyzed by gas chromatography for benzene, toluene, ethylbenzene, xylenes, total volatile hydrocarbons, and methane. Soil gas survey results are summarized in Section 4.0. A copy of the report from Tracer Research Corporation is provided in the Appendix J.

2.10 HUDSON RIVER SURFACE WATER AND SEDIMENT SAMPLES

Surface water samples (SW) and sediment cores (SD) were collected during the RI field investigation from a total of six (6) locations in the Hudson River (SD/SW-1 through SD/SW-6) to evaluate the potential migration of Site-related constituents into the river (see Figure 1-2).

Two of the sediment core-surface water pairs were collected to evaluate upgradient (SD/SW-5, upstream of the Site) and local (SD/SW-4, outboard of the lock channel adjacent to the Site) background levels of contamination. Sediment cores were advanced by a vessel-mounted vibratory coring rig to depths of approximately six feet below the sediment-water interface where possible. However, four of the six cores reached the bedrock at depths of less than or equal to three feet. Composite sediment samples were collected from the 0 to 3 foot depth interval and, where possible, from the 3 to 6 foot depth interval. Each of the composite samples was analyzed for TCL organics, TAL inorganics, TOC and grain size. The analytical results are discussed in Section 4.0.

2.11 SURVEYING

Following completion of PSA and RI field activities at the Site, NMPC's surveyors located the sampling points (i.e., monitoring wells, soil borings, test pit excavations, and surface soil samples) and measured the ground surface (elevation above mean sea level) for each monitoring well location. For the monitoring well locations, the surveyors also determined the elevation of the top of the inner PVC riser. The survey elevations are provided in Appendix H.

2.12 WASTE HANDLING AND DISPOSAL

Drill cuttings generated during the PSA and RI field programs were secured on-site in a roll-off container. Monitoring well development and purge water, in addition to water and fluids used to decontaminate drilling and sampling equipment, were temporarily stored on-site in polyethylene tanks. Solid waste was discarded on-site into a garbage dumpster, however, contaminated personal protective equipment (PPE) was placed in drums and/or the roll-off. Waste characterization and disposal was coordinated directly by NMPC in accordance with NYSDEC regulations.

2.13 ANALYTICAL PROGRAM

2.13.1 Environmental Sample Analyses

The PSA/IRM and RI analytical programs were designed to characterize and delineate MGP by-product impacts, as well as other potentially hazardous substances at the Site. Analytical testing for the RI was performed by Nytest Environmental, Inc. (NEI), a New York State Department of Health ELAP-certified laboratory and a participating member of the NYSDEC ASP CLP Program. The analytical program included the following analyses:

- NYSDEC-ASP Target Compound List (TCL) Volatile Organic Compounds (VOCs);
- NYSDEC-ASP TCL Semi-volatile Organic Compounds (SVOCs);
- NYSDEC-ASP TCL pesticides and Polychlorinated Biphenyls (PCBs);
- NYSDEC-ASP Target Analyte List (TAL) Metals and Cyanide;
- Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX);
- Polycyclic Aromatic Hydrocarbons (PAHs);
- Toxicity Characteristics Leaching Procedure (TCLP) testing;

- Resource Conservation and Recovery Act (RCRA) parameters;
- Conventional Water Quality parameters; and
- Geotechnical parameters.

2.13.2 QA/QC Samples

Field quality control samples consisting of field blanks (FB), field duplicates (DUP), and trip blanks (TB) were analyzed to assess field sampling accuracy and precision. One field blank was collected for each decontamination event associated with soil boring, test pit excavation, surface water/sediment, and groundwater sampling events. One trip blank accompanied each aqueous sample shipment from the Site to the analytical laboratory. These samples were collected to detect contamination introduced by the sampling equipment, in the laboratory, or during shipment of the samples. The analytical results are discussed in Section 4.0 and summarized in tabular format in Appendix E.

2.13.3 PSA Data Validation

A QA/QC review of the analytical data generated by NEI was performed as the data were received. This included a review of pertinent QA/QC data such as holding times, calibration, laboratory and field blanks, duplicate precision, and surrogate and matrix spike recovery. Nonconforming QA/QC results were evaluated with respect to data reliability and usability. Upon completion of the data validation task, the analytical data were arranged in summary tables (Appendix E).

3.0 PHYSICAL CHARACTERISTICS OF THE STUDY AREA

3.1 INTRODUCTION

This section presents information related to the physical characteristics (surface features, topography, geology, and hydrogeology) of the Site and surrounding area. The information discussed in this section is based upon data generated from the PSA and RI field investigations and a review of various published reference materials.

3.2 SURFACE FEATURES AND TOPOGRAPHY

The Troy (Smith Avenue) Site is located adjacent to the Hudson River at Smith Avenue in Troy, Rensselaer County, New York. The Site occupies a total of approximately five acres and is comprised of two properties, one owned by NMPC and the other by the ACOE (see Figure 1-2). The eastern portion of the Site, which is owned by NMPC, slopes gently toward the Hudson River with ground surface elevations ranging from 34 to 28 feet above mean sea level (MSL). The northwestern portion of the Site, adjacent to the Troy Lock and owned by the ACOE, is characterized by a steep slope down to the sheet piling wall of the lock, with a ground surface elevation of approximately 15 feet above MSL at the wall. The southwestern boundary of the Site exhibits a steep slope from the edge of the NMPC parking area (approximately 28 feet above MSL) down to the tidal Hudson River.

A majority of the NMPC property is paved. The south side of the Site includes an office building with a paved parking lot extending to the fence line to the east and west and to within approximately 20 feet of the fence line to the south. To the north are two steel-sided buildings used for maintenance and storage and one brick-sided garage building (see Figure 1-2). Four gasoline dispensing pumps served by below grade storage tanks are located west of the brick garage building near the center of the Site. The northern portions of the NMPC property, bordering the property lines, are areas of open equipment storage. A relatively small unpaved area near the center of the Site, immediately north of Smith Avenue, is covered by gravel. The only vegetated areas are a wooded strip along the Hudson River and a grassy strip along the southern boundary of the Site.

The ACOE-owned portion of the Site is entirely covered by either grass lawn or buildings. The lower portion of the Troy Lock forms the western boundary of this property (see Figure 1-2). A small building that is used as an office is present in the northwestern corner of the parcel.

The areas immediately surrounding the Site are characterized by mixed residential and urban/commercial land use.

3.3 SURFACE WATER HYDROLOGY

3.3.1 Regional Surface Water Hydrology

The Site is situated within a highly developed area in which the ground surface is predominantly covered with either asphalt, concrete, or structures (i.e., buildings). Surface water travels via overland flow to catch basins and drainage culverts in the vicinity of the Site, and eventually flows into the Hudson River. Minor amounts of surface water percolates to recharge the uppermost unconfined aquifer. The Hudson River, bordering the Site to the west, is the major regional surface water drainage. The Hudson River is a Class C water body according to NYSDEC water classifications (O'Brien & Gere, 1994).

3.3.2 Site Surface Water Hydrology

Since the NMPC property is primarily covered with buildings or asphalt, the subsurface soils/aquifer obtains limited recharge from precipitation events. Much of the surface runoff drains off the property to the west and down the steep embankment toward the Hudson River. Some surface water runoff from the northern portion of the NMPC property drains onto the ACOE property and infiltrates. The ACOE property is primarily grass covered. Thus the subsurface soils/aquifer obtains significant recharge from precipitation events.

3.4 GEOLOGY

3.4.1 Regional Geology

The Site is located in the Hudson-Champlain Lowland physiographic province (O'Brien & Gere, 1994). This province is characterized by undeformed to gently folded Early to Middle Ordovician-aged sedimentary bedrock. Based on regional mapping, the Site appears to be underlain by the Middle Ordovician-aged Normanskill Formation, a dark gray shale formation with a minor mudstone and sandstone constituent (Fisher et. al., 1970). Based on local borings the bedrock is overlain by a variety of unconsolidated units attributed to glacial till, glacial-fluvial outwash deposits, river channel deposits, and fill (O'Brien & Gere, 1994).

3.4.2 Site Geology

Soil boring logs (Appendix B) of the boreholes completed during PSA and RI activities indicate the presence of four geologic units beneath the Site. These units, in descending order, are as follows: fill, glacial-fluvial outwash deposits, till, and bedrock. Bedrock (shale) was encountered at six boring locations on the ACOE property at depths ranging from approximately 31 feet bgs (MW-8) to 59 feet bgs (SB-1). Bedrock was encountered at 15 locations on NMPC property and one location at the end of Douw Street, at depths ranging from approximately 38 feet bgs (MW-1, MW-15 and MW-16) to 57 feet bgs (MW-13). In general, the bedrock was encountered at depths ranging from approximately 38 feet bgs (MW-1, MW-15, and MW-16) beneath the eastern side of the Site to between approximately 51 to 57 feet bgs beneath the western side of the Site, south of the lock and adjacent to the Hudson River. North of the lock, adjacent to the Hudson River, bedrock is encountered at approximately 31 feet bgs (MW-8). The Site geology is illustrated along four geologic cross sections (A-A', B-B', C-C' and D-D') prepared for the transects shown on Figure 3-1.

Of the four cross sections, two are aligned north-south (Sections A-A' and B-B') and two are aligned east-west (Sections C-C' and D-D'). These cross sections are provided as Figures 3-2, 3-3, 3-4, and 3-5, respectively. Generally, the sequence of units underlying the Site are described as follows:

- Fill - brick, ash, sand, gravel, and cobbles - 10 to 34 feet thick
- Glacial-fluvial outwash deposits - sand and gravel - 14 to 34 feet thick
- Glacial till - dense sand, silt and gravel - <1 to 10 feet thick

The fill material is primarily a heterogeneous mixture of sands, gravels, and cobbles, but also includes brick, cinders, slag, wood, coal, and ash. Underlying the fill layer exists glacial-fluvial outwash material consisting of sands, silts, and gravels with occasional lenses of silty clays and peat. Till deposits underlying the glacial-fluvial outwash material consist of dense clayey-silts with shale fragments and occasional sand and gravel inclusions.

Rock cores drilled during the installation of the four bedrock wells revealed a medium-hard, black shale with micro-laminated (less than 1/16 inch thick) bedding planes angled at approximately 45 degrees to 60 degrees above the horizontal. The bedrock was competent and showed little to no weathering and generally blocky to occasionally broken fracturing. One core (MW-13) contained small crystals of pyrite, and two cores (MW-13 and MW-14) contained occasional white bedding planes possibly of calcareous composition. The competent shale was generally overlain by a thin (0.25 to 1 feet) weathered shale interval. However, at MW-13, there was a 6-foot interval from approximately 51 to 57 feet bgs of highly weathered or fractured bedrock. The depth to competent bedrock ranged from approximately 38 feet (MW-1) to 59 feet (SB-1) bgs.

3.5 GROUNDWATER HYDROLOGY

3.5.1 Regional Groundwater Hydrology

The water table is sloped toward the Hudson River, indicating westward groundwater flow and discharge to the river. The shale bedrock generally exhibits poor groundwater yield. Groundwater is usually hard (high in calcium and/or magnesium), is often cloudy, and frequently contains hydrogen sulfide (O'Brien & Gere, 1994). The Hudson River, adjacent to the west side of the Site, is tidal below ACOE Lock 1. Below the lock, the ground water table may be tidally influenced. Above the lock, the river level is artificially controlled at several feet above MSL, and the river may be either a gaining or loosing body depending upon the controlled surface water elevation.

3.5.2 Site Groundwater Hydrogeology

Of the seven monitoring wells installed during the PSA Study, five (MW-1, MW-2A, MW-3, MW-4A, and MW-5S) were screened across the water table. MW-6 was screened at the base of the water table aquifer, just above the competent bedrock, and MW-5D was screened from 47 to 32 feet bgs in an overburden zone where MGP-like residues were observed. Of the ten wells installed during the RI investigation, two (MW-7S and MW-9S) were screened across the water table; four (MW-7D, MW-8, MW-9D, and MW-16) were screened at the base of the water table aquifer, just above the competent bedrock; and four (MW-12, MW-13, MW-14, and MW-15) were screened in the bedrock. Five wells on the ACOE property pre-date the PSA and RI activities. Of these wells, four (USMW-1, USMW-2, US-201, and US-204) are screened across the water table and one (US-206) is screened at the base of the water table aquifer.

One round of groundwater level measurements was collected from five wells on NMPC property on September 8, 1994. An additional round of water level measurements was performed at all of the wells sampled for the PSA Study on December 13, 1995, including five wells on the NMPC property and six wells on the adjacent ACOE property.

On September 30, 1997, during the RI activities, another round of water level measurements was performed prior to groundwater sampling. Measurements were collected at 11 wells on the NMPC property, eight wells on the ACOE property and two wells at the end of Douw Street. The results of these measurements are shown in Table 3-1. Water table elevations measured on September 30, 1997 ranged from -27.16 to 12.09 feet above MSL. However, monitoring well MW-12 recharged extremely slowly. Thus the anomalously low measured elevation (-27.16 above MSL) does not likely reflect the static water table. The water surface elevation in USMW-1 represents water contained within the intact foundation of the former gas holder. Therefore, this anomalously high measured elevation does not reflect the Site-wide piezometric surface. Excluding these two anomalous measurements, the September 30, 1997 data were used to construct a water table piezometric surface contour map of the Site (Figure 3-6). Based on these data, the groundwater flow direction in the water table aquifer is to the west-southwest, toward the Hudson River.

The ACOE routinely collects hourly surface water elevation measurements in the tidal Hudson River south of the lock, adjacent to the Site. Water table elevations measured during the PSA and RI activities were thus compared to surface water elevations taken over equivalent time periods to evaluate the potential hydraulic connection between Site groundwater and the Hudson River. This comparison shows that water table elevations do not respond rapidly to changing river elevations, and are generally slightly higher than the average river elevation. On December 13, 1995, surface water elevations were consistently lower than water table elevations in all wells measured. The surface water elevation ranged from 3.0 feet to 1.7 feet above MSL during the period of time over which water table elevations were measured, 0900 to 1100 hours (USACE, 1996). On September 30, 1997, water table elevations in shallow wells along the river (MW-2A, MW-3, MW-7S, MW-9S, USMW-2, and MW-5S), when compared at equivalent times of measurement, were lower than surface water elevations in the tidal Hudson River in all but two wells. Water table elevations were higher than surface water levels at USMW-2 and MW-5S. The surface water elevation ranged from 0.7 feet below to 4.3 feet above MSL over the period in which the water table elevations were measured, approximately 1130 to 1740 (USACE, 1998). This period corresponds to 1.5 hours after low tide to 2.5 hours after high tide and may suggest that tides are responsible for the dichotomous relationship between surface water and water table elevations on September 30, 1997.

Monitoring well MW-8 appears to be completely isolated from the surface water of the upper Hudson River, i.e., north of the lock. On September 30, 1997 at 1050 hours, the water table elevation at MW-8, which is situated along the Hudson River above the lock, was significantly lower than the water elevation in the river, 7.82 feet above MSL and 16.0 feet above MSL respectively. The water elevation in the Hudson River above the lock fluctuated between 15.6 and 16.9 feet above MSL throughout September 30, 1997. The water table elevation at MW-8 appears to be lower than the surface water elevation in the Hudson River above the lock due to the engineered controls at the lock complex which artificially maintain the water at a higher elevation.

Piezometric heads in three of the bedrock wells (MW-13, MW-14, and MW-15) were relatively close to the piezometric heads in adjacent corresponding water table and deep overburden wells. However, the piezometric head at one bedrock well (MW-12) was approximately 32 feet lower than the piezometric head in adjacent water table and deep overburden wells. During well development and sampling, MW-12 exhibited extremely slow recharge which may be due to a locally tight bedrock formation. Therefore, despite allowance of greater than the requisite one week between development and water level measurement (developed September 18, 1997, water level measured September 30, 1997), the measured water level in MW-12 clearly does not represent the static piezometric surface for the bedrock aquifer.

The water table gradient across the Site, calculated using Figure 3-6, ranges from approximately 0.013 to 0.018 feet/foot. Vertical groundwater gradients vary across the Site. In the overburden aquifer vertical gradients are negative (downward) in the east and positive (upward) in the west, along the river. In the east, at MW-1 and MW-16, the vertical gradient in the overburden aquifer is approximately -0.19 feet/foot. Along the western side of the Site, the vertical gradients in the overburden are approximately 0.0018 feet/foot (MW-9S and MW-9D), 0.030 feet/foot (MW-7S and MW-7D), 0.024 feet/foot (MW-3 and MW-6), and 0.039 feet/foot (MW-5S and MW-5D).

The vertical gradients between the water table and the bedrock aquifer were as follows: -0.045 feet/foot (MW-1 and MW-15), -0.040 feet/foot (MW-2A and MW-14), and 0.0063 feet/foot (MW-3 and MW-13).

The vertical gradients between the deep overburden wells and the bedrock wells were as follows: 0.0052 feet/foot (MW-16 and MW-15) and -0.0090 feet/foot (MW-6 and MW-13). Vertical gradients between the overburden and the bedrock aquifers were not calculated for the MW-5S, MW-5D, and MW-12 cluster due to the anomolously low groundwater elevation measurement at MW-12.

4.0 NATURE AND EXTENT OF IMPACTS

4.1 INTRODUCTION

Part of the investigation conducted at the Troy (Smith Avenue) Site consisted of a multimedia environmental sampling and analysis program. The program was separated into two portions: the PSA conducted from June 1994 to December 1995, and the RI conducted from July to October 1997. These two programs included the collection and analysis of surface (PSA, 0 to 6 inches bgs; RI, 0 to 2 inches bgs) and subsurface (greater than 6 inches bgs) soil samples from across the Site to determine the presence and nature of hazardous substances, including MGP residues, in the soils. Sediment and surface water samples were also collected from the Hudson River. Groundwater samples were collected to determine the groundwater quality, and air samples were collected to assess potential impacts to ambient air quality during excavation of the test pits.

Soil, sediment, surface water, groundwater and air samples were submitted to Nytest Environmental, Inc. for laboratory analysis of various chemical parameters. All data generated by the laboratory were validated by a Foster Wheeler chemist familiar with the analyses and certified by USEPA Region II to perform organic and inorganic data validation. Further information on the data validation of the samples is presented in Section 2.13.3 of this Report. The laboratory program included the following analyses:

- NYSDEC-ASP Target Compound List (TCL) Volatile Organic Compounds (VOCs);
- NYSDEC-ASP TCL Semi-volatile Organic Compounds (SVOCs);
- NYSDEC-ASP TCL Pesticides and Polychlorinated Biphenyls (PCBs);
- Benzene, Toluene, Ethylbenzene, and Xylenes (BTEX);
- Polycyclic Aromatic Hydrocarbons (PAHs);
- NYSDEC-ASP Target Analyte List (TAL) Metals and Cyanide;
- Physical/Geotechnical parameters;
- Conventional Water Quality parameters;
- Toxicity Characteristic Leaching Procedure (TCLP) testing; and
- Resource Conservation and Recovery Act (RCRA) parameters.

The tabulated results of the sampling investigation are summarized by environmental medium in Appendix E.

The selection of chemical analyses performed focused on those constituents indicative of potential MGP residue impacts. The majority of the surface and subsurface soil samples (approximately 66 percent) were analyzed for monocyclic aromatic hydrocarbons (BTEX compounds), PAH compounds and/or cyanide. Full NYSDEC-ASP TCL/TAL analyses were performed on approximately 30 percent of the soil samples to identify other potential constituents. The sediment, surface water and groundwater samples were analyzed for full NYSDEC-ASP TCL/TAL parameters by the laboratory.

Laboratory testing for volatile, semi-volatile, pesticide, herbicide, and/or metal constituents by TCLP procedures and for RCRA parameters was performed on three subsurface soil samples to determine whether the soils would be classified as hazardous waste. In addition, 79 soil samples were analyzed for physical/geotechnical parameters (e.g., grain size, total organic carbon) to help characterize the geologic units beneath the Site and to support the risk assessment. Hardness was analyzed during the surface water sampling to constrain applicable surface water quality criteria, and various conventional water quality parameters were analyzed during the groundwater sampling to support both fate and transport analysis and potential subsequent remedial design efforts. Air samples collected during the test pit excavations were analyzed for BTEX and PAHs to document any potential releases of these constituents into the atmosphere during excavation activities.

The analytical results were compared to NYSDEC recommended guidance values and/or standards. Site surface and subsurface soil concentrations were reviewed against the soil clean-up objectives recommended in the NYSDEC Division Technical and Administrative Guidance Memorandum HWR-94-4046, *Determination of Soil Clean-up Objectives and Clean-up Levels* (January 1994). Surface soil clean-up objectives were adjusted to account for an average total organic carbon (TOC) concentration of 3.1 percent across the Site, and subsurface soil clean-up objectives were adjusted to account for an average TOC concentration of 2.8 percent across the Site. For the metals data, the maximum of the background occurrence concentrations for surface soils (locations SS-8, SS-9, and SS-10) and for subsurface soils (locations SS-18, SS-19, MW-1, MW-8, and MW-15) was used to represent "site background." The comparison criterion used for each metal was the greater of the given NYSDEC value, as applicable, and the maximum site background concentration.

NYSDEC *Technical Guidance for Screening Contaminated Sediments* (November 1993) was utilized for comparison of the Site sediment data. For the organics, the most conservative value of the four levels of protection, i.e., Human Health Bioaccumulation, Benthic Aquatic Life Acute Toxicity, Benthic Aquatic Life Chronic Toxicity, and Wildlife Bioaccumulation, was chosen. In addition, the criteria were normalized to the amount of TOC present at the Site; an average value of 0.86 percent TOC was used. The Severe Effect Level screening criteria were chosen for the metal and cyanide comparisons, as this level indicates the concentration at which pronounced disturbance of the sediment dwelling community can be expected.

Surface water and groundwater analytical results were compared with levels specified in NYSDEC Division of Water Technical and Operational Guidance Series 1.1.1, *Ambient Water Quality Standards and Guidance Values* (October 1993). Class AA surface water values were applied, as these values are applied to drinking water supply and are the most conservative standards for surface waters. For groundwater, Class GA values were applied. Class GA waters are defined as fresh groundwaters, found in the saturated zone of unconsolidated deposits and consolidated rock or bedrock, which are used as a source of potable water supply (NYSDEC 1986).

To assist in the comparison of results, the applicable NYSDEC guidance levels and/or site background concentrations used for comparison are presented on the corresponding data tables in Appendix E. Constituent concentrations which are greater than these guidance values are highlighted with shading.

Summaries of the constituents detected during the two parts of the sampling investigation (i.e., the PSA field investigation and the RI sampling event) can be found within the appropriate subsections below (Sections 4.2 and 4.3). Figures illustrating the sampling locations and the total concentrations of detected BTEX and PAHs are referenced in the sediment, surface water, soil and groundwater matrix subsections where applicable.

4.2 PSA ANALYTICAL RESULTS

4.2.1 Soil Gas Survey Results

A soil gas survey investigation of the Troy (Smith Avenue) Site was conducted on July 18 and 19, 1994, by Tracer Research Corporation. The shallow soil gas samples from various locations around the Site were analyzed by gas chromatography for the following VOC constituents: benzene, toluene, ethylbenzene, xylenes, total volatile hydrocarbons, and methane. Twenty-four samples were collected from sampling locations, at depths between 3.5 and 10 feet bgs. Benzene and toluene were detected in two and four samples, respectively, with maximum concentrations of 0.9 ppb and 1 ppb. Total volatile hydrocarbons were present in seven locations, and ranged in concentration from 3 ppb to 68 ppb. Ethylbenzene, xylenes and methane were not detected during the soil gas survey. The comprehensive report, including data result tables, submitted by Tracer Research Corporation is provided as Appendix J.

4.2.2 Surface Soil Analytical Results

Ten surface soil samples and three duplicate surface soil samples (i.e., soils less than 6 inches bgs) were collected at on- and off-site locations to evaluate potential surficial contamination during the PSA. Samples SS-1 through SS-4 were collected from the ACOE property, samples SS-5 through SS-7 from the NMPC property, and samples SS-8 through SS-10 were collected at off-site background locations. Four surface soil samples (SS-1, SS-8, SS-9 and SS-10) and one duplicate (SS-10D) were analyzed for full NYSDEC ASP-TCL/TAL parameters, while the other six samples and two duplicates (SS-2 through SS-7, and SS-5D and SS-14) were analyzed for BTEX, PAHs and cyanide only (see Appendix E, Tables E-2 through E-8). Total BTEX and total PAH concentrations for the surface soils are presented on Figure 4-1.

As shown in Appendix E, Tables E-2 and E-3, four volatile organics (acetone, 2-butanone, tetrachloroethene and toluene) were detected at low concentrations in the surface soils during the PSA Study. None of these volatile constituents were present at concentrations above their respective NYSDEC soil clean-up objectives. Concentrations for these constituents ranged up to 0.02 ppm (tetrachloroethene in SS-8). Toluene, the only BTEX constituent present, was detected in the two samples collected from beneath asphalt on the NMPC property (i.e., 0.002 ppm in SS-5 and 0.002 ppm in SS-6) and in one of the off-site background samples (i.e., 0.005 ppm in SS-8); see Figure 4-1.

Seventeen of the 21 SVOCs detected in the surface soil samples were PAHs, and with the exception of sample SS-7, at least one individual PAH compound was detected in all of the surface soil samples including the background samples (see Appendix E, Tables E-4 and E-5). Individual PAH compounds present at concentrations exceeding NYSDEC soil clean-up objectives included benzo(a)anthracene, chrysene, benzo(a)pyrene, and dibenzo(a,h)anthracene. The total concentration of PAH compounds detected in surface soils ranged from 2.48 ppm (SS-4) to 14.8 ppm (SS-6), and total PAH concentrations are shown on Figure 4-1. The other four SVOCs contained in the surface soil samples were phthalates, and were generally present in the background samples (see Table E-4). These constituents were detected at concentrations up to 2.1 ppm (bis(2-ethylhexyl)phthalate in SS-10) which are below NYSDEC clean-up objectives.

Eight pesticides were detected in the surface soil samples, and were only present in the off-site background samples. Concentrations ranged from 0.0037 ppm (alpha-chlordane in the duplicate of SS-10) to 0.066 ppm (4,4'-DDT in the duplicate of SS-10). No pesticides or PCBs were detected in the surface soils at concentrations above NYSDEC soil clean-up objectives. Table E-6 presents the analytical results for the pesticides and PCBs.

Twenty-three metals were present in at least one of the five surface soil samples analyzed for TAL metals during the PSA (i.e., SS-1, SS-8, SS-9, SS-10 and SS-10D). The resulting concentrations are presented in Appendix E, Table E-7. In general, the detected metal concentrations for the ACOE property were of lesser or equal magnitude than the background surface soil concentrations and/or the NYSDEC soil clean-up objectives (see Table E-7). Due to this distribution of analyte concentrations, these metal constituents may be naturally occurring or indications of background levels in urban surface soils in the area. Potassium and selenium were the only two metals detected at concentrations above comparison criteria, and they were present in sample SS-1 from the ACOE property at 1,290 ppm and 2.7 ppm, respectively). The potassium and selenium concentrations were greater than their respective soils comparison criteria by only 1.2 times and 1.35 times, respectively, as shown in Table E-7.

Cyanide was detected in only one of the PSA surface soil samples (the duplicate of SS-4) at a concentration of 0.9ppm (see Table E-8). NYSDEC has not recommended a soil clean-up objective level for cyanide.

4.2.3 Subsurface Soil Analytical Results

Sixty-six subsurface soil samples and four duplicate samples were collected during the PSA from soil boring (SB) and monitoring well boring (MW) locations, and from test pit (TP) excavations. The samples were analyzed for BTEX, PAHs, NYSDEC-ASP TCL organic and TAL metals, and/or cyanide. Nine samples were also analyzed for TOC, while two samples were analyzed for TCLP and RCRA parameters. Tabulated results of the analyses are presented in Appendix E, Tables E-10 through E-22. The maximum concentrations of total BTEX and total PAHs for two subsurface depth ranges (6 inches to 8 feet bgs and greater than 8 feet bgs) are shown on Figures 4-2 and 4-3, respectively. In addition, Figures 3-2 through 3-5 provide total BTEX and total PAH concentrations by depth on cross sections of the subsurface soil boring and monitoring well boring locations.

As shown in Tables E-10 and E-11 of Appendix E, there were detections of 11 volatile organics in the PSA subsurface soil samples. Generally, with the exception of styrene in SB-10 (6 to 8 feet bgs), the non-BTEX volatile constituents were present at ppb levels. The sample from SB-10 contained 120 ppm of styrene. Individual BTEX constituents had concentrations ranging from 0.001 ppm to 1,100 ppm, with the more elevated concentrations present in locations SB-10, MW-2A, MW-6, and TP-3; see Tables E-10 and E-11. These four borings were the only locations to contain BTEX concentrations which were greater than NYSDEC soil clean-up objectives, and these exceedances occurred from 2 feet bgs to 12 feet bgs (SB-10/TP-3) and from 42 feet bgs to 46 feet bgs (MW-2A/MW-6). Total BTEX concentrations ranged up to 3,480 ppm, and are provided on Figures 4-2 and 3-2 through 3-5.

During the PSA Study, subsurface soil samples were analyzed for TCL SVOCs (Table E-12) or PAHs (Table E-13). Individual PAH constituents were detected in a majority (approximately 80 percent) of the subsurface soil samples, and the number of PAH compounds present in any one sample ranged from 1 to 19. Subsurface soil samples from three of the soil borings (SB-01, SB-03 and SB-10), five of the monitoring well borings (MW-2A, MW-3, MW-4A, MW-5D, and MW-6), and four of the test pits (TP-1, TP-3, TP-4, and TP-5) contained a minimum of one individual PAH compound at a concentration greater than NYSDEC soil clean-up objectives. Exceedances were detected at depth intervals ranging from 2 to 52 feet bgs; see Tables E-12 and E-13. Concentrations for the individual PAHs ranged up to 9,300 ppm (naphthalene in TP-3, 2 to 3 feet bgs). As shown in Figures 4-3 and 3-2 through 3-5, the more elevated total PAH concentrations were present in locations SB-10 (from 4 to 12 feet bgs, maximum of 16,247 ppm); MW-2A (from 44 to 46 feet bgs, maximum of 797.9 ppm); MW-4A (from 20 to 22 feet bgs, maximum of 258 ppm); TP-3 (from 2 to 3 feet bgs, maximum of 36,566 ppm); and TP-4 (at 3 feet bgs, maximum of 305.9 ppm). In general, samples from these locations, particularly SB-10, MW-2A and TP-3, also contained elevated total BTEX concentrations. The other three SVOCs detected during the PSA investigation were phthalates, and these compounds were present at concentrations up to only 0.33 ppm (see Appendix E, Table E-12).

As presented in Table E-14, relatively low concentrations of 10 pesticides (i.e., less than 0.19 ppm) were distributed across the Site. In addition, there was one PCB, Aroclor-1260, detected during the subsurface soil sampling. Aroclor-1260 was present in the samples collected from TP-5, located on NMPC property, and had concentrations of 0.09 ppm (1.5 feet bgs) and 0.045 ppm (3 feet bgs). None of the detected pesticide/PCB constituents were present at a concentration that exceeded its NYSDEC soil clean-up objective level (see Table E-14).

The PSA subsurface soils of the Site contained detectable concentrations of up to 23 metals; see Table E-15 of Appendix E. Concentrations of 21 of these 23 metals were greater than the soils comparison criteria (either NYSDEC soil cleanup objectives or maximum Site background), in one or more borings. Generally, the concentrations for the metal analytes were approximately equivalent in magnitude across the Site and throughout all the geologic formations sampled. This suggests that the detected metal concentrations may be indicative of urban soils in the Site area or of naturally occurring background levels. However, certain areas of the Site indicated more elevated concentrations of some of the metals. For example, soil from the ACOE property (i.e., SB-10 and TP-3), contained concentrations from about 2.2 to 21 times greater than comparison criteria, for arsenic, cadmium, copper, lead, mercury, selenium, thallium, and zinc. Also, barium was detected at higher concentrations in the soil samples collected from the fill deposits, while calcium, with the exception of SB-2, was more elevated in the glacial/fluvial outwash deposits.

Cyanide was present in only one subsurface soil sample from the PSA Study. As shown in Table E-16, the 3 foot bgs sample from TP-5 contained 4.5 ppm of cyanide. NYSDEC has not recommended a soil clean-up objective level for cyanide.

Analysis of nine PSA subsurface soils for TOC indicated concentrations ranging from 2,500 ppm to 6,400 ppm (see Appendix E, Table E-17). The maximum concentration was present in TP-3 (2 to 3 feet bgs), which is located on the ACOE property of the Site.

Two samples, one sample from SB-10 (8 to 10 feet bgs) and one from MW-2A (44 to 46 feet bgs), were analyzed by TCLP testing for volatile, semi-volatile and metal constituents, and the results are presented in Tables E-18 through E-21. All compounds were detected below the TCLP maximum allowable concentration levels, with the exception of benzene. Benzene was detected in the SB-10 sample at a concentration of 1.1 ppm, which exceeds the 0.5 ppm limit.

4.2.4 Groundwater Analytical Results

Round 1 - October 1995

Eleven monitoring wells were sampled in October 1995, and these samples were analyzed for NYSDEC-ASP TCL organics, TAL metals, cyanide, and/or various water quality parameters. Analytical data for the Round 1 groundwater are presented in Appendix E, Tables E-35 through E-40. Figure 4-4 displays the concentrations of total BTEX and total PAHs detected in the groundwater samples.

BTEX compounds were detected in monitoring wells MW-2A, MW-4A, MW-5D, US-204, US-206, USMW-1, and USMW-2 (see Table E-35 of Appendix E). With the exception of MW-2A, the above wells all contained at least one constituent at a concentration above NYSDEC water quality standards during the Round I sampling. Concentrations of individual constituents ranged from 1 ppb to 19,000 ppb, with a total BTEX maximum of 46,200 ppb in USMW-1. USMW-1 is located within a former gas holder, on the ACOE property; see Figure 4-4. In addition, styrene was present at 3 ppb in US-204 and at 340 ppb (an exceedance of its NYSDEC water quality standard) in USMW-1. Other VOCs detected during the Round 1 sampling include chloromethane and chloroform (see Table E-35).

Detections of phenolics, phthalates, and PAHs were present during Round 1; see Appendix E, Table E-36. The NYSDEC water quality standard for total phenolics is 1 ppb, and the sum of the two detected phenolic compounds (4-methylphenol and 2,4-dimethylphenol, with a total concentration of 950 ppb) exceeded this standard in the sample for USMW-1. Nineteen PAH compounds were detected in the Round I groundwater samples, and 13 were present in at least one monitoring well at a concentration greater than NYSDEC water quality standards. PAH concentrations exceeding groundwater standards ranged from 1 ppb to 130,000 ppb; see Table E-36. As shown on Figure 4-4, total PAHs were present at elevated concentrations in MW-4A (563 ppb); US-206 (512 ppb); USMW-1 (358,879 ppb); and USMW-2 (512 ppb). MW-4A is proximal to the fuel island located in the eastern portion of the NMPC property, and contained a separate phase liquid/product layer during the sampling event. DNAPL was also present in USMW-1 during the Round 1 groundwater sampling.

The groundwater sampled from US-206 contained a relatively low concentration of endrin aldehyde (0.098 ppb). This was the only pesticide present in the groundwater, and endrin was not detected above NYSDEC water quality standards (see Table E-37 of Appendix E). In addition, no PCBs were detected during Round 1.

Twenty-three metals were detected in the groundwater samples collected during the PSA, and of these 23 metals, 16 analytes were present at groundwater concentrations greater than their respective NYSDEC water quality standards. As shown in Table E-38, there were 15 metals detected in the background well, MW-1. Eleven metals were detected at concentrations greater than 10 times their respective background (MW-1) concentration (see Table E-38), and these occurrences were generally located in samples collected from the ACOE property wells. In addition, 15 metal analytes had their maximum concentration present in the sample from US-204 (southeastern corner of ACOE property), while the maximum for 7 other metals detected was contained in the USMW-1 sample (southeastern portion of the ACOE property). Of the metals detected, only sodium was present at its highest concentration in a monitoring well (MW-4A) located on the NMPC property.

Cyanide was detected in two monitoring well samples. MW-3 and MW-4A contained concentrations of 60 ppb and 19 ppb of cyanide, respectively (see Table E-39 of Appendix E). These cyanide concentrations were below NYSDEC water quality standards.

Round 2 - December 1995

During Round 2, the same 11 monitoring wells were sampled as in Round 1. Analyses for the samples included full NYSDEC-ASP TCL organics, TAL metals and cyanide, and/or various water quality parameters. Tables E-41 through E-46 of Appendix E contain the analytical data for the December 1995 sampling round. In addition, Figure 4-4 presents the monitoring well concentrations of total BTEX and total PAHs.

Seven volatile organic compounds were detected in the Round 2 groundwater samples (Appendix E, Table E-41). Concentrations for the non-BTEX constituents were 84 ppb (acetone in US-206); 20 ppb (2-butanone in US-206); and 130 ppb and 450 ppb (styrene in US-206 and USMW-1). The acetone and styrene concentrations were greater than NYSDEC water quality standards. BTEX compounds were detected in the following six monitoring well locations: MW-4A, US-201, US-204, US-206, USMW-1, and USMW-2. Individual BTEX constituents were found at concentrations up to 17,000 ppb (benzene, USMW-1), and were present above NYSDEC water quality standards; see Table E-41. The maximum total BTEX concentration was present in USMW-1 (31,400 ppb), which is located on the western portion of the Site (ACOE property) within the foundation bounds of a former gas holder; see Figure 4-4. In addition, this well contained the maximum concentration of total BTEX during the Round 1 groundwater investigation.

Three phenolic compounds, one phthalate compound, 18 PAH compounds, and isophorone were detected in the Round 2 groundwater samples (see Table E-42 of Appendix E). The three phenolics (phenol, 2-methylphenol and 4-methylphenol) were present only in the USMW-1 groundwater sample, with concentrations up to 200 ppb. The summed concentration of the three phenolic constituents (310 ppb) exceeded the NYSDEC water quality standard for total phenolics of 1 ppb. Wells MW-3 and MW-4A contained bis(2-ethylhexyl)phthalate at concentrations of 2 ppb each, while isophorone was detected at 14 ppb in MW-5D. Individual PAH constituents were detected above NYSDEC water quality standards in seven Round 2 monitoring wells (MW-2A, MW-4A, MW-5D, US-201, US-204, USMW-1, and USMW-2), with concentrations in these wells ranging from 1 ppb to 9,800 ppb. Total PAH concentrations, indicated on Figure 4-4, had a maximum value of 16,503 ppb in monitoring well USMW-1.

USMW-1 had contained the highest total concentration of PAHs during Round 1. DNAPL was encountered in this well during both the Round 1 and Round 2 sampling events.

Two pesticides (endosulfan sulfate and 4,4'-DDT) were detected in the sample from USMW-1 at concentrations of 0.25 ppb and 0.46 ppb, respectively. As shown in Table E-43, no other pesticides or PCBs were present in the Round 2 groundwater. The detected amount of 4,4'-DDT (0.46 ppb) was greater than its NYSDEC water quality standard.

Table E-44 presents the results of the PSA Round 2 groundwater analyses for metals. Fourteen metals were detected at concentrations which exceeded their respective NYSDEC water quality standards. As during the Round 1 investigation, numerous metals were detected at concentrations in the on-site wells that were more than 10 times their respective background (MW-1 and/or the duplicate of MW-1) concentrations. In general, these occurrences were present in the samples collected from the monitoring wells installed on the ACOE property. Maximum concentrations for the metals generally were found in US-201 (see Table E-44).

Cyanide was not detected in the groundwater samples collected during the Round 2 investigation (Appendix E, Table E-45).

4.2.5 Air Investigation Results

Air samples were collected with a low-flow sampling pump through adsorbent tubes during the test pit investigation to assess potential impacts to ambient air quality. Twenty-six samples were analyzed for BTEX compounds (benzene, toluene, ethylbenzene, meta- and para-xylenes, and ortho-xylene) and PAH compounds (Appendix E, Tables E-53 and E-54, respectively). There were no BTEX or PAH constituents present in the air samples above analytical detection limits.

4.3 RI ANALYTICAL RESULTS

4.3.1 Sediment Analytical Results

Eight sediment samples and one duplicate sample were collected from the Hudson River in the vicinity of the Troy Lock during the RI investigation at the locations shown on Figure 3-1. The samples were collected as composites from 0 to 3 feet below the sediment-water interface. Composite samples were also collected from 3 to 6 feet below the sediment-water interface at two of the locations (SD-1 and SD-3). All of the sediment samples were analyzed for full NYSDEC-ASP TCL organics, TAL metals and cyanide, and TOC. The results are presented in Appendix E, Tables E-23 through E-28. Concentrations of total BTEX and total PAHs for the sediment samples are presented on Figure 4-5.

Three volatile organic compounds (benzene, ethylbenzene and xylenes) were detected in the sediment samples (see Table E-23 of Appendix E), all at samples from location SD-3. Detected concentrations were below NYSDEC sediment criteria. Total BTEX concentrations were 0.011 ppm (SD-3, 0 to 3 feet) and 0.004 ppm (SD-3, 3 to 6 feet).

In general, as indicated in Table E-24, the SVOCs detected in the sediment samples were PAHs. Individual PAHs were present in all but one (SD-6) of the eight locations, including the two samples collected as background (SD-4 and SD-5). Concentrations for eight of the detected PAHs were greater than NYSDEC sediment criteria, and exceedance concentrations ranged from 0.051 ppm (indeno(1,2,3-cd)pyrene in SD-3, 0 to 3 feet) to 6.8 ppm (acenaphthene in SD-3, 0 to

3 feet); see Table E-24. Total PAH concentrations for the downstream sediment samples were 4.93 ppm (SD-1, 0 to 3 feet); 9.99 ppm (SD-1, 3 to 6 feet); 4.67 ppm (SD-2, 0 to 3 feet); 29.8 ppm (SD-3, 0 to 3 feet); and 31.5 ppm (SD-3, 3 to 6 feet). As shown on Figure 4-5, sample SD-3 contained the highest amount of total PAHs and was located adjacent to the ACOE property, just south of the Troy Lock.

The sediment samples collected during the RI contained pesticide constituents at relatively low levels (i.e., less than 0.0093 ppm); see Appendix E, Table E-25. However, a majority of these pesticide concentrations were greater than NYSDEC sediment criteria. In addition, one PCB, Aroclor-1242, was detected in six of the eight sediment samples (and the duplicate), including the background sediment samples, and exceeded its NYSDEC sediment criteria value in all six of these samples. Concentrations for Aroclor-1242 ranged from 0.054 ppm (SD-5, upstream of the Site) to 1 ppm (the duplicate of SD-3, to the west of the Site).

Twenty-two metals were detected in the sediment samples. Table E-26 of Appendix E contains the analytical data for the metals. In general, the concentrations of the metals in the downstream samples were of lesser or equivalent magnitude to the two background samples. None of the metal analytes were detected at concentrations above their respective severe effect levels for sediments (see Table E-26). There were, however, four metal constituents (calcium, lead, mercury, and thallium) in which at least one downstream sample concentration was more than three times the maximum background sample value (i.e., from SD-4 or SD-5).

In addition, cadmium, selenium and silver were not detected in either SD-4 or SD-5, but were present at detectable concentrations in at least one of the downstream sediment samples (SD-1, SD-2, SD-3, and/or SD-6); see Table E-26.

Cyanide was not detected in any of the Hudson River sediment samples (see Table E-27).

Total organic carbon was analyzed in all sediment samples, and the resulting concentrations of TOC ranged from 1,800 ppm (SD-1, 0 to 3 feet) to 21,800 ppm (the duplicate to SD-3, 0 to 3 feet), as presented in Table E-28 of Appendix E.

4.3.2 Surface Water Analytical Results

In September 1997, six surface water samples and one duplicate sample were collected from the Hudson River in the vicinity of the Troy Lock (SW-1 through SW-6). The samples were analyzed for full NYSDEC-ASP TCL organics, TAL metals and cyanide, and hardness. The tabulated data are presented in Appendix E, Tables E-29 through E-34, and on Figure 4-5 for total BTEX and total PAHs.

No VOCs, pesticides or PCBs were detected in any of the surface water samples (see Tables E-29 and E-31). There were two SVOCs detected at relatively low concentrations, diethylphthalate at 1 ppb (the duplicate to SW-3), and bis(2-ethylhexyl)phthalate at 1 ppb (SW-2) and 1 ppb (SW-6). The two occurrences of bis(2-ethylhexyl)phthalate were above the NYSDEC water quality standard for this constituent (0.6 ppb). As shown in Table E-32 of Appendix E, 16 metals were present in at least one of the surface water samples. Many of these metal concentrations were detected below the analytical method detection limit (denoted with a “B” on the Appendix E data table). Selenium was the only metal detected at a concentration which exceeded NYSDEC water quality standards. Sample SW-1 contained 3.8 ppb of selenium; its surface water standard is 1 ppb. None of the surface water samples contained detectable levels of cyanide. The hardness of the surface water was tested, and ranged from 84.7 ppm (the duplicate to SW-3) to 1,840 ppm (SW-1).

4.3.3 Surface Soil Analytical Results

Twelve additional surface soil samples and one duplicate sample were collected during the RI event. The samples were located on the NMPC property (SS-15, SS-20, SS-21 and SS-22); on the ACOE property (SS-12, SS-13, SS-14 and SS-17); off-site at the end of Douw Street (SS-16); and at background locations (SS-11, SS-18 and SS-19). The samples were analyzed for either BTEX, PAHs and cyanide (SS-11 through SS-16, SS-18 through SS-20, and SS-22) or full NYSDEC-ASP TCL/TAL (SS-17 and SS-21). In addition, the 12 surface soil samples were analyzed for TOC. The results are provided in Appendix E, Tables E-2 through E-9. Figure 4-1 presents the concentrations for total BTEX and total PAHs.

Only one volatile organic compound (toluene) was detected in the surface soils. Toluene was present in sample SS-19, a background sample, at a concentration of 0.001 ppm; see Tables E-2 and E-3. This concentration of toluene is below its NYSDEC recommended soil clean-up objective (1.5 ppm).

As shown in Tables E-4 and E-5 of Appendix E, with the exception of SS-22 which was collected beneath asphalt, at least one individual PAH compound was detected in all of the RI surface soil samples, including the three background samples (SS-11, SS-18 and SS-19). The number of individual PAHs detected in a sample ranged from 8 (SS-15, near the fuel island on the NMPC property) to 15 (SS-18, a background sample collected off the Site to the east). At least one exceedance of NYSDEC soil clean-up objectives occurred in all RI surface soil samples except SS-15 and SS-22. Compounds which had concentrations greater than the recommended objectives were benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, and dibenzo(a,h)anthracene. The total concentrations of PAHs ranged up to 125.6 ppm (SS-14, on the ACOE property), and are presented on Figure 4-1. In addition to the PAHs, surface soil sample SS-17 (an off-site sample near Clinton Street) contained pentachlorophenol (0.039 ppm); di-n-butylphthalate (0.066 ppm); butylbenzylphthalate (0.11 ppm); and bis(2-ethylhexyl)phthalate (0.23 ppm). Bis(2-ethylhexyl)phthalate was also present in the sample from location SS-21, at 0.072 ppm; see Table E-4.

As indicated in Table E-6, concentrations of the detected pesticides were relatively low (i.e., less than 0.022 ppm) for the surface soil samples, and were below NYSDEC soil clean-up objective levels. Sample SS-21 collected from the NMPC property contained four pesticides (4,4'-DDE, endrin, 4,4'-DDT, and alpha-chlordane), while six pesticides (aldrin, dieldrin, 4,4'-DDE, endosulfan II, 4,4'-DDD, and 4,4'-DDT) were present in the sample collected from the ACOE property (SS-17).

As shown in Appendix E, Table E-7, 22 metals were detected in the RI surface soil samples, SS-17 and SS-21. The distribution of metals for the RI samples is similar to that represented by the PSA analytical results; see Section 4.2.2. The metals were generally detected at concentrations less than or equivalent to the background concentrations. Concentrations greater than comparison criteria (either NYSDEC soil clean-up objectives or maximum site background) were detected for calcium (28,700 ppm), magnesium (6,100 ppm), mercury (0.16 ppm), potassium (1,380 ppm), and thallium (4 ppm); see Table E-7. ACOE property soil sample SS-17 contained the exceedance concentrations for mercury and thallium; and the NMPC property sample (SS-21) contained the calcium, magnesium and potassium exceedances.

Cyanide was detected in only one of the surface soil samples collected during the RI. It was present in sample SS-17 (from the ACOE property), at 1.05 ppm (see Table E-8 of Appendix E). There is no NYSDEC soil clean-up objective level for cyanide.

The surface soils collected during the RI were also analyzed for TOC (see Table E-9). The resulting concentrations for the on-site samples ranged from 2,500 ppm (SS-21, from the NMPC property) to 96,500 ppm (SS-14, from the ACOE property). Background samples contained TOC at concentrations up to 54,200 (the duplicate of SS-18).

4.3.4 Subsurface Soil Analytical Results

During the RI, 18 soil borings were drilled at locations across the Troy (Smith Avenue) Site, and 54 samples and 4 duplicate samples from these borings were analyzed for either BTEX, PAHs and cyanide, or full NYSDEC-ASP TCL/TAL constituents. Fifty-two of the soil boring samples were also analyzed for TOC, while one sample was tested for TCLP and RCRA parameters. Analytical data results for the subsurface soil samples were tabulated, and are presented in Appendix E, Tables E-10 through E-22. The sample results for total BTEX and total PAHs were grouped into two depth ranges (i.e., from 6 inches to 8 feet bgs and greater than 8 feet bgs), and the maximum concentration for each depth range is provided on Figures 4-2 and 4-3, respectively. In addition, Figures 3-2 through 3-5 provide total BTEX and total PAH concentrations by depth on cross sections of the subsurface soil boring and monitoring well boring locations.

The TCL volatile organic data for the subsurface soil samples are presented in Table E-10, while Table E-11 contains the results of the BTEX analyses. Individual BTEX constituent concentrations were relatively low (i.e., less than 0.036 ppm) in the RI samples, with the exception of the 44 to 46 feet bgs sample from boring MW-9D. This sample contained ethylbenzene at 1.8 ppm and xylenes at 0.8 ppm (see Table E-11). There were no exceedances of NYSDEC soil clean-up objectives for the VOCs detected during the RI. Total BTEX concentrations ranged from 0.002 ppm to 2.6 ppm, and these concentrations are shown on Figures 4-2 and 3-2 through 3-5.

Subsurface soils collected during the RI were analyzed for full TCL SVOCs or PAHs, and analytical results are presented in Tables E-12 or E-13, respectively. Thirty-nine of the 54 samples collected for the RI indicated the presence of at least one PAH compound, and these samples contained individual PAH concentrations up to 150 ppm (pyrene in SB-18, 2 to 4 feet bgs). A minimum of one individual PAH compound at a concentration greater than the respective NYSDEC soil clean-up objective was detected in nine of the subsurface soil borings (SS-17, SS-18, SB-11, and SB-17 through SB-22) and seven of the monitoring well borings (MW-7D through MW-9D, and MW-12 through MW-15). Soils from depth intervals between 2 feet bgs and 52 feet bgs contained PAHs at concentrations that exceeded NYSDEC soil clean-up objectives, as indicated in Tables E-12 and E-13. As shown in Figures 4-3 and 3-2 through 3-5, total PAH concentrations for the RI were not as elevated as those from the PSA sampling event.

Total PAHs ranged up to a maximum of 662 ppm, and the more elevated concentrations were present in locations SB-18 (2 to 8 feet bgs); SB-22 (24 to 26 feet bgs); and MW-9D (44 to 46 feet bgs). SB-18 and SB-22 were drilled on the ACOE property, while MW-9D, which also contained elevated amounts of BTEX constituents, was located at the end of Douw Street (see Figure 4-3). In addition to the PAHs, the SVOC analyses indicated the presence of diethylphthalate (detected at 0.043 ppm) and bis(2-ethylhexyl)phthalate (detected range of 0.043 ppm to 2 ppm); see Table E-12.

As presented in Table E-14 of Appendix E, pesticides were present at relatively low concentrations (i.e., less than 0.014 ppm) from subsurface soil sampling locations across the Troy (Smith Avenue) Site. A total of 12 pesticides were detected; there were no detections of PCBs during the RI (see Table E-14). None of the pesticide occurrences were present at a concentration greater than NYSDEC soil clean-up objectives.

Thirteen subsurface soil samples, and two duplicate samples, were collected during the RI and analyzed for TAL metals. Twenty-three metals were detected in these subsurface soil samples, and 15 of these metals had concentrations which exceeded their respective soils comparison criteria (either NYSDEC soil cleanup objectives or maximum site background); see Table E-15, Appendix E. The concentrations for the metal analytes were, in general, approximately equivalent in magnitude throughout the geologic formations sampled at both on-site and background locations. This distribution suggests that the detected metal concentrations may be indicative of urban soils in the Site area or of naturally occurring background levels. Exceptions included a lower than typical concentration in MW-14 (for aluminum, less than half of the background values) and more elevated concentrations in SB-22 and MW-14 (up to approximately four times greater); see Table E-15.

None of the subsurface soil samples collected during the RI contained detectable levels of cyanide; see Appendix E, Table E-16.

TOC concentrations for the RI subsurface soils ranged from a low of 600 ppm (SB-11, 40 to 42 feet bgs) to a maximum value of 636,000 ppm (MW-14, 4 to 6 feet bgs). Results for TOC are presented in Table E-17 of Appendix E.

The 22 to 24 feet bgs sample from SB-22 was analyzed for TCLP constituents and RCRA parameters (see Tables E-18 through E-21). No VOC, SVOC, pesticide or herbicide compounds were detected in the sample, and of the two metals present (barium and mercury), neither analyte had a concentration which was greater than the TCLP maximum allowable concentration limits.

4.3.5 Groundwater Analytical Results

Round 3 - October 1997

During the Round 3 sampling for the RI, groundwater was collected from a total of 21 monitoring wells, including 11 monitoring wells that were not previously sampled. Analyses for the samples included full NYSDEC-ASP TCL organics, TAL metals and cyanide, and various water quality parameters. Tables E-47 through E-52 of Appendix E contain the analytical data for the October 1997 sampling round. In addition, Figure 4-4 presents the monitoring well concentrations of total BTEX and total PAHs.

The October 1997 sampling event resulted in the detection of eight VOCs (acetone, chloroform, 2-butanone, benzene, toluene, ethylbenzene, styrene, and xylenes), of which six were present at concentrations greater than NYSDEC water quality standards; see Table E-47. The non-BTEX constituents were detected at relatively low concentrations (i.e., up to 14 ppb). Groundwater samples from 10 of the monitoring wells contained BTEX constituents, with individual concentrations ranging from 1 ppb to 1,200 ppb. As shown in Figure 4-4, total BTEX concentrations were highest in MW-4A (663 ppb) which is located on the eastern portion of the Site near the fuel island, and in bedrock well MW-13 (2,001 ppb) which was installed at the end of Smith Avenue. The concentration in MW-4A has decreased by 38 percent from the Round 2 sampling in December 1995 and by 69 percent from the Round 1 sampling in October 1995 (see Section 4.2.4). No comparison can be made for MW-13 since it was recently installed. USMW-1 was not sampled in Round 3.

Eighteen PAH compounds and two phthalate compounds were detected in groundwater samples collected during the RI, and the SVOC results are provided in Appendix E, Table E-48. Of these SVOC compounds, there were ten constituents, all PAHs, which were detected above their respective NYSDEC water quality standards. Di-ethylphthalate and bis(2-ethylhexyl)phthalate were detected at less than 4 ppb in 9 monitoring wells (see Table E-48). In general, the following monitoring wells contained more elevated individual PAH concentrations: MW-6, MW-13, US-201, US-204, US-206, and USMW-2. Total PAHs ranged up to 7,695 ppb (MW-13), and these concentrations are shown in Figure 4-4. The above monitoring wells are located either at the end of Smith Avenue or on the central to southern portions of the ACOE property. These wells are screened across the water table (US-201, US-204, USMW-2), within the deep overburden (MW-6, US-206) or within the bedrock (MW-13).

MW-12, a newly installed bedrock well on the ACOE property, contained the only pesticide/PCB constituent detected during the RI. As presented in Table E-49, endrin was detected there at a concentration of 0.058 ppb. This concentration of endrin is not considered to be above NYSDEC water quality standards. The groundwater standard for endrin is a "non-detectable concentration" using an approved analytical method. The endrin concentration of 0.058 ppb is less than the practical quantitation limit of the analytical method (0.1 ppb) and the sample-specific quantitation limit (0.11 ppb) for this constituent.

Twenty-three metals were detected in Round 3 groundwater samples. Exceedances of NYSDEC water quality standards occurred for the following eleven analytes: antimony, arsenic, barium, beryllium, chromium, copper, iron, lead, magnesium, manganese, sodium, and thallium. As shown in Table E-50 of Appendix E, more elevated concentrations for all of the metal analytes were generally present in monitoring well US-201. This well also contained a majority of the maximum concentrations during the Round 2 sampling of the PSA Study; see Section 4.2.3. Many of the metal concentrations detected in the background well MW-1 during Round 3 were elevated (i.e., from 1.2 to 14.2 times greater) relative to the Round 1/Round 2 events. This may be due to the elevated turbidity levels of the groundwater (measurement of suspended particulate matter) from the well during the RI sampling event.

Detectable levels of cyanide were not present in any of the monitoring wells sampled during the RI; see Appendix E, Table E-51.

5.0 FATE AND TRANSPORT

5.1 INTRODUCTION

An understanding of the environmental fate and the potential transport mechanisms of the constituents present at the Troy (Smith Avenue) Site is necessary to determine the potential for continued on-site and off-site migration, and to assess the potential for exposure.

Two major characteristics affecting the fate and transport of a chemical are the persistence of the chemical in environmental media, and the mobility.

Persistence is the tendency of a chemical to remain in the environment. Persistence is influenced by many of the factors affecting chemical mobility (including solubility, sorption, and volatility), but is also a function of oxidation rates, hydrolytic and photolytic reactions, and biochemical processes (such as biodegradation and bioaccumulation).

Mobility is the tendency of a chemical to migrate through the environment. Mobility is controlled by both the physicochemical environment at a given site and the behavioral characteristics of individual chemicals. Important factors controlling the physicochemical environment of a site include the local climate, the configuration of surface water and groundwater bodies, and the nature of underlying soils and bedrock. Factors that control the behavior of individual compounds include aqueous solubility, susceptibility of a chemical to sorption, and volatility.

This section focuses on the fate and transport processes that may affect constituents associated with the Troy (Smith Avenue) Site. Detected compounds/analytes at the Site have been grouped into four categories sharing similar physicochemical and behavioral characteristics: [1] BTEX; [2] PAHs; [3] metals; and [4] cyanide. Section 5.2 contains information about the environmental behavioral characteristics of the above four constituents/constituent categories. In Section 5.3, potential transport and migration pathway routes that may affect the constituents are discussed relative to the data collected from the Site and relevant environmental characteristics of the contaminants. A summary of the fate and transport analysis findings, especially those routes that pose the greatest potential for migration at the Site, is presented in Section 5.4.

5.2 PERSISTENCE

In this section, the chemical characteristics and available fate and transport data are summarized. Each constituent or generalized constituent class is discussed (i.e., BTEX; PAHs; metals; and cyanide) along with a summary of the anticipated environmental fate characteristics. A summary of the behavioral characteristics that affect environmental fate and transport for the above categories is presented in Table 5-1.

5.2.1 BTEX

General physicochemical characteristics of BTEX (benzene, toluene, ethylbenzene, and xylenes) are listed in Table 5-1. Compounds of this class are mobile and not very persistent in the environment due to their high volatility, low to moderate (ethylbenzene only) adsorptive affinity to soils, low bioaccumulation potential, and high water solubility. In addition, biodegradation/biotransformation processes may further contribute to a low persistence in the environment.

5.2.2 PAHs

Operations at the Site produced MGP by-products such as PAHs. Nineteen PAH compounds (acenaphthene, acenaphthylene, anthracene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, benzo(g,h,i)perylene, carbazole, chrysene, dibenzo(a,h)anthracene, dibenzofuran, fluoranthene, fluorene, indeno(1,2,3-cd)pyrene, 2-methylnaphthalene, naphthalene, phenanthrene, and pyrene) were detected on the Site. As indicated by their physicochemical characteristics presented in Table 5-1, PAHs are persistent and generally immobile in soil matrices under normal environmental conditions. This is primarily due to their low aqueous solubility, their resistance to photolytic, oxidative and hydrolytic degradation, and their high affinity for adsorption to organic matter and soil particles. However, in the presence of highly mobile volatile organic compounds which can act as co-solvents, the mobility of PAHs in soils and/or aqueous matrices can be greatly enhanced. PAHs can be degraded by microbial populations; however, this degradation is generally a slow process in the environment. Among the PAHs, the lower molecular weight compounds, such as naphthalene, are more mobile in the environment, due to lower adsorptive affinities and higher aqueous solubilities. The carcinogenic PAHs tend to be higher molecular weight compounds, and are generally less mobile in the environment (i.e., more likely to sorb to soil particles). Some of the PAHs may exhibit substantial bioaccumulation (i.e., phenanthrene, fluoranthene); however, this effect is usually ephemeral, since most organisms have the ability to metabolize these compounds.

5.2.3 Metals

Numerous metals were detected in the various matrices sampled at the Site. Many of these metals are normal constituents of soil parental material and uncontaminated regional groundwater. However, a number of metals exhibited atypical environmental concentrations. These metals are aluminum, arsenic, barium, beryllium, chromium, cobalt, copper, lead, manganese, mercury, nickel, selenium, thallium, vanadium, and zinc. Relevant fate and transport data for the above metals are presented in Table 5-1.

Many of the fate and transport mechanisms that may be important for organic compounds have little impact on the metals. In addition, the metals are difficult to discuss in terms of behaviorally similar groups, and it is sometimes difficult to distinguish between naturally-occurring and introduced metals, particularly in the case of geochemical major (e.g., aluminum, calcium, iron, magnesium, potassium and sodium) and minor (e.g., barium and manganese) analytes. The characteristics of individual metals are generally better understood, and fate and transport profiles of the metals are presented in Appendix G.

The most important factors controlling metal fate and transport are solubility, redox behavior, aqueous speciation, and sorption behavior, all of which are functions of the ambient geochemical environment. In general, metals are persistent and of limited mobility within environmental matrices under normal environmental conditions. This persistence is primarily related to recycling mechanisms and removal mechanisms (i.e., precipitation, cationic exchange, adsorption, etc.) which decrease mobility. Chemical speciation of metals in the environment results in metals in both solid and aqueous media.

5.2.4 Cyanide

The cyanide functional group (-CN) can exist in a diverse group of organic or inorganic compounds whose fate and transport in the environment can vary greatly. The cyanide ion typically forms complexes with a variety of metals, especially transition series metals, with ferricyanides and ferrocyanides being the most prominent form typically encountered in the environment. Cyanides adsorb to a variety of materials, including clays, biological solids and sediments; however, sorption is typically not a significant immobilizing process due to the relatively high volatility, solubility and/or reactivity of most cyanide containing compounds. Generally, cyanides typically occur in water as: [1] free hydrocyanic acid; [2] simple cyanides; [3] easily decomposable complex cyanides and, [4] relatively stable complex cyanides.

In general, most cyanide compounds are typically mobile and not very persistent in the environment due to their high volatility (hydrogen cyanide, nitriles), high reactivity (principally hydrogen cyanide), high aqueous solubility (except for insoluble simple metal cyanides), low adsorption to soil, low bioaccumulation potential, and susceptibility to microbial, metabolic, photolytic (primarily iron cyanides) and hydrolytic degradation. However, since many of these compounds can be converted to other cyanide-containing compounds during various degradation/decomposition reactions, various forms may exist for some time in the environment, particularly if insoluble and/or stable cyanide-containing compounds are produced. Cyanides associated with MGP by-products typically occur as ferri-ferrocyanide which is a low toxicity compound. A complete fate and transport profile for cyanide is located in Appendix G.

5.3 POTENTIAL ROUTES OF MIGRATION

The fate and transport of contaminants at a given site are affected by the site-specific environmental characteristics, specifically the geology and soil type, geochemistry, hydrogeology, and climate. These environmental characteristics are described in detail in Section 3.0 for the Troy (Smith Avenue) Site.

Contaminants may migrate from a source area through a variety of mechanisms. The importance of a given migration mechanism is controlled by the specific physical, geochemical, hydrogeology and climatic conditions at a given site, as well as by the physicochemical characteristics of the contaminated media. The importance of each migration pathway to the Site and to the chemicals detected at the Site are discussed below relative to the conditions and features present at the Troy (Smith Avenue) Site.

5.3.1 Surface Water and Sediment Route

In general, contaminants may enter local surface waters (e.g., the Hudson River) through surface runoff and/or groundwater discharge, depending on a given site's conditions. Storm events can generate surface water runoff and ponding. Constituents, especially the more water soluble chemicals, may migrate into and/or within the surface water runoff. In addition, the runoff may be able to transport fine particulates that have contaminants adsorbed to them. Constituents may migrate within the groundwater (see Section 5.3.4) and enter a surface water body through groundwater infiltration and recharge. In addition to the above, limited deposition of airborne particulates to surface water bodies may occur at a given site.

Once in the surface water, migration transport can generally occur in two ways: via transport of contaminated material in the sediment load and through transport of dissolved components. Sediment transport is controlled by physical processes and is dependent on the rate of flow, which determines the sediment load capacity of the given water body. In more stagnant bodies of water, contaminated sediments will accumulate without further significant transport. In rivers and streams, increased flow rates increase the capacity to transport sediment away from sources (i.e., downstream). Points of deposition where sediments may accumulate are dependent on the river/stream system. In contrast to sediment transport, transport of dissolved components is a chemical process, generally controlled by the rate of release of the contaminant from the source, by the solubility of the contaminant, and by the rate of influx of a contaminated media (e.g., rate of groundwater discharge into surface water). The amount of contaminant transported is a function of the equilibrium dissolution/precipitation conditions of both the constituent and the water system.

For the Troy (Smith Avenue) Site, volatile organic compounds, such as BTEX, are not expected to persist in surface waters due to their rapid volatilization. In addition, they have low to medium affinities for adsorption and high aqueous solubilities, indicating that these volatiles are not likely to occur within the sediments. In comparison, PAHs have lower aqueous solubilities and higher affinities for adsorption. These compounds are more likely to be present in the sediments and/or to be transported in the sediment load. These behavioral characteristics are supported by the sampling data for the Site. Neither BTEX nor PAH compounds were detected in the surface water samples from the Hudson River. Sediment samples from the Hudson River contained only a few occurrences of BTEX constituents, with total BTEX concentrations present up to 0.011 ppm. Numerous occurrences of PAHs were detected in the sediments, and total PAHs were present at concentrations up to 31.5 ppm. Transport of metals in surface waters and sediments is controlled by the solubility of the individual metal, which is in turn controlled by the physicochemical characteristics of the water body. Cyanide compounds are generally not expected to persist in the surface water and sediment matrices due to their high solubility, high volatility, and low affinity for sorption. Cyanide was not detected in either the surface water or the sediment samples from the Hudson River.

5.3.2 Surface Soil Route

Contamination of surface soil generally occurs at a given site as a result of daily operations and/or disposal practices (e.g., surface spills). Transitory surface runoff and ponding of stormwater may occur in localized areas that are within or adjacent to areas of contaminated soil, and more water-soluble constituents may migrate within the surface runoff/ponded water and spread to surrounding surface soils. Surface runoff may also transport fine particulates that have constituents adsorbed to them to other surface soil areas, if the runoff flow is sufficient to entrain the particulates. In addition, dry, windy weather may result in the entrainment of contaminated particles from exposed surface soil into the atmosphere, with subsequent deposition over adjacent surface soils.

Migration of surface soil contamination would occur to a degree at the Troy (Smith Avenue) Site. The NMPC property is primarily covered with buildings or asphalt, which will significantly reduce the possibility of storm water ponding on and airborne disposition of contaminated surface soils. Surface water runoff on this portion of the Site drains to the west and down the embankment, entering the Hudson River. In general, the ACOE property is vegetated, with drainage of surficial water occurring through percolation. The relatively low concentrations of MGP by-products present in the surface soils (i.e., total BTEX at less than 0.006 ppm and total PAHs at less than 14.9 ppm) would reduce the significance of this migration route.

5.3.3 Subsurface Soil Route

Contamination of subsurface soil at a given site also generally occurs as a result of the historic disposal practices employed during site operations. As a consequence of these activities, chemical constituents located in these potential sources may migrate into and through the surrounding soils through percolation of rain, groundwater infiltration, and/or gravity.

As indicated by the analytical data, subsurface soils at the Troy (Smith Avenue) Site have been impacted by MGP by-product residual constituents, for example in the vicinity of the former gas holders on the ACOE property (see Section 4.0). Further migration of these constituents into and through the vadose zone soils would likely occur. Migration of contaminants into/through deeper soils is described below in Section 5.3.4. Although portions of the Site are covered by asphalt, much of the ACOE property area is vegetated. Rainwater would percolate through the vadose zone soils, leaching the more soluble constituents, such as BTEX. PAHs are more persistent and generally immobile in soil matrices under normal environmental conditions, primarily due to their low aqueous solubility and high affinity for adsorption. Metals are also persistent and of limited mobility within soil matrices under normal environmental conditions, lessening subsurface migration. Cyanide, with its high reactivity and low adsorption to particulates, tends not to migrate into and/or through the surrounding vadose zone subsurface soils, and the analytical data indicates that cyanide was not present in most of the soil sample locations.

5.3.4 Groundwater Route

In general, contaminants detected in subsurface soils and/or buried material at a site may migrate into groundwater by the percolation of rainwater through the soils/material and by the infiltration of groundwater into the contaminated area(s). Incorporation of contaminants into the groundwater may be through direct dissolution of contaminants from soil or buried material, or by dissolution into more water soluble organic compounds already entrained within the percolating rainwater (i.e., co-solvent effects).

Migration of contaminants in groundwater is controlled by two processes: advection and dispersion. Advection is the process by which dissolved contaminants are transported by the bulk motion of groundwater flow. Dispersion is the spreading of dissolved contaminants as they move within groundwater through two basic processes: molecular diffusion and mechanical mixing. Both advection and dispersion act on contaminants in solution. Contaminants associated with large soil particles generally are not transported by groundwater. However, some transport of fine particles (e.g., very fine clay, colloids) with adsorbed constituents may occur.

Volatile organics, such as BTEX, are characterized by high aqueous solubilities and low adsorptive affinities for soils. Due to the permeable nature of the Site soils (see Section 3.0), in conjunction with BTEX characteristics, dissolution and transport in groundwater is expected to be an environmental fate mechanism for these compounds. This is substantiated by the analytical data, which indicated relatively elevated concentrations of BTEX constituents in groundwater (i.e., up to 46,200 ppb for total BTEX). BTEX compounds were also present in nearby subsurface soils at elevated concentrations, and the groundwater is potentially leaching these relatively soluble constituents from the subsurface soils. As shown by the groundwater data, migration of low molecular weight PAHs (i.e., naphthalene, 2-methylnaphthalene, acenaphthene) and to a lesser extent, the higher molecular weight PAHs, in the groundwater is of importance for the Site.

The transport of metals in groundwater is a function of the solubility (and related leachability) of a given metal in a specific water mass under specific conditions. Transport of metals in groundwater may also occur, to some extent, with particulate phases to which the metals are adsorbed. Metals detected in the groundwater were generally also present in the overlying and/or nearby subsurface soils, which implies that the metals are migrating from the Site soils to and through the groundwater.

The high aqueous solubility and low adsorptive affinity of cyanide indicates that this constituent would likely migrate in the groundwater, if present. Cyanide was detected infrequently in the Site monitoring wells, at concentrations up to 60 ppb.

5.3.5 Air Route

Contaminants migrate into air through two distinct emission mechanisms: volatilization and entrainment of contaminated particles by the wind (e.g., fugitive dust emissions). VOCs can migrate into the air directly from surface and subsurface soils. Volatilization from surface materials is essentially unrestricted, and as such, is governed only by the physicochemical characteristics of a given compound under ambient conditions. Volatilization from subsurface materials is more complex, and factors such as soil moisture and permeability must be taken into account. The extent of particulate entrainment at a given site is governed in large part by climatic conditions (i.e., dry, windy conditions are more conducive to entrainment than wet, calm conditions). Other factors that affect entrainment of particulates include the extent of vegetated areas, and the grain size distribution of the surface soils.

The concentrations of the BTEX compounds in the surface soil and surface water samples from the Hudson River adjacent to the Site indicate that volatile emissions from these matrices should be relatively insignificant. Volatilization of BTEX from the subsurface soils, where these compounds were detected at elevated concentrations, is possible; however, it is likely limited due to the asphalt and vegetated surface covers across the Site. In addition, BTEX constituents were not detected during perimeter air monitoring of test pit excavation activities.

The airborne entrainment of contaminated soil particles is potentially a viable transport mechanism, especially for the PAHs and metals (i.e., those constituents with high adsorptive affinities). The majority of the Troy (Smith Avenue) Site is covered with either asphalt or vegetation; therefore, this mechanism would be limited. Airborne entrainment of particulates would only occur when intrusive activity in a contaminated area was performed at the Site. Air monitoring data collected during the test pit excavation activities indicated no detections of PAH compounds.

5.4 MOBILITY

The migration of detected constituents to underlying soils and groundwater by the percolation of rainwater and/or groundwater infiltration through contaminated soils is expected to be an environmental fate and transport mechanism at the Troy (Smith Avenue) Site. The soils data indicate the presence of BTEX and PAHs at elevated concentrations, and the analytical data show that groundwater migration is especially of importance for the BTEX constituents and the lower molecular weight PAH constituents (i.e., naphthalene, 2-methylnaphthalene, acenaphthene). Upon entering the groundwater, constituents migrate with the local groundwater flow until dispersion and attenuation mechanisms result in the reduction of their concentration to non-detectable levels.

Migration to the sediments is expected to occur primarily for constituents with higher adsorptive affinities, such as the PAHs. The nearby surface water of the Hudson River, although a viable route of migration from the Site, would not be a primary means of transport due to the low constituent concentrations detected in the surface water samples.

The surface soil and air migration routes would also not be principal environmental transport mechanisms for the Troy (Smith Avenue) Site. The majority of the Site is either paved with asphalt or vegetated, and generally low concentrations of MGP by-products were present near the surface. However, intrusive activities which occurred at the Site would increase the importance of these routes of migration.

6.0 BASELINE RISK ASSESSMENT AND FISH AND WILDLIFE IMPACT ANALYSIS

This section presents the results of both the qualitative baseline Human Health Risk Assessment and also the Fish and Wildlife Impact Analysis Step I through Step IIB performed on the Troy (Smith Avenue) Site. Each section below discusses the scope of work performed and the results of the assessment and analysis.

6.1 QUALITATIVE BASELINE HUMAN HEALTH RISK ASSESSMENT

6.1.1 Introduction

Section 6.1 presents the findings of a baseline Human Health Risk Assessment performed for the Troy (Smith Avenue) Site. The assessment and the information presented are designed to comply with NMPC's requirements under the Order on Consent. The latter requires an evaluation of Site exposures and risks according to the baseline Human Health Risk Assessment guidance provided in CERCLA. This risk assessment was prepared in accordance with the requirements set forth in the NYSDEC-approved RI Work Plan for the Troy (Smith Avenue) Site dated June 1997. The baseline risk assessment has been conducted to provide quantitative and qualitative information with which to evaluate the need for remedial action(s) for the Site.

The assessment described in Section 6 includes:

- An evaluation of overall Site conditions and the identification of specific Areas of Concern (AOCs), based on factors such as the potential for differential exposure behavior, patterns of contamination in various environmental media, and property ownership;
- An analysis of the compiled laboratory data and the identification of the Chemicals of Potential Concern (COPCs) for environmental media in each of the identified AOCs, using USEPA Risk Assessment Guidance for Superfund (RAGS); and
- Development of a conceptual exposure model for the Site which extends the exposure assessment to identify the plausible and complete exposure pathways for each AOC in consideration of actual current and reasonable anticipated future conditions. This exposure model (summarized in Section 6.1.4) is used as the framework for determining the appropriate set of exposure pathways during development of Site-specific Preliminary Remediation Goals (PRGs) in Section 7.

Section 6.1.2, and its associated appendix (Appendix F-1), describes the identification and selection of CERCLA-based COPCs for the AOCs at the Troy (Smith Avenue) Site. Section 6.1.3 presents the exposure assessment performed for the Site, including a description of the exposure setting and the identification of potentially exposed populations and exposure pathways. Section 6.1.4 summarizes the latter information as a conceptual Site model for potential exposures and risks.

6.1.2 Identification of Chemicals of Potential Concern

The following section documents the process used to identify the COPCs for applicable media within the three AOCs: the NMPC property, ACOE property, and the off-site (Douw Street) residential properties. The general process for COPC selection, as presented in USEPA, RAGS Part A (USEPA, 1989), includes:

- Compilation of data sets from validated analytical results collected from each medium and depth range;
- Identification of duplicate samples and averaging their results;
- Removal of results associated with non-detects at unusually high detection limits as defined in RAGS Part A;
- Elimination of compounds indicated to be present because of laboratory contamination;
- Compilation of frequency of analytical detections and minimum and maximum detected levels or concentrations;
- Elimination of essential human nutrients from consideration as COPCs (e.g., iron, magnesium, calcium, potassium and sodium);
- Comparison of maximum detected contaminant levels or concentrations of naturally-occurring compounds to local measured background values, as defined by the Background Upper Tolerance Limit (BUTL) (see below and Appendix F-1 for details on calculations); and
- Consideration of any other factors (i.e., low frequency of detection and low maximum and average detection levels relative to the sample quantitation limit) which either support the indicated presence or absence of a particular compound in that medium and depth range.

BUTLs were calculated (see Equation F-1-1, Appendix F) for naturally-occurring compounds in each medium based on available samples from areas considered to be unimpacted. The BUTL is designed to represent the maximum concentration of 95 percent of the background population of analytical samples. The calculation of the BUTL assumes that the analytical data are normally distributed and requires lognormally distributed data be transformed to more closely approximate a normal distribution. For screening analytes against background conditions, the maximum level for each analyte is compared to the respective BUTL.

If the maximum Site concentration was less than the respective BUTL, the compound was considered to be within the range of background concentrations and was not considered a COPC. However, given that the BUTL only defines 95 percent of the background samples, it is possible that some samples will exceed the BUTL even though they are part of the background condition. This will occur more frequently for areas sampled more extensively (i.e., with higher numbers of samples).

For compounds for which a BUTL could not be calculated (due to an insufficient number of background samples or the fact that the compound was not a naturally occurring constituent), the maximum detected background concentration or the non-detect sample quantitation limit for that compound (characteristic of good laboratory procedure and practice), was used as a comparative benchmark concentration for screening purposes.

In addition to these CERCLA established criteria, consideration must also be given to the fact that a few analytes and compounds not associated with former MGP operations at the Site were detected in several samples at concentrations below conservative risk-based screening levels. Because less than 20 samples were collected and analyzed in each of the three AOCs for a particular medium, these compounds could not be eliminated strictly on the basis of low frequency (i.e., <1/20). However, in consideration of all these factors, these analytes and chemicals pose no practical human health concern at the Site and therefore were eliminated from further evaluation. Carcinogenic (EPA Class A) constituents were not eliminated in this basis.

Further details on the specific criteria used to identify COPC for applicable media in each AOC are presented in Appendix F-1. Table 6-1 summarizes the COPCs selected for each medium for the NMPC property, the ACOE property, and the off-site (Douw Street) properties. NMPC property and ACOE property COPCs are combined in the list presented in Table 6-1 on the findings that the majority of COPCs are identical, the properties are each a portion of the original MGP Site, and share potential source areas. The single exception is the finding of pesticides in the soil at the ACOE property at levels consistent with pest control efforts. Tables F-1-11 and F-1-12 present the individual lists of COPCs. No COPCs were identified for the Hudson River environmental media relative to the Human Health Risk Assessment. Tables F-1-11 through F-1-14 in Appendix F provide justification as to the rationale for the inclusion or exclusion of detected contaminants as COPCs in each AOC, respectively.

NMPC Property

Three surface soil samples were collected from the NMPC property from depths of 0 to 2 inches below ground surface (bgs) and analyzed for the surface soil investigation. Samples were collected during two sampling events in July 1994 and September 1997. Two samples were analyzed for BTEX, PAHs, cyanide, and total organic carbon (TOC), and the other was analyzed for VOCs, SVOCs, pesticides/PCBs, metals, cyanide and TOC (see below). Sample locations are shown in Figure 1-2.

Sixty-six subsurface soil samples were collected in two sampling rounds (July 1994 and September 1997) from the NMPC property from depths of 6 inches to 52 feet bgs and analyzed. Three field duplicates were collected and analyzed for samples SB-4, MW-2A, and TP-4. Twenty-one samples were analyzed for VOC, SVOC, pesticides/PCBs, metals, and cyanide; the remaining 45 samples were analyzed for BTEX, PAHs, and cyanide. The location of these samples can be seen in Figure 1-2.

One complete round of groundwater samples was collected in October 1997 (Round 3) from eight monitoring wells on the NMPC property and analyzed. One field duplicate, associated with monitoring well MW-7S during the October 1997 (Round 3) sampling period, was collected and analyzed. The location of each monitoring well is identified in Figure 1-2. Samples were analyzed for VOCs, SVOCs, pesticides/PCBs, metals, and cyanide.

Tables F-1-1 through F-1-3 in Appendix F-1 provide a summary of the chemicals detected in the NMPC property surface soils, subsurface soils and groundwater, listed by class, as well as their frequency of detection, minimum and maximum detected levels, and concentrations for surface soil, subsurface soils and groundwater. Table F-1-11 lists the COPCs identified for the surface soil, subsurface soils and groundwater in the NMPC property.

ACOE Property

Four surface soil samples were collected from the ACOE property from depths of 0 to 2 inches bgs and analyzed for the surface soil investigation. Samples were collected during two sampling events in July 1994 and September 1997. Three samples were analyzed for BTEX, PAHs, cyanide and TOC, and the other was analyzed for VOCs, SVOCs, pesticides/PCBs, metals, and cyanide. Sample locations are shown in Figure 1-2.

Thirty-six subsurface soil samples were collected from the ACOE property from depths of 6 inches to 48 feet bgs and analyzed. Two field duplicates were collected and analyzed for samples SB-10 and SS-4. The location of these samples can be seen in Figure 1-2. Analysis included VOCs, SVOCs, pesticides/PCBs, metals, and cyanide for 11 samples and BTEX, PAHs, and cyanide for the remaining 25 samples.

Seven groundwater samples were collected in October 1997 (Round 3) from the monitoring wells in the ACOE property and analyzed. The location of each monitoring well is identified in Figure 1-2. Samples were analyzed for VOCs, SVOCs, pesticides/PCBs, metals and cyanide.

Tables F-1-4 through F-1-6 in Appendix F-1 provide a summary of the chemicals detected in the ACOE property surface soils, subsurface soils and groundwater, listed by class, as well as their frequency of detection, minimum and maximum detected levels, and concentrations for surface soil, subsurface soils and groundwater. Table F-1-12 lists the COPCs identified for the surface soil, subsurface soils and groundwater in the ACOE property.

Off-Site (Douw Street)

One surface soil sample was collected from the off-site (Douw Street) property from a depth of 0 to 2 inches bgs and analyzed for the surface soil investigation. The sample was analyzed for BTEX, PAHs, cyanide and TOC. The sample was not analyzed for metals. The sample location is shown in Figure 1-2.

Four subsurface soil samples were collected in the off-site (Douw Street) property from depths of 2 to 52 feet bgs and analyzed. The four samples were analyzed for BTEX, PAHs and cyanide. The location of these samples can be seen in Figure 1-2.

Groundwater samples were collected in October 1997 (Round 3) from two monitoring wells in the off-site (Douw Street) property and analyzed. The location of each monitoring well is identified in Figure 1-2. Samples were analyzed for VOCs, SVOCs, pesticides/PCBs, metals, and cyanide.

Tables F-1-7 through F-1-9 in Appendix F-1 provide a summary of the chemicals detected in the off-site (Douw Street) property surface soil, subsurface soils and groundwater, listed by class, as well as their frequency of detection, minimum and maximum detected levels, and concentrations in subsurface soils and groundwater. Table F-1-13 lists the COPCs identified for subsurface soils and groundwater in the off-site (Douw Street) property.

Hudson River

Sediment samples were collected from the Hudson River at a distance of at least 10 feet from the shore line. These sediments are never exposed to the surface, dryout, or otherwise available for human exposure. Therefore, sediment COPCs are not selected for the human health risk evaluation of sediments due to the lack of a complete exposure pathway.

Surface water samples were collected on September 22, 1997, from four locations along the Hudson River adjacent to the Site. One field duplicate was collected and analyzed for sampling location SW-3. Sampling locations are shown in Figure 1-2. The samples were analyzed for VOCs, SVOCs, pesticides/PCBs, metals, and cyanide.

Table F-1-10 provides a summary of the chemicals detected in the surface water of the Hudson River, listed by class, as well as their frequency of detection, and minimum and maximum detected levels. Table F-1-14 lists the rationale for all COPCs identified for the surface water. As shown in the table, there were no COPCs selected for evaluation in the Human Health Risk Assessment.

6.1.3 Exposure Assessment

To characterize the risks associated with potential exposures to COPCs identified at the Site, an exposure assessment was conducted to identify current and reasonably anticipated future Site uses, potentially exposed receptors, the pathways and routes by which each receptor may be exposed to the COPCs, and the frequency and intensity of the anticipated exposures. These components, as critical elements of the exposure assessment, are discussed in the following sections.

The exposure assessment has been conducted in accordance with guidance presented in RAGS: Part B, Development of Risk-Based Preliminary Remediation Goals (USEPA, 1991), using Reasonable Maximum Exposure (RME) assumptions, augmented by Site-specific exposure information where justified by Site conditions or required in the absence of guidance for a particular exposure pathway by current risk assessment practices in the geographic region.

6.1.3.1 Exposure Setting

The Troy (Smith Avenue) Site is located adjacent to the Hudson River at Smith Avenue in Troy, Rensselaer County, New York. Figure 1-1 depicts the Site location (USGS - North Troy Quadrangle). The Site occupies a total of approximately five acres and is divided into two properties (Figure 1-2). The southern and northeastern portions of the Site are owned by NMPC and are currently used as a natural gas distribution facility and service center. The northwestern portion of the Site, bordering the Troy Lock on the Hudson River, is owned by the U.S. Government. This property includes an active ACOE field office that supports the operation and maintenance of the Troy Lock and Dam.

Most of the NMPC property is paved. The south side of the Site includes an office building with a paved parking lot extending to the fence line to the east and west and to within approximately 20 feet of the fence line to the south. To the north are two steel-sided buildings used for maintenance and storage and one brick-sided garage building (see Figure 1-2). Four gasoline dispensing pumps are located west of the brick garage building near the center of the Site. The northern extremes of the NMPC property, bordering the property lines, are areas of open equipment storage. Most of the unpaved areas are covered by gravel. A wooded strip along the Hudson River and a grassy strip along the southern boundary are the only vegetated areas.

The ACOE-owned portion of the former MGP Site is entirely covered by either grass lawn or buildings. The lower portion of the Troy Lock forms the western boundary of this property (see Figure 1-2). A small building is used as an office is located in the northwestern corner of the property.

Groundwater beneath the Site ranges in depth from approximately 15 to 28 feet bgs, and flows in a westerly direction toward the Hudson River. The Hudson River is classified as a Class C freshwater body.

Currently, Site use is industrial/commercial in nature. It is reasonably anticipated that, in the future, Site use will remain industrial/commercial. Drinking water from the City of Troy and the Site is supplied from the Hudson River via a reservoir. The Site is currently serviced by municipal water and sewer. No private wells are reported within a one-mile radius of the Site. Since the City of Troy does not allow a single distribution system to be connected to both municipal and private water supplies, there are no cost savings to using water from a private well (a single fee is charged for municipal water use); thus, it is highly unlikely that private wells will be installed in the area in the future.

The Site has been divided into three separate properties or AOCs for the baseline Human Health Risk Assessment to account for differences across the Site that directly affect the likelihood or magnitude of current or potential future exposures. These differences relate to:

- Ownership;
- Topographic features and physical accessibility to the AOCs;
- Extent of exposed surface soil;
- Nature of contaminated media present; and
- Current and future foreseeable Site activities and uses, deed restrictions and the existing Site Health and Safety Plan.

In consideration of these differences, the three individual AOCs were defined as the NMPC, ACOE, and off-site (Douw Street) properties (see Figure 1-2). Each of these AOCs is discussed below.

NMPC Property

The NMPC property is currently used for the operation of a natural gas distribution facility and service center. Employees are present in the office/crew quarters and, occasionally, in each of the other buildings. The Site is paved or gravel-covered (80 percent) with unpaved, vegetated areas near the southern fence and the river (Figure 1-2). The property is bordered by a chain link fence with locked gates. Underground utilities, associated with the natural gas distribution and vehicle service station underground storage tanks are present in the northern portion of the property.

ACOE Property

The commercial/industrial property consists of the ACOE lock maintenance property which is located on the northwest portion of the Site. This property is bounded by the Hudson River on the west, the Site on the east and south, and Clinton Street on the north. The Site is mowed grass with two buildings including a house converted to office use by the lock attendants and a small storage shed. Access to this portion of the Site is controlled by the ACOE which maintains a fence and gate.

Off-Site (Douw Street) Property

The off-site (Douw Street) property consists of a junk yard adjacent to the Hudson River and a series of residential properties which are located to the east. As shown on the map (Figure 1-2), the residences on the south side of the Site are in close proximity to the Site and the junk yard. One residence has a swimming pool noted on the map. Exposures to Site constituents are based on the presence of those constituents in the soil and groundwater samples obtained from the off-site (Douw Street) property. These include surface soil, subsurface soil and groundwater.

Identification of Potentially Exposed Populations and Exposure Pathways

Exposure scenarios were developed for the Site in which current and reasonably anticipated future Site activities and uses were examined to identify potential receptors, pathways and routes of exposure to COPCs identified in various media. The baseline risk assessment used this conceptual model to estimate potential exposures and to develop Preliminary Remediation Goals (PRGs) for each impacted medium associated with the various AOCs.

The receptors identified may be exposed to COPCs in one or a combination of the following contaminated media at, or near the Site, depending on the specific activities assumed to occur now and in the future:

- Surface soil (0 to 2 inches bgs);
- Subsurface soil (greater than 2 inches bgs);
- Groundwater;
- Air contaminated with soil particulates; and
- Air contaminated with volatilized organics.

The Hudson River supports recreational fishing. Currently, however, NYSDEC has instituted a fish consumption advisory for a variety of species of gamefish due to widespread PCB contamination in the upper Hudson River estuary. The river bank is accessible from the southern end of the property at the end of Douw Street. The river bank is steep, wooded, and the river edge is rock covered.

Since the Hudson River sediments were not accessible (due to their distance from shore, rocky or precipitous shore features, and continual submersion), this environmental medium was not evaluated further in the human health exposure assessment or the baseline risk assessment.

Since no COPCs were identified for the Hudson River surface water, this environmental medium and the associated pathways were not evaluated further in the Human Health Risk Assessment.

The following exposure routes and pathways were identified as potentially leading to receptor exposures:

- Direct (dermal) contact with soil;
- Incidental ingestion of soil;
- Inhalation of air contaminated by soil particulates or volatilized organics;
- Ingestion, inhalation of, and dermal contact with groundwater developed for local residential or commercial use;
- Direct (dermal) contact with groundwater used to fill swimming pools; and
- Incidental ingestion of groundwater used to fill swimming pools.

Ingestion of groundwater at the NMPC property, as a source of potable water, is not considered a likely route and pathway of exposure for the following reasons:

- The NMPC property and surrounding areas are serviced by municipal water;
- NMPC is committed to the institution of deed restrictions on its property (the NMPC property) that will preclude its use for residential purposes in the future and the extraction and use of shallow groundwater from beneath the Site as a potable water supply; and
- Depth to groundwater on NMPC property is 15 to 28 feet bgs., and is not expected to be encountered during routine utility excavation. NMPC is committed to continuing the implementation and enforcement of its Health and Safety Plan (HASP) for Site operations, which minimizes intrusive subsurface activities, requires on-site activities to be performed by OSHA-trained personnel, and controls and limits potential exposures to groundwater.

Exposures to groundwater COPCs at the Site would most likely be associated with development of the shallow water bearing zone for residential or commercial/industrial use. However, these exposures are considered highly unlikely on the NMPC property, because of the implementation and enforcement of the NMPC HASP. They were evaluated for the ACOE property and the adjacent residential property, due to the absence of knowledge of a similar HASP for ACOE workers and due to the presence of the residences and private swimming pools nearby.

Ingestion of fish from the Hudson River has not been evaluated as a current or reasonable anticipated future exposure pathway in the exposure assessment. Even though fish are present in the Hudson River, NYSDEC has instituted a fish consumption advisory for a variety of species of gamefish due to widespread PCB contamination in the upper Hudson River estuary, the source of the fish present in the Hudson River at Troy. Therefore, the fish ingestion exposure pathway (potentially associated with a recreational angler) has not been evaluated further in this exposure assessment. Further details of the Fish and Wildlife Study are presented in Section 6.2 of this Report.

USEPA guidance stipulates that Remedial Action Objectives (RAOs) for CERCLA remediations should be linked to the protection of plausible receptors under reasonably anticipated current and future land use scenarios, and be consistent with the set of Standards, Criteria and Guidance

(SCGs) identified as applicable, relevant and appropriate for the Site based upon the current and reasonably anticipated future land and groundwater use. A combination of NMPC commitments to implement and maintain certain institutional controls, City of Troy zoning considerations, and the physical features and characteristics of the Site, serve to define and limit the current and reasonably anticipated future uses and activities at the Site, and which corresponding exposure routes and pathways of exposure are considered plausible.

These commitments and considerations are:

- NMPC is committed to institute deed restrictions on its property (the NMPC property) that preclude its residential use in the future. These restrictions would prevent completion of the most likely exposure pathways for children and adults in the residential setting. This deed restriction is consistent with and is a logical extension of industrial zoning designation for the area.
- NMPC is also committed to institute deed restrictions on its property that preclude the extraction and use of groundwater from beneath the Site in the future. These restrictions would prevent completion of the most likely exposure pathways associated with consumptive and non-consumptive uses of the groundwater. This deed restriction is consistent with current servicing of the property by the municipal system. In addition, the City of Troy assesses a combined water and sewer fee, regardless of whether the facilities at each property are tied into the system or not, which removes any economic incentive to install, operate and maintain an independent well system.
- NMPC is committed to continuing to implement and enforce its HASP for Site operations. This HASP, which is currently in effect, requires that intrusive activities at the Site are minimized, and intrusive activities are performed only by OSHA-trained workers. Continued application and enforcement of the HASP precludes completion of the most likely routes and pathways of exposure to contaminants in Site soils and groundwater for workers performing intrusive construction and utility maintenance activities. Specifically, use of the HASP procedures and personal protective equipment (PPE) mitigates exposures to contaminants via direct contact, incidental ingestion and inhalation.
- The ACOE property is not owned by NMPC. Consequently, future use of the land and groundwater on this property cannot be restricted or controlled by NMPC. However, certain features of the property reduce the plausibility of residential use in the future: 1) current zoning as industrial precludes residential development without a variance; 2) the current land use (i.e., support of the Troy Lock), is expected to continue for the foreseeable future, at least 30 years. Consequently, whereas residential land use and the installation and operation of a drinking water well on the property are considered highly implausible, potential exposures to groundwater cannot be fully excluded, and are retained only for purposes of establishing RAOs for the ACOE property.
- The off-site residential properties are not owned by NMPC. Consequently, future use of the land and groundwater cannot be restricted or controlled by NMPC. While it is plausible that these properties could be developed for commercial/industrial use, as

they are located in a mixed residential/industrial area, this land use is not considered separately for these properties. Current land use is considered to continue in the future with the potential of development of groundwater wells for domestic consumption and for filling the current and potential future backyard swimming pools. Whereas residential installation and operation of a drinking water well on the properties are considered implausible, potential exposures to groundwater cannot be fully excluded, and are retained only for purposes of establishing RAOs for the off-site residential property.

Consequently, the following potential receptors were evaluated for the three AOCs under current and/or future Site conditions:

- NMPC property: commercial worker; adolescent trespasser;
- ACOE property: commercial worker; maintenance/utility worker; construction worker; adolescent trespasser; and
- Off-site residential properties: adult and child residents.

Based on the current uses of the surrounding properties and NMPC's commitment to implement deed restrictions on the NMPC property, the potential for any part of the Site to be used in the future for farming or other agricultural purposes is considered highly unlikely. Therefore, a farmer was not considered as a potential receptor for any of the land AOCs.

The following discussion summarizes the evaluation of the potential exposure routes and pathways considered for each receptor, and identifies which of the exposure pathways were considered to be complete and/or significant. The justification for not quantifying other possible exposure pathways that could be linked to a potential receptor also is provided.

Commercial Worker

Commercial Workers could potentially be exposed to COPCs in the surface soils in the unpaved or undeveloped portions of the Site, while mowing grass and/or operating vehicles or other outdoor equipment as part of their duties, either through direct dermal contact, incidental ingestion, or inhalation of entrained and resuspended particulates or voltilized constituents. These potential routes of exposure would be limited or constrained by the extensive paved and gravel cover on the NMPC property (80 percent covered), the presence of a vegetative cover in locations requiring mowing, the limited extent of the routine duties of the worker, and the presence of frozen soil and/or snow cover on the Site for a significant portion of the year. In addition, since the Commercial Worker will be indoors for a portion of the work day, exposure to contaminants that have migrated to indoor air also is possible. This potential exposure scenario for a Commercial Worker was considered applicable to both current and future Site conditions at both the NMPC property and the ACOE properties.

The pathways quantified in this risk evaluation were:

- Direct contact with surface soil;
- Incidental ingestion of surface soil;
- Inhalation of entrained surface soil particulates; and

- Inhalation of volatiles from domestic groundwater use on the ACOE property.

Other pathways were considered but not quantified for this receptor in the risk evaluation. These pathways were:

- Exposures to contaminants volatilized from the surface and subsurface soil or groundwater and released to the open air. The potential for indirect exposures to volatile COPCs detected in soil and groundwater, through the inhalation of impacted outdoor air, is considered negligible under current Site conditions due to dilution and dispersion of the vapors in ambient air. Air samples collected as part of the health and safety program to monitor sample collection from the test pits, indicated that volatile chemicals were not present in detectable concentrations in the air down wind of exposed contamination. Since the amount of any volatile contaminant remaining in the soil and groundwater will decrease with time, this exposure pathway is also considered negligible under future Site conditions. Therefore, this exposure pathway was not further evaluated.
- Exposures to subsurface soil (i.e., incidental ingestion, direct contact, and inhalation of particulates). These exposures are only possible if the ground surface is disturbed to a sufficient depth over an appreciable areal extent. The Commercial Worker, by definition, would not be engaging in activities that would cause such a disturbance of the surface soil cover at the Site. Therefore, this exposure pathway and routes were not retained for quantitative evaluation.
- Pathways associated with groundwater use (i.e., consumption and direct contact). It is assumed that a Commercial Worker would not be directly exposed to groundwater, should excavation activities occur in the future at the Site.

The Commercial Worker is identified as an adult male, 70 kg average body weight, involved in moderate physical activities, resulting in an average inhalation rate of 0.83 m^3/hour. Under a worst-case, most conservative current and future scenario, outdoor exposures are assumed to take place five days per week for the warmest seven months of the year (approximately 140 days per year) for a period of 4 hours per day. The incidental ingestion rate of soil was set at 100 mg/day and dermal contact with COPCs assumed via the hands and face. The resuspension of soil particulates for the ACOE property was estimated based on a particulate emission factor (PEF) of 1.32×10^9 m^3/kg (USEPA, 1996) which is consistent with a 50 percent vegetative cover and no activities involving excavation or vehicular traffic. Indoor exposures are assumed to occur 8 hours a day, 250 days of the year. The conservative assumption was made that the commercial/industrial worker could be exposed for as long as 12 hours per day during the summer months. The chronic exposure duration for each of the commercial exposure scenarios is 25 years. The complete list of exposure parameters, values, and sources is presented in Appendix F-2, Table F-2-1.

Utility/Maintenance Worker

A Utility/Maintenance Worker could potentially be exposed to COPCs while digging through the surface soils to the subsurface soils to maintain or repair the underground utilities or building foundations currently at the Site, either through direct contact, incidental ingestion, or inhalation. These potential routes of exposure and their frequency and duration will be limited or constrained by the location(s) of the subsurface utility or structure to be maintained or repaired, the extent of the excavation(s) required, and the frequency at which such maintenance and repairs have typically been conducted. This potential exposure scenario was only considered applicable to current and future Site conditions at the ACOE property due to the commitment to continue to enforce the existing HASP on the NMPC property.

The pathways quantified in this baseline risk assessment were:

- Direct contact with surface soil;
- Incidental ingestion of surface soil;
- Inhalation of entrained surface soil particulates;
- Inhalation of volatiles from surface soil;
- Inhalation of volatiles from subsurface soil;
- Direct contact with subsurface soil;
- Incidental ingestion of subsurface soil; and
- Inhalation of entrained subsurface soil particulates.

Other pathways were considered but not retained for the risk assessment for the receptor. These pathways were:

- Exposures to groundwater contaminants by incidental ingestion or dermal contact. The depth to groundwater (15 to 28 feet bgs) is such that exposure of the groundwater by routine maintenance and utility work is considered unlikely to occur.

The Utility/Maintenance Worker is identified as an adult male, 70 kg average body weight, involved in moderate physical activities resulting in an average inhalation rate of 0.83 m^3/hour. Subchronic exposure is conservatively assumed to occur within a single month (22 working days) for a period of 8 hours per day. The incidental ingestion rate of soil was set at 100 mg/day and dermal contact with COPCs assumed via the hands and face. The resuspension of soil particulates was estimated based on a PEF of 1.32 x 10^9 m^3/kg (USEPA, 1996) which is based on exposed soil with 50 percent vegetative cover. The complete list of exposure parameters, values, and sources are presented in Appendix F-2, Table F-2-2.

Construction Worker

Future uses of all or part of the Site could require the demolition or renovation/rehabilitation of existing structures and/or the construction of new buildings (facilities and/or residences). Such demolition/construction activities are likely to be of limited duration, but could expose a Construction Worker to contaminated surface and subsurface soils, as well as to shallow groundwater, through direct contact, incidental ingestion, or inhalation. These potential exposures would be limited or constrained by the locations of the new structures or facilities, and by the extent of excavation that may be necessary to perform the required work (impacting the extent and period of time that contaminated soil may be exposed). This potential exposure scenario was only considered applicable to future Site conditions on the ACOE property, as NMPC is committed to continue implementation of the existing HASP on the NMPC property.

The pathways quantified in this baseline risk assessment were:

- Direct contact with surface soil;
- Incidental ingestion of surface soil;
- Inhalation of entrained surface soil particulates;
- Inhalation of volatiles from surface soil;
- Inhalation of volatiles from subsurface soil;
- Direct contact with subsurface soil;
- Incidental ingestion of subsurface soil; and
- Inhalation of entrained subsurface soil particulates.

Exposure to shallow groundwater was not retained for the construction worker as the depth to groundwater (15 to 28 feet bgs) is such that groundwater is not likely to be encountered.

The Construction Worker is identified as an adult male, 70 kg average body weight, involved in moderate physical activities resulting in an average inhalation rate of 0.83 m^3/hour. Subchronic exposure is assumed to occur for 100 days during a one (1) year construction project for 8 hours per day. The incidental ingestion rate for soil was set at 500 mg/day, and dermal contact with COPCs assume via the hands, legs and face. The resuspension of soil particulates was estimated based on a PEF of 4.63×10^9 m^3/kg (USEPA, 1991) which is based on exposed soil with no vegetative cover. This is consistent with construction activities. The complete list of exposure parameters, values, and sources is presented in Appendix F-2, Table F-2-3.

Adolescent Trespasser

Although the Site is currently surrounded by fencing, this is not assumed to be a permanent nor completely effective means for limiting potential exposures to COPCs. An Adolescent Trespasser could gain access to the Site and could potentially be exposed to COPCs in a combination of the contaminated media present. An adolescent between the ages of 12 and 17 years was selected as representative of this potential receptor, since a younger child trespasser would find it more difficult to travel to and access the Site. This exposure scenario was considered applicable for both current and future Site conditions for the NMPC property and ACOE property.

The pathways quantified in this risk evaluation for this receptor were:

- Direct contact with surface soil; and
- Incidental ingestion of surface soil.

Other pathways for the Adolescent Trespasser considered but not quantified for the qualitative baseline risk assessment were:

- Exposures to contaminants volatilized from the surface and subsurface soil or groundwater and released to the open air. The potential for indirect exposures to volatile COPCs detected in soil and groundwater, through the inhalation of impacted outdoor air, is considered negligible under current Site conditions due to dilution and dispersion of the vapors in ambient air. Air samples collected as part of the health and safety program to monitor sample collection from the test pits, indicated that volatile chemicals were not present in detectable concentrations in the air down wind of exposed contamination. Since the amount of any volatile contaminant remaining in the soil and groundwater will decrease with time, this exposure pathway is also considered negligible under future Site conditions. Therefore, this exposure pathway was not evaluated further.

- Exposures to the subsurface soil (i.e., incidental ingestion, direct contact, and inhalation of particulates). These exposures are only possible if the ground surface is disturbed to a sufficient depth over an appreciable areal extent. An adolescent trespasser may dig in Site soils, but would be unlikely to engage in activities that would cause a marked disturbance of and exposure to subsurface soils. Therefore, this exposure pathway was not retained for quantitative evaluation.

The body weight used for the Adolescent Trespasser was 40 kg, the approximate 50th percentile of body weights for a 12 year-old male and 11 year-old female (USEPA, 1990). Subchronic exposure was assumed to occur primarily during summer months and was conservatively set at 40 days for 2.5 hours per day, which represents half of the average daily time spent outdoors by older children (USEPA, 1995). The ingestion rate of soil was set at 100 mg/day and dermal contact with COPCs was assumed via the hands, arms, legs and face. The complete list of exposure parameters, values, and sources is presented in Appendix F-2, Table F-2-4.

Off-Site Resident

The resident may be exposed to COPCs in Site surface soils and groundwater. While the resident is not considered to have direct contact with the Site media, entrained particulates derived from the surface soil and dissolved COPCs in the groundwater may be transported across the property/fence line to the receptors.

Pathways quantified in this risk evaluation were:

- Inhalation of airborne particulates;
- Ingestion of groundwater as a drinking source;
- Inhalation of vapors from domestic groundwater use; and
- Dermal contact with groundwater used for bathing or filling swimming pools.

Also considered, but not retained for quantitation in this risk evaluation for the residential receptor, was incidental ingestion of groundwater during swimming. This exposure was not retained as the exposure frequency and the ingestion rate would be insignificant compared to intentional ingestion of groundwater as drinking water.

The resident used for exposure to non-carcinogenic constituents is considered to be either an adult (greater than 7 years old) or a child (less than 6 years old) who lives on-site for 30 years. Both receptors are assumed to have a chronic exposure of 16 hours per day for 350 days per year. The child's age specific exposure parameters are: ingestion of 1 liter of water per day, ingestion of 200 mg of soil per day, a whole body skin surface area of 1.06 m^2, and a body weight of 15 kg. The adult's exposure parameters are: ingestion of 2 liter of water per day, ingestion of 100 mg of soil per day, a whole body skin surface area of 2.28 m^2, and a body weight of 70 kg. Both receptors are assumed to engaged in moderate to light physical activity consistent with a residential scenario and resulting in an average inhalation rate of 0.625 m^3/hr. The complete list of exposure parameters, values and sources for the child and adult receptors are presented in Appendix F-2, Table F-2-5 and Table F-2-6, respectively.

The composite child/adult resident used for exposure to carcinogenic constituents is a life time (30 year) resident. Six years are allocated to the young child (0-6 years old) with a body weight of 15 kg, and 24 years allocated to the adult (greater than 18 years old) with a body weight of 70 kg. The intake rates (ingestion and inhalation) and dermal surface area are similarly allocated. The child has a water ingestion rate of 1 liter per day, an inhalation rate of 0.83 m^3/hr and a whole body skin surface area of 1.06 m^2. The adult groundwater ingestion rate is 2 liters per day, the inhalation rate is 0.83 m^3/hr and a whole body skin surface area of 2.28 m^2. The surface area is based on the 95 percentile of the whole body surface for males in the represented age group. The PEF for surface soil particulates is 1.32×10^9 m^3/kg, which is consistent with 50 percent vegetation cover and no excavation or vehicular traffic. The calculation of the composite factors is presented in Table F-2-8. The complete list of exposure parameters, values, and sources is presented in Appendix F-2, Table F-2-7.

6.1.4 Summary of Conceptual Site Exposure Model

Table 6-2 outlines the receptors and exposures that were quantitatively evaluated at each AOC under current or future Site activities and uses for the Site baseline risk assessment. The exposure assessment indicates that on-site exposures are limited to surface soil exposures and that the NMPC institutional controls, as presented in Section 6.1.3.1, preclude exposure to the on-site groundwater. Off-site ACOE or residential property exposures are consistent with unrestricted use of the soil and groundwater in either a commercial or residential setting, respectively.

6.2 FISH AND WILDLIFE IMPACT ANALYSIS

This Fish and Wildlife Impact Analysis (Step I and Step II A-B) for the Troy (Smith Avenue) Site has been prepared as part of the RI. This impact analysis has been conducted in accordance with guidance provided in Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites (NYSDEC, 1994).

6.2.1 Purpose and Objectives

The objectives of Step I are (1) to identify fish and wildlife resources that may potentially be affected by Site-related contaminants; and (2) if such resources are present, to provide the necessary information for a remedial investigation of these resources.

The objectives of the Step II A-B evaluation are (1) identify contaminant transport pathways from the Site to areas supporting fish and wildlife resources; and (2) perform a criteria specific comparison of contaminant concentrations to appropriate ecological benchmark criteria and guidance values. A Site reconnaissance was performed by Foster Wheeler ecologists to identify fish and wildlife resources in the Site vicinity and determine the potential for impacts resulting from exposure to Site-related contaminants. The information collected through correspondence with state and federal agencies and during the reconnaissance was used to identify fish and wildlife resources within a two-mile radius of the Site and to map vegetative covertypes for the Site and the area within a 0.5-mile radius of the Site.

6.2.2 Habitat-Based Assessment

A qualitative assessment of vegetation cover types and habitats was performed for the Troy (Smith Avenue) Site and the area within a 0.5-mile radius of its perimeter, collectively designated as the study area. This assessment included documentation of vegetation communities and wildlife observed during the field investigation. Fish and wildlife habitats, and potential resources associated with these habitats, were identified based on the vegetation communities present. Documented fish and wildlife resources within a two-mile radius of the Site were also identified. Fish and wildlife resources include, NYSDEC Significant Habitats; habitats supporting endangered, threatened or rare species; species of concern; regulated wetlands; wild and scenic rivers; significant coastal zone areas; streams; lakes; and other major resources. The potential value of identified habitats to both wildlife resources and humans is addressed in this analysis, as are applicable fish and wildlife regulatory standards, criteria, and guidance (SCGs).

6.2.2.1 Habitat Characterization

Field investigations were conducted on August 10, 1994, of the Site and a 0.5-mile radius from its perimeter. Vegetation cover types within the study area were characterized and a total of six sample stations were established during the investigation. Sample stations chosen were representative of vegetation throughout the study area. At each station, vegetation was identified and observations of wildlife were noted. All six sample stations, SS-1 through SS-6, were recorded along the banks of the Hudson River.

The Troy (Smith Avenue) Site is located along the eastern bank of the Hudson River (Figure 1-1). The Site is bordered to the west by the Hudson River, to the north by the federal dam/lock facility (Troy Lock), to the east by residential houses, and to the south by an abandon field. The Site occupies approximately five acres and is highly developed, including numerous buildings, parking lots, storage areas, and gravel areas. Vegetative cover accounts for a very small percentage of the Troy (Smith Avenue) Site, with most being located along the bank of the Hudson River outside the Site fence. The Site is currently used by NMPC as a service center.

The land use within the 0.5-mile radius of the Site is predominantly urban/industrial, constituting approximately 65 percent of the study area. Topography within the 0.5-mile radius study area ranges from gently sloping to steep slopes. Elevations range from 20 feet to 40 feet above mean sea level within the portion of the study area to the west of the Hudson River, and 20 feet to 240 feet above mean sea level east of the Hudson River. Vegetative cover types within the study area are limited to northern hardwood woodlands and herbaceous meadows located within the Hudson River corridor, including Adams and Stony Islands in the river, and a portion of an approximately 60 acre broad-leaved northern hardwood forest located on Green Island along the west bank of the river. Vegetative cover types compose approximately ten percent of the study area, and the Hudson River composes approximately 25 percent of the study area (Figure 6-1).

6.2.2.2 Terrestrial Habitats Within 0.5 Miles of the Site

The Troy (Smith Avenue) Site is composed of structures, including buildings, storage areas, and garages, parking lots, roadways, and gravel areas. The Site is located along an area of the

Hudson River that is dominated by commercial and residential development. A large portion of the east bank of the Hudson River is lined by a row of residential and commercial buildings. Much of the east bank of the Hudson River has been stabilized by cement retaining walls to decrease erosion of adjacent properties, and to provide structural protection for several buildings along the riverbank. Access to the east bank of the river is limited due to development. Along the eastern bank of the Hudson River, vegetated areas are dominated by broad-leaved deciduous woodland, ranging in width from 10 to 25 feet. Black willow (*Salix nigra*), quaking aspen (*Populus tremula*), and box elder (*Acer negundo*) are dominant in the tree layer. The understory is sparse along most of the bank with riverbank grape (*Vitis riparia*) and white snakeroot (*Eupatorium rugosum*) being dominant.

The ACOE property, located to the north of the NMPC property, is composed of a mowed lawn habitat. To the north of the ACOE property, along the eastern bank of the Hudson River, the river corridor is also composed of mowed lawn habitats associated with single family homes. A small park area is present within the northern-most portion of the 0.5-mile radius study area. The area is maintained as a mowed lawn with several park benches located throughout the park. Adjacent to the park, in the tidal zone of the Hudson River, vegetation is dominated by scrub/shrub vegetation. Tree of heaven and quaking aspen saplings dominate the shrub layer, while riverbank grape, goldenrods, and Virginia creeper (*Parthenocissus quinquefolia*) dominate the herbaceous layer. Within the study area, the park provides the easiest access to the eastern bank of the river which is used for other recreational purposes.

Within the eastern-most portion of the study area, there is a stream channel which flows west, towards the Hudson River. The stream travels through a woodland area until it reaches an abandoned railroad bed/hiking trail. At this point, the stream is culverted for the remainder of its length.

Along the western bank of the Hudson River is a thin strip of herbaceous and scrub/shrub vegetation, ranging from 15 to 25 feet in width, which buffers the river from residential and commercial development. Small patches of emergent wetlands dominated by purple loosestrife (*Lythrum salicaria*) are present in the tidal zone. To the north of the Troy Lock, vegetation along the Hudson River is dominated by broad-leaved deciduous tree species, typically quaking aspen, box elder, and black willow. The northern-most portion of the 0.5-mile radius study area, in the southern portion of Green Island, is composed of successional northern hardwood woodlands totaling approximately 60 acres. The woodland is bordered to the north and east by the Hudson River, to the west by Cohoes Avenue, and to the south by a utility line easement and an Allied Signal/Bendix facility. The area contains several trails which all lead to the Hudson River. These trails are presumably used by anglers for access to the river. NYSDEC fishery consumption advisory signs were found along one of the trails. Fish consumption advisories have been established for the Hudson River based on the elevated levels of PCBs found in sampled fish (Brighton, 1996). An abandoned railroad track also passes through the woodland area, separating the upland woodland from a small forested wetland located within the floodplain of the Hudson River (Figure 6-1).

The wooded upland is vegetated by broad-leaved deciduous trees species, i.e., oaks (*Quercus*.), red maple (*Acer rubra*), and quaking aspen. Black cherry and red oak saplings, black raspberry (*Rubus occidentalis*), dewberry (*Rubus flagellaris*), and gray dogwood dominate the shrub layer, while yarrow (*Achillea millefolium*), rough stemmed goldenrod, english plantain (*Plantago* *lanceolata*), and white clover (*Trifolium repens*) dominate the sparse herbaceous layer. The wetland area is also dominated by broad-leaved deciduous hardwoods, in particular silver maple (*Acer saccharinum*). This wetland area has not been mapped by the NYSDEC.

Adams and Stony Islands, located within the Hudson River, are also composed of successional northern hardwood. These islands were inspected from the bank of the Hudson River and were observed to be undeveloped and significantly smaller than the 60 acre woodland area observed on Green Island. The islands could provide habitat for transient or resident bird species similar to those species encountered in the larger woodland area.

During the August 10, 1994 field investigation, six bird species and one mammal species were observed on the eastern bank of the Hudson River. The species observed include:

Bird	
American Crow	*Corvus brachyrhynchos*
Mourning Dove	*Zenaida macroura*
Herring Sea Gull	*Larus argentatus*
Canada Goose	*Branta canadensis*
Double-crested Cormorant	*Phalacrocorax auritus*
House Sparrow	*Passer domesticus*
Mammal	
Eastern Gray Squirrel	*Sciurus carolinensis*

With the exception of the waterfowl observed during the Site investigation, the wildlife species observed typically prefer urban/suburban areas similar to the habitat along the eastern bank of the river. Additional bird species which reside in urban/suburban areas include the house finch (*Carpodacus mexicanus*), house wren (*Troglodytes aedon*), and European starling (*Sturnus vulgaris*). Mammals which could also reside in the urban/suburban areas, but were not observed during the field investigation, include the raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), opossum (*Didelphis marsupialis*), and several mouse species. These species are expected in the residential areas of the 0.5-mile radius study area, provided adequate food sources are available.

A total of 12 bird species, one mammal, and one herpetofauna species were observed along the western bank of the Hudson River, within the 60 acre upland and wetland woodland area. The species are listed below:

Birds	
Black-capped chickadee	*Parus atricapillus*
American Robin	*Turdus migatorius*
Blue Jay	*Cyanocitta cristata*
Red-tailed hawk	*Buteo jamaicensi*s
Gray Catbird	*Dumetella carolinensis*
Common Flicker	*Colaptes auratus*

Northern Cardinal	*Cardinalis cardinalis*
Common Yellowthroat	*Geothlypis trichas*
Warbler (Several Species)	
House Finch	*Carpodacus mexicanus*
Northern Oriole	*Icterus galbula*
Great Blue Heron	*Ardea herodias*

Mammal

Chipmunk	*Tamias striatus*

Herpetofauna

Garter snake	*Thamnophis sirtalis*

The relatively isolated 60 acre woodland area, located in the northern portion of Green Island and to the south of the Mohawk River, is the largest undeveloped property within the 0.5-mile radius study area. This woodland could potentially provide habitat for a large number of bird species, small mammals, and herpetofauna due to its abundant food sources (i.e., nuts, fruits and berries) and the cover present. The openings in the woodland area resulting from the railroad right-of-way and maintained utility line easement increase habitat diversity and, therefore, potential species diversity. Wildlife species that were observed within the woodland area are classified as edge and/or urban/suburban species. Because of their mobility and available habitat, bird species were encountered more frequently than mammals or herpetofauna species in the woodland area.

Additional bird species that could reside in the woodland area include the northern mockingbird (*Mimus polyglottos*), brown thrasher (*Toxostoma rufum*), gray catbird (*Dumetella carolinensis*), white-breasted nuthatch (*Sitta carolinensis*), brown creeper (*Certhia familiaris*), eastern kingbird (*Tyrannus tyrannus*), various woodpeckers (*Picoides spp*.), and sparrows. Game birds, such as the ruffed grouse (*Bonasa umbrellus*), could also inhabit the woodland area. Additional mammal species which could reside in the woodland area, but were not observed during the Site investigation, include the eastern gray squirrel, raccoon (*Procyon lotor*), striped skunk (*Mephitis mephitis*), opossum (*Didelphis marsupialis*), woodchuck (*Marmota monax*), eastern cottontail (*Sylvilagus floridanus*), and various mice species. The transition between open and woodland habitats, commonly referred to as edge habitat (or ecotone), allows for increased species diversity by providing species opportunities to utilize features from both habitats.

One herpetofauna species, the garter snake, was observed during the field survey. Additional herpetofauna species may reside within the upland woodland habitat, including the eastern box turtle (*Terrepene carolina*) and eastern ribbon snake (*Thamnophis sauritus*). Several frog species, such as the bullfrog (*Rana catesbeiana*) and green frog (*Rana clamitans*), may be present in the wetland woodland habitat during seasonal flooded conditions.

Pursuant to NYSDEC guidance, documented fish and wildlife resources within a two-mile radius of the Site was identified for Step I - Site Description. Significant wildlife game species were not identified within a two-mile radius of the Site (NYSDEC, 1994). Correspondence with the NYSDEC New York Heritage Program has revealed that no New York State Endangered or

Threatened species occur within either the 0.5 or two-mile radius study areas. It was, however, determined that the Hudson River below the Troy Lock has been classified as a Significant Habitat due to the large number of waterfowl (primarily black ducks) which winter within this portion of the Hudson River. The Mohawk River, to the west of Van Schaick Island, is also used by large numbers of wintering waterfowl and gulls. Although the area has not been classified as a Significant Habitat, it does provides habitat for a significant number of duck and gull species. Correspondence with the NYSDEC revealed that transient bald eagles and ospreys may travel along the Hudson River corridor. Feeding and resting conditions are present along this portion of the river; however, it does not appear to provide nesting habitat for the two bird species.

6.2.2.3 Aquatic Habitats

The main stem of the Hudson River represents the largest continuous aquatic habitat within the two-mile radius of the Site location in the City of Troy, New York. Several small unnamed tributaries of the Hudson River were also identified during the field survey. The Hudson River in vicinity of the Troy, New York area is considered tidal freshwater habitat with a mean tidal range of 1.45 m (NOAA, 1991). Although the river is considered freshwater, it is still part of the lower Hudson estuary because of the daily tidal intrusion. Flow below Troy Lock changes direction four times daily, except during high flows in spring, which overpower the tidal influence (Stedfast, 1982). The freshwater flow, as measured at the Green Island gauging station near the City of Troy, New York generally ranges from 3,000 to 30,000 cubic feet per second (cfs) (Stedfast, 1982).

River basin morphology in the Troy-Albany reach has been described as narrow, straight sided and deep (Stedfast, 1982). The total width of the river, as determined from the Troy-South NY USGS quadrangle map, is approximately 1,178 feet. The U.S. Government maintains a navigation channel 400 feet wide and approximately 14 to 32 feet deep.

During the field investigation, benthic substrates in the shallow areas of the river adjacent to the Troy (South Avenue) Site were qualitatively characterized as pebble and gravel with scattered sand bars. Banks along the shoreline were steep and consisted of exposed bedrock and boulders with widely scattered lowland riparian habitats. The upper tidal zone and banks along the shoreline were characterized as rock and gravel. Land use in the vicinity of the river bank consisted largely of commercial and industrial buildings. Buildings and facilities immediately adjacent to the river shoreline were associated with large concrete retaining walls. The highly commercial and industrial nature of the land use along the river bank greatly restricted riparian habitats in this section of the river. Field parameters measured in the Hudson River in vicinity of the Troy (Smith Avenue) Site included water temperature, dissolved oxygen, specific conductivity, salinity and pH. Results for the field parameters measured on August 10, 1994, were as follows:

Water Temperature (°C):	25.0
Dissolved Oxygen (mg O_2/L):	7.6
Specific Conductivity (umhos/cm):	190.0
Salinity (o/oo):	0.0
pH (su)	7.0

Submerged aquatic vegetation was limited to floating fronds of water celery (*Vallisneria americana*) in the shallows of the river. This was the only submergent macrophyte observed during the survey. Emergent aquatic vegetation along the extreme shallow areas of the river shoreline included smartweeds (*Polygonum*) and purple loosestrife.

The National Marine Fishery Section of the National Oceanic and Atmospheric Administration in Milford, CT, has determined that the shortnose sturgeon (*Acipenser brevirostrum*), a federal and state endangered species, is present within this section of the Hudson River. The Hudson River, at the location of the Troy Lock, is spawning ground for shortnose sturgeon, and spawning occurs yearly within the region between the dates of April 15 through May 15 (Dovel, 1981). Several additional species of anadromous or Trust fish species may also spawn in this portion of the Hudson River at various times throughout the year. The Hudson River in the vicinity of the Troy (Smith Avenue) Site is classified by NYSDEC as Class C waters subject to Class C New York water quality standards (NYSDEC, 1994a).

Although no quantitative sampling of aquatic biota was conducted during the survey, previous investigators have described and documented the aquatic biota found in the Troy-North Albany reaches. Simpson et al. (1986) described 167 species of benthic macroinvertebrates within the Troy to Albany reach of the Hudson River. The Troy-Green Island area of the river displayed the greatest species richness (average taxa richness of 47 and 42 species). The benthic community was numerically dominated by aquatic worms, freshwater snails and clams, and the freshwater worm *Manayunkia speciosa* (Simpson et. al., 1986). Species of the family Chironomidae (midges) comprised the largest number of species observed in this area. Simpson et al. stated that the benthic communities appeared well balanced with respect to percentage contribution of major benthic groups observed.

In the vicinity of the Troy (Smith Avenue) Site, the Hudson River supports a warmwater fishery, which includes largemouth and smallmouth bass (*Micropterus salmoides* and *M. dolomieu*), rock bass (*Ambloplites rupestris*), various sunfish species (*Lepomis*), carp (*Cyprinus carpio*) and other cyprinids, walleye (*Stizostedion vitreum*), northern pike (*Esox lucius*), tiger muskellunge (*Esox masquinongy* (hybird)), channel catfish (*Ictalurus punctatus*), and brown bullhead (*Ameriurus nebulosus*). In addition to this warmwater fish community, seasonal migrations of anadromous species, including blueback herring (*Alosa aestivalis*), alewife (*Alosa pseudoharengus*), American shad (*Alosa americana*), striped bass (*Morone saxatilis*), and shortnose sturgeon move up into the lower Hudson estuary to spawn (Muessig et al., 1988). As part of a statewide monitoring program, NYSDEC monitors contaminants in fish tissues in the vicinity of the City of Troy, New York on the Hudson River. Results indicate that both resident and migrant species have detectable concentrations of PCBs in their tissue. The highest PCB tissue concentrations were detected in walleye in the Troy/Albany area (Sloan et. al., 1987).

Aquatic biota within the two mile study area of the Hudson River was investigated for signs of stress potentially related to Site constituents. Observed aquatic vegetation present in the river appeared to be growing normally and did not show signs of stress. Correspondence with NYSDEC has determined that as of the early 1990's, several fish kills have occurred within the two-mile radius of the Site, however, these fish kills were related to sewage discharges from the cities of Albany and Rensselaer, New York, or were from natural disease origin. No fish kills were linked to contamination from the Troy (Smith Avenue) Site.

6.2.2.4 Wetlands

Small patches of emergent wetland, dominated by purple loosestrife (*Lythrum salicaria*), are present in the tidal zone. A northern hardwood forested wetland, dominated by silver maple (*Acer saccharinum*), is also present approximately one mile from the Site, located on the western bank of the Hudson River adjacent to the 60 acre northern hardwood upland (Figure 6-1).

A review of NYSDEC State Freshwater Wetlands maps (Troy North and Troy South, NY USGS topographic quadrangles) revealed that state regulated wetlands are present within the 0.5 and two-mile radius study areas. The wetlands are referenced in Figure 6-2 as TN-6 and TN-105. Wetland TN-6 is located approximately 0.5 miles west of the Site. It is approximately 15 acres in size and consists of an emergent marsh and open water located in an urban area. TN-105 is approximately 30.1 acres and consists of a mix of emergent and scrub/shrub wetlands. Small pockets of emergent wetlands and a woodland wetland are also present within the flood plain of the Hudson River; however, these wetlands are not regulated by New York State.

6.2.3 Habitat-Based Value Assessment

As part of a Fish and Wildlife Impact Analysis, Step I - Site Description, habitat value for both wildlife and humans was assessed. Wildlife habitat was assessed within the 0.5-mile study area, based on availability of food, seasonal cover, water, and shelter. For humans, the value of habitats within the 0.5-mile study area was assessed based on the current and potential use of fish and wildlife resources. Human resources may include hunting, fishing, observation of wildlife, scientific studies, agriculture, forestry, and other recreational and economic activities.

6.2.3.1 Value of Resources to Wildlife

The Hudson River corridor, including Adams and Stony Islands, and the approximately 60 acre northern hardwood forest provide the only valuable wildlife habitat within the 0.5-mile radius study area. The Hudson River corridor, below the Troy Lock/Dam, has been designated by the NYSDEC Natural Heritage Program as a Significant Habitat due to the large number of wintering waterfowl, including black ducks, which use the river and the seasonal migration of anadromous fish, including the shortnose sturgeon (Federal and State Endangered Species). Additional anadromous fish species, including blueback herring, alewife, American shad, and striped bass, also use the river. Transient bald eagle (*Haliaeetus leucocephalus*) and osprey (*Pandion haliaetus*) can also utilize this portion of the river for feeding and resting habitat. Due to the high degree of development and industrialization along the banks of the Hudson River, the majority of wildlife species which would inhabit the banks of the river would be classified as urban/suburban species. Because these species have adapted to developed areas, they are present in relative abundance throughout New York State. The Hudson River in the vicinity of the Troy (Smith Avenue) Site is classified by NYSDEC as Class C waters subject to Class C New York water quality standards (NYSDEC, 1994a).

The approximately 60-acre broad-leaved deciduous woodland located in the northern portion of Green Island provides suitable habitat for bird, mammal and herpetofauna species. A total of 12 birds, one mammal, and one herpetofauna species were observed within the area during the field survey. The area comprises the largest habitat within the 0.5-mile radius study area.

6.2.3.2 Value of Resources to Humans

Within the 0.5-mile and two-mile radius, the Hudson River provides a recreational fishing resource to the people within the Troy, New York area. However, access to the river is limited due to development along the banks. Within the 0.5-mile radius study area, access along the east bank is limited to a small park, within the northern most portion of the 0.5-mile radius, and within the vicinity of several dead-end roads and vacant lots located to the south of the Site. The western bank of the river provides greater access to the river; however, access is still limited due to industrial and residential development along the bank. The woodland area in the northern portion of Green Island provides access to the river by way of several trails throughout the area. The Mohawk River enters the Hudson River to the northwest of the Site. The river is located within the two mile radius study area. It also provides a recreational fishing resource. The Hudson River below the Troy Lock and the Mohawk River to the west of Van Schaick Island both sustain large wintering waterfowl and gull populations. The presence of these populations provides an opportunity for the people in the Troy area to observe waterfowl in their natural environment. A boat marina is located on the west bank of the Hudson River, within the southern portion of Van Schaick Island, directly outside of the 0.5-mile radius study area. The marina appears to be associated with the Van Schaick Island Country Club and allows boaters access to the Hudson and Mohawk Rivers.

6.2.4 Pathway Analysis

Soil samples were collected at the Troy (Smith Avenue) Site. Surface soil samples, SS-1 through SS-4, were collected at points adjacent to the Site, along the Hudson River Corridor and within the ACOE property. Polycyclic aromatic hydrocarbon (PAH) compounds were the most common compounds identified in samples SS-1 through SS-4. Results from these soil samples (SS-1 through SS-4) revealed that pyrene was detected in the highest concentrations for all four samples ranging from 0.46 to 2.50 ppm. Overall, the highest concentrations of PAHs were detected in sample SS-3, ranging from 0.087 ppm for dibenzo(a,h)anthracene to 2.50 ppm for pyrene. Review of sampling data has determined that PAHs have been detected off-site in concentrations typical to industrialized areas. Soil regulatory criteria has not currently been established for PAH compounds and their ecological receptors. A literature search has been performed to determine the potential effect of PAHs on wildlife and plants which would utilize these areas. PAHs are ubiquitous in the environment as evident by their wide distribution in sediments, soils, air, surface water, and plant and animal tissue (Eisler, 1987). PAHs show little tendency for bioconcentration, probably because most PAHs are rapidly metabolized in vertebrates (Eisler, 1987). Based upon the observed soil evaluation, terrestrial receptors are not expected to be impacted by Site-related contamination given the industrialized nature of the area and lack of significant terrestrial habitats on and adjacent to the Troy (Smith Avenue) Site.

The Site is located within a highly developed and industrialized portion of the City of Troy, New York. Due to the industrialized nature of the area, it would be difficult to determine if PAHs detected within off-site soils are from site-specific events, or are an accumulation from industry within the area. Since PAHs were detected at levels typical to industrialized areas, it is believed that similar concentrations would be found throughout the Troy, New York area. Therefore, it is believed that PAH constituents potentially derived from the Troy (Smith Avenue) Site will have no incremental impact upon wildlife and vegetation adjacent to the Site.

The Hudson River corridor offers the only surface water resource within the two mile radius which could be potentially affected by PAH constituents from the Site. No fish kills related to chemical contamination have been documented in the Hudson River within the vicinity of the Troy (Smith Avenue) Site. Site-related constituents were identified in sediments of the Hudson River. However, species such as the anadromous fish, wintering waterfowl, and gulls would have a limited potential for adverse ecological effects due to the seasonal nature of their exposure. Additionally, site-related constituents (e.g., PAHs) are readily metabolized by these vertibrate species.

Resident aquatic (i.e., benthic communities in the Hudson River sediments) species would have a greater potential for adverse ecological effects than migratory species due to longer periods of exposure. Within both the Hudson River and terrestrial habitats, wildlife species and habitat resources were observed for signs of stress from chemical or environmental related factors. None of the wildlife species or habitats investigated showed signs of stress. Therefore the focus of the pathway analysis and criteria specific analysis was the surface waters and sediments in the Hudson River.

Results of the Phase I Site investigation revealed that both fish and wildlife resources were associated with areas adjacent to the Site but that the Site itself provides limited value for fish and wildlife resources based upon the following observations:

- The small size of the Site (approximately 5 acres) and absence of any significant vegetation communities on the Site proper;
- The Site remains active as a service center area with both vehicle and pedestrian traffic during the day;
- The majority of the Site is paved and developed for storage and maintenance operations;
- The Site boundary is enclosed by a chain linked fence; and
- The Site provides limited wildlife habitat due to its developed and highly maintained nature.

Surface soil and surface water were evaluated as potential pathways for ecological receptors. The majority of the Site is covered by impervious structures which would limit wildlife contact with impacted soils. The extremely limited vegetation on-site would provide limited feeding and resting habitat for transient species, and therefore, habitation of the Site by wildlife is not anticipated. The Hudson River represents a potential surface water pathway. To evaluate this potential pathway, surface water and sediment samples were collected from the river in vicinity of the Site.

6.2.4.1 Identification of Ecological SCGs

The primary media of concern to ecological receptors were identified as surface water and sediments found in the Hudson River. Analytical results from surface water and sediment samples collected were used to compare concentrations of contaminants to numerical criteria for the above media. Although the Hudson River is tidally influenced in vicinity of the Site, this reach of the river is considered part of the freshwater portion of the Hudson River estuary. The Hudson River is classified as Class C freshwaters by the NYSDEC in this area of the estuary.

Numerical criteria or guidance values used in screening of the sediment contamination included NYSDEC technical guidance for screening contaminated sediments (chronic values) (NYSDEC 1993) and Ontario Ministry of the Environment (Persaud et al. 1993) lowest effect level (LEL) and severe effect level (SEL) values. Both the NYSDEC chronic sediment values and the SEL values for volatile organics, semi-volatile organics and PCB/pesticides are standardized to Site specific organic carbon (TOC) content. The LEL value provided is a bulk sediment concentration which is not normalized to the Site specific total organic carbon (TOC) content. For screening the sediment data, the SEL values for SVOCs were normalized to 0.86 percent total organic carbon. This TOC content was utilized based upon Site-specific data collected from the river sediments during the 1997 field effort.

The NYSDEC chronic sediment quality value was selected and is considered the lowest observed concentration to result in a toxic effect in sensitive communities or receptors from the available NYSDEC sediment benchmarks. The receptor population considered in the sediment evaluation are benthic communities in the Hudson River. The LEL is defined as the level of sediment contamination that can be tolerated by the majority of benthic organisms inhabiting the affected sediments. The SEL is defined as the level at which pronounced disturbance of the sediment dwelling community can be expected and would be detrimental to the majority of benthic species (Persaud et al. 1993). Therefore if a contaminant concentration exceeds both the SEL and chronic NYSDEC values, significant impacts to indigenous benthic communities are to be expected. For the surface water evaluation NYSDEC Class C AWQC values were used to screen contaminants detected above background levels. Those metals criteria which are hardness dependent were normalized to Site-specific hardness values (70.5 mg/L $CaCO_3$) observed in the river.

6.2.4.2 Contaminants of Concern

Contaminants associated with the Site include a variety of volatile organic compounds, semi-volatile organic compounds and heavy metals. The most important group of semi-volatile organic contaminants are the polycyclic hydrocarbons (PAHs) which are principle components of coal tar. Heavy metals typically associated with MGP by-products include arsenic, cadmium, chromium lead, mercury, nickel, zinc and cyanide (Haney et.al. 1992).

6.2.4.3 Sources of Contaminants

Coal tar is a complex mixture of semi-volatile organic compounds with the consistency of thickened oil (Haney et.al. 1992). Its highly insoluble nature allows for the product to adhere to soils and sediments commonly associated with high total organic content.

Results from the PSA indicated that subsurface soils and, to a much more limited extent, surface soils on the Site contained elevated concentrations of PAHs and metals. Sampling of the sediments in the Hudson River verified the presence of coal tar-like substances and analytical results found detectable concentrations of PAHs to be present.

6.2.4.4 Potential Pathways of Contaminant Migration and Exposure

Media considered important in the exposure of ecological receptors to Site-related contaminants include surface soils, surface water and sediments. While Site-related contaminants have been detected in surface soils, direct exposure of this media to ecological receptors is considered minimal given that the majority of the contamination is associated with soils below an impervious layer of asphalt in subsurface soils. Potential movement of soil bound contaminants via the surface water runoff pathway would be into the adjacent Hudson River. Given the above fate and transport characteristics of the contaminants of concern, it would be assumed that PAHs and metals could be incorporated into the Hudson River surface water and sediments.

Based upon the points of exposure of contaminants to receptors and the fate and transport properties of the contaminants of concern, the primary media of concern would be surface water and sediments associated with the Hudson River. Key exposed aquatic populations would be benthic communities in the river sediments.

6.2.5 Criteria Specific Analysis

Data used to compare to the numerical criteria included surface water and sediment samples collected from stations located in the Hudson River adjacent to the Site.

6.2.5.1 Surface Water Evaluation

Surface water samples from both the stations adjacent to and downstream from the Site were combined to determine mean, minimum and maximum concentrations of contaminants detected in the Hudson River. The data were then compared to observed background range and promulgated NYSDEC ambient water quality standards and guidance values. Ambient AWQC values for select metals including cadmium, chromium, copper, lead and nickel are hardness dependent. A Site-specific hardness value (measured) for the surface waters in the river of 70.5 mg/L was used to derive the standards for the above metals.

Screening of the surface water data revealed no detections of volatile organics or pesticides/PCBs in the collected samples. Two semi-volatile organic compounds, diethylphthalate and bis (2-ethylhexyl) phthalate, were detected at two downstream stations. Occurrence of these compounds at such low concentrations (1.0 ug/L) make them suspect laboratory contaminants with regard to their presence in the surface waters of the river. Most metals in the downstream surface water stations remained comparable to background levels (Table 6-3). Those metals detected above background levels included cadmium, cobalt, lead, and mercury. In comparisons to the NYDEC AWQC values, none of the metals exceeded the corresponding water quality standards (Table 6-3).

6.2.5.2 Sediment Evaluation

Contaminants detected in the river sediments included semi-volatile organics, several volatile organics, pesticide/PCBs and metals. Table 6-4 summarizes the data for volatile organic compounds (VOCs) and semi-volatile organics detected for both the sediments. All of the VOCs detected at the downstream stations were detected at low frequency, but remained above concentrations detected at the background station. None of the VOCs detected among the sampling stations had corresponding NYSDEC chronic values or LEL/SEL sediment quality criteria. Given the apparent lack of comparison criteria, the VOCs could not be evaluated directly to applicable sediment benchmarks.

Semi-volatile organic compounds (SVOCs) were the most frequently detected group of contaminants in the near shore sediments. As a group, the higher molecular weight PAHs occurred at higher concentrations than other semi-volatile organics. Overall, the highest observed PAH concentrations in sediments were detected in shallow water stations (SD-1 through SD-3) and remained undetected in the deeper water station (SD-6). Both mean and maximum concentrations of PAHs detected exceeded available NYSDEC chronic sediment values and at least the Persaud et.al. (1993) LEL values in the sediments. Mean concentrations of all detected PAHs exceeded the background levels by several orders of magnitude for most compounds in the adjacent river sediments (Table 6-4).

Based upon these exceedances and the magnitude of the concentrations in excess of background levels, benthic communities present in the sediments may be impaired to some extent at both the chronic exposure level due to PAHs.

Metals data in the Hudson River sediments were compared to NYSDEC (1993) guidance values which are inclusive of the Persaud et.al. (1993) LEL and SEL values, and Long and Morgan (1990) ER-L and ER-M values. Maximum concentrations of antimony, cadmium, copper, iron, lead, mercury, and zinc all exceeded background levels and the corresponding LEL values (Table 6-5). Maximum concentrations of chromium and silver exceeded background levels but not the corresponding LEL value. Mean concentrations of copper and lead exceeded their corresponding LEL value. None of the metals detected in the sediments at a maximum concentration exceeded its corresponding SEL value.

Table 6-6 summarizes the data for pesticides/PCBs detected in the river sediments. Like the VOCs, most pesticides were detected in low frequency at the downstream locations. The only exceptions were heptachlor and chlordane which were consistently detected among the downstream stations. Of all the pesticides detected, only three compounds-heptachlor, DDT and chlordane-exceeded corresponding NYSDEC sediment quality but not OMOE LEL/SEL criteria. In addition to the detected pesticides, Aroclor-1242 was detected in the sediments (Table 6-6).

Although detected in the sediments, the pesticides and PCBs do not appear to be Site-related given their absence in sampled on-site media. The Aroclor-1242 was the member of the pesticide/PCB analytes to exceed both LEL and SEL levels. Although minor detections of pesticides and Aroclor-1260 were detected in subsurface samples, the observed concentrations remain lower than those observed in the river sediments. Additionally given the different PCB congeners and historical PCB contamination of Hudson River estuary, the observed PCB contamination cannot be attributable to the Troy (Smith Avenue) Site.

7.0 PRELIMINARY REMEDIATION OBJECTIVES

This section presents the development of preliminary remediation goals (PRGs) for the Troy (Smith Avenue) Site, which first involves the calculation/selection of human health and ecological risk-based PRGs. The risk-based PRGs are then evaluated relative to other considerations, such as applicable Standards, Criteria and Guidance (SCGs), practical analytical method detection limits (MDLs) and local background concentrations, to establish the final PRGs for the identified AOCs under varying land use assumptions. The conceptual Site exposure model, presented in Section 6.1.4, was used to identify which SCGs would be applicable or relevant and appropriate for application to each environmental medium and COPC in each AOC. For example, the exposure assessment indicates that potential off-site exposures and impacts are consistent with the TAGM-4046 soil exposure and groundwater protection requirements. Consequently, the TAGM-4046 soil levels were considered as SCGs for use in establishing the PRGs for the off-site, Douw Street, area. The direct human health-based soil levels presented in TAGM-4046 also were considered as SCGs for the off-site ACOE property, as groundwater exposure routes were not identified as current or reasonably anticipated under future conditions in this AOC. The NMPC on-site exposure assessment indicated that the groundwater exposure pathways assumed in the development of the TAGM-4046 recommended soil clean-up levels are not consistent with the current or reasonably anticipated future use of the site given the existing NMPC institutional controls. Therefore, health-based PRGs were calculated in a manner consistent with paragraphs 2A and 2B TAGM-4046 using site-specific exposure parameters presented in Appendix F-2. The final PRGs developed in this manner are then compared to Site COPC concentrations for each medium in each AOC to provide an indication of the current acceptability of each AOC to support current and reasonably anticipated future activities given the risk, regulatory, Site background condition and analytical detection criteria assembled.

7.1 PRELIMINARY REMEDIATION GOALS

7.1.1 Definition of the PRGs and the Selection Process

PRGs are chemical-, receptor- and pathway-specific clean-up levels that are considered protective of human health and the environment. This section presents the development of PRGs for the COPCs identified in applicable media at the Troy (Smith Avenue) Site. The selection of PRGs also considers local background levels of naturally occurring materials, analytical MDLs, and other SCGs and regulatory benchmark values.

Consistent with USEPA guidance (USEPA, 1991), health-based PRGs are calculated by:

- Step 1 - Identifying COPCs;
- Step 2 - Identifying potential receptors and complete routes and pathways of exposure;
- Step 3 - Quantifying exposures (i.e., establishing receptor-specific exposure assumptions);
- Step 4 - Evaluating the toxicity and environmental mobility of the COPCs; and
- Step 5 - Combining these factors to estimate the health-based PRGs.

The health-based PRGs (human health and ecological) are taken as the starting point of the final PRG selection process. They are then adjusted, as needed, based upon: (1) local background conditions (so as to not require clean-up to below local background conditions), (2) analytical detection limits (so as to not require clean-up to levels below what could be analytically confirmed), and/or (3) regulatory SCGs. To identify potential risks to human health or the environment from COPC-related exposures, and thus the possible need for remediation, COPC concentrations measured in Site media are then compared to the final PRGs.

For the human health-based PRGs, Step 1 was discussed in Section 6.1.2 of this Report, with details of the identification of the CERCLA-based COPCs provided in Appendix F-1. Steps 2 and 3 were discussed in Section 6.1.3 of this Report, with additional details and parameter assumptions presented in Appendix F-2. For the ecologically-based PRGs, Steps 1 through 3 were discussed in Section 6.2. Sections 7.1.2 and 7.1.3 discuss Steps 4 and 5 for the human health- and ecologically-based PRGs, respectively. Section 7.1.4 documents the other considerations relating to SCGs, local background conditions and analytical detection limits, and Section 7.1.5 presents the final PRG values developed from this overall evaluation. Additional details regarding the development of the health-based PRGs are provided in Appendix I.

7.1.2 Human Health-Based PRGs

7.1.2.1 Toxicity Assessment

This section addresses Step 4 of the USEPA PRG development process, the toxicity assessment, and describes the toxicity criteria that were used to develop the human health-based PRGs for each COPC. The information from the toxicity assessment is used in conjunction with information from the exposure assessment (Section 6.1.3) to calculate the human health-based PRGs.

Specific toxicity criteria are available to evaluate both carcinogenic and non-carcinogenic endpoints. For non-carcinogenic effects, the USEPA has developed Reference Doses (RfDs) for oral and dermal exposures and Reference Concentrations (RfCs) for inhalation exposures, which are doses below which no significant adverse health effects are expected. The chronic RfD and RfC values are based upon a 70-year lifetime exposure, and are approximate doses derived from an available No Observed Adverse Effect Level (NOAEL) or the Lowest Observed Adverse Effect Level (LOAEL). Subchronic RfD values, which have been used only for the construction worker scenario, are based on toxicological studies for exposures that were episodic in nature and significantly less than a lifetime in duration. As such, the subchronic RfD values were judged more appropriate for the potential construction worker exposure scenario.

For carcinogens, the USEPA has implemented a system for classifying chemicals according to the likelihood that the compound is a human carcinogen. This system groups chemicals into five classes reflecting the "weight-of-evidence" of carcinogenicity based on the available data. This classification system is summarized and the weight-of-evidence for each COPC is listed in Appendix I. For purposes of the toxicity assessment for this evaluation, only chemicals or compounds with a Group A or B (B1 and B2) classification were considered to be human carcinogens.

To evaluate potential carcinogenic risk, the USEPA has developed cancer slope factors (CSFs) and unit risk (UR) values, which are typically derived from the upper 95 percent confidence limit of the dose-response curve. The toxicity values used in this evaluation for carcinogenic effects are the oral Cancer Slope Factors (CSF_o) for oral and dermal exposures, and the inhalation Cancer Slope Factors (CSF_i) and inhalation unit risk values (UR_i) for inhalation exposures.

Toxicity criteria were obtained from the USEPA's Integrated Risk Information System (IRIS), the Health Effects Assessment Summary Tables (HEAST), or the Environmental Criteria and Assessment Office (ECAO), in that order of preference. Tables in Appendix I present the RfDs/RfCs and the CSFs/URs, used in this evaluation.

7.1.2.2 Environmental Mobility Assessment

The second element of Step 4 of the USEPA PRG development process is the assessment of the environmental mobility, or potential fate and transport, of the COPCs in the local environment. Based on the potential for COPCs to migrate from one environmental medium to another in the context of the Troy (Smith Avenue) Site, PRGs have been developed to be protective of the leaching of soil contaminants to groundwater, and the migration of volatile and particulate contaminants into air.

For the leaching pathway, soil, hydraulic and contaminant source data are combined with COPC-specific chemical and physical property data to estimate the potential leachability of each COPC. The specific equations and the COPC-specific fate and transport parameters are presented in Appendix I.

The equations used to evaluate the particulate and volatile inhalation pathways are based on those presented in USEPA's Risk Assessment Guidance for Superfund (RAGS): Part B, Development of Risk-Based Preliminary Remediation Goals (USEPA, 1991). These equations and the COPC-specific fate and transport parameters used in the calculations are shown in Appendix I.

7.1.2.3 Calculation of Human Health-Based PRGs

Equations for human health-based PRGs were taken from RAGS, Part B (USEPA, 1991). PRGs are chemical-, medium-, and receptor-specific values which are designed to account for the applicable exposure pathways identified in the exposure assessment (Section 6.1.3). Carcinogenic and non-carcinogenic PRGs are calculated for each COPC, as applicable. If exposure to a COPC is associated with both carcinogenic and non-carcinogenic effects, PRGs for both effects are calculated, and the lower of the two (i.e., the PRG that is protective of both types of effects) is selected as the human health-based PRG.

Human health-based PRGs are developed by establishing the target risk level, and solving for the corresponding concentration of the COPC that could be present in the applicable medium, given the projected exposure and the COPC's indicated toxicity. For these PRG calculations, the target risk level for non-carcinogenic effects (Hazard Quotient, or HQ) has been set at 0.2 per constituent, and for carcinogenic effects (Excess Lifetime Cancer Risk, or ELCR), at 1E-06 per constituent. The health-based PRG for a COPC represents the concentration in the applicable medium which would be associated with a level of acceptable risk to the identified target receptors exposed to that medium currently or during reasonably anticipated future uses.

The parameters used in the calculation of the human health-based PRGs (and discussed in detail in Appendix I) include:

- Subchronic and chronic RfDs, RfCs, and oral and inhalation CSFs;
- Chemical-specific physical parameters (e.g., Henry's Law Constant, molecular weight, and dermal permeability in water);
- Exposure assumptions (e.g., exposure time, exposure frequency, exposure duration, inhalation and ingestion rates);
- Target risk levels for non-carcinogenic and carcinogenic effects;
- Volatilization factors to account for the volatility of COPCs from soil-to-indoor air and groundwater-to-indoor air; and
- Particulate emission factors to quantify the resuspension/entrainment of soil particulates into ambient air.

The equations for non-carcinogenic and carcinogenic PRGs for soil, and groundwater for the commercial worker, utility/maintenance worker, construction worker, adolescent trespasser, and off-site resident are presented in Appendix I. Tables 7-1 through 7-3 present the human health-based PRGs for soil and groundwater, respectively.

7.1.3 Ecologically-Based PRGs

Based upon the results of the Fish and Wildlife Criteria Specific Analysis for the surface waters and sediments of the Hudson River (Section 6.2), the ecological receptors identified to be most at risk and potentially impacted are the benthic communities present in the sediments of the Hudson River.

Sources for preliminary remediation goals that are protective of the benthic community include the sediment quality guidance values provided in NYSDEC (1993) and Persaud et al. (1993). NYSDEC (1993) guidance document provides State-specific values at both an acute and chronic level for only a limited number of PAHs. Persaud et. al. (1993) provide values for a larger number of PAH compounds for a low effect level (LEL) and a severe effect level (SEL). As a general guide for threshold levels protective of the benthic community, the lower value of either the Persaud et. al. (1993) LEL or the NYSDEC (1993) chronic sediment value may be considered as a preliminary goal for limiting risks and impacts to the benthic community in the river.

Detected concentrations of Site-related PAHs and selected metals in the river sediments exceeded chronic sediment values (NYSDEC, 1993) and/or LEL benchmark criteria and guidance values (Persaud et. al., 1993). Given that observed concentrations of Site-related PAHs and metals exceeded only the lower threshold sediment value (i.e. LEL) and not the severe effect levels (SEL), the potential for impacts to benthic organisms may not be acute. The Feasibility Study should include further evaluation of the PAH contamination to determine if potential impacts warrant remedial considerations.

7.1.4 Other Considerations

Selection of the final PRGs includes consideration of the level at which the naturally occurring COPCs are present in the vicinity of the Site under unimpacted "background" conditions, and the lowest concentration at which a chemical or compound can be practically detected and measured using available analytical methods. These considerations are discussed below.

7.1.4.1 SCGs

As part of the PRG development process, SCGs are identified for the Site and compared to the calculated health-based PRGs. If a health-based PRG exceeds a legislatively mandated SCG, the site-specific PRG is adjusted downward to equal the SCG. Maximum Contaminant Levels (MCLs) were identified as SCGs for residential groundwater use. No SCGs were identified for soil or for commercial/industrial groundwater use.

Because all exposure pathways evaluated for the development of the NYSDEC Technical and Administrative Guidance Memorandum (TAGM 4046) residential soil clean-up criteria apply to receptors of off-site COPCs, no Site-specific health-based PRGs were calculated for exposure of off-site (Douw Street) residents to COPCs in off-site soil. Thus, NYSDEC TAGM residential soil values have been used as SCGs in the selection of final PRGs for off-site soils. NYSDEC TAGM and/or TOG values have also been used as SCGs for those compounds or exposure scenarios for which health-based PRGs could not be calculated due to the lack of available toxicity data. For lead, the USEPA Action Levels for commercial/industrial soils (1000 ppb), residential soils (400 ppm) and groundwater (15 ppm) also were identified as SCGs.

7.1.4.2 Local Site Background Conditions

To reflect the inherent variability associated with local background conditions, Background Upper Tolerance Limits (BUTLs), equivalent to the upper 95 percent confidence limit of the background data sample mean, were calculated (see Equation F-1-1 in Appendix F) for naturally-occurring compounds in soil and groundwater. Available samples from each medium from areas considered to be unimpacted were used in the calculation of the BUTLs. The calculation of the BUTL assumes that the background analytical data are normally distributed. Log normally distributed data were log transformed to more closely approximate a normal distribution. Additional information on tolerance limits or intervals and values of the tolerance factor (k) is provided in Section 6.1.2 and Appendix F-1 of this Report, as extracted from USEPA (1992) or Guttman (1970).

7.1.4.3 Analytical Method Detection Limits

The analytical MDL defines the lowest concentration that a prescribed analytical method can practically and reliably detect and quantify for a particular chemical or compound. In the State of New York, the MDLs are specified by NYSDEC in Analytical Service Protocols (ASP), based on USEPA Contract Laboratory Program (CLP) Statement of Works, and are defined in the NYSDEC ASP-CLP Methods, 95-1, 95-2, 95-3 and 95-M. These MDLs are chemical-specific and vary by the type of sample - solid (e.g., soil) or aqueous (e.g., groundwater). The MDLs for the COPCs for each applicable medium are included in the PRG selection tables (see Section 7.1.5).

7.1.5 PRG Selection

The risk-based PRGs (both human health- and ecologically-based) were evaluated relative to other considerations, such as SCGs, MDLs and local background concentrations, to establish the final PRGs for the identified AOCs of the Site under varying land use assumptions.

The rules used to select the final PRG value were:

1. Identify the lowest (most stringent) human health-based PRG by COPC for each medium from across the applicable receptors. Health-based PRGs calculated to exceed physical limits (e.g., solubilities) were adjusted (e.g., to upper solubility limits), where appropriate.
2. Identify the lowest (most stringent) ecologically-based value, when more than one was applicable.
3. Select the lower (more stringent) of the human health-based and ecologically-based PRGs as the representative health-based PRG.
4. For compounds with SCGs identified (i.e., drinking water MCLs for the residential receptor), adjust the PRG to equal the SCG, if the SCG is more stringent and the current or reasonably anticipated future land use involves exposures of the appropriate type. If no health-based PRG was calculated, e.g. for off-site (Douw Street) soils, the SCG value is selected.
5. Confirm that the PRG identified up to this point is higher than the MDL. If not, adjust the PRG upward to equal the MDL.
6. Confirm that the PRG identified is not below local background levels (if the COPC is a naturally occurring chemical or compound). If not, adjust the PRG upward to equal the appropriate background level. For soils, the lowest representative background concentration (i.e., the BUTL or the maximum detected concentration) for the surface and subsurface soils was selected for this comparative value.
7. The PRG identified following Step 6 becomes the final PRG.

The final PRG selection tables resulting from this seven-step evaluation for the Troy (Smith Avenue) Site are presented in the following tables:

- Table 7-4 Final Soil PRGs for Commercial/Industrial Land Use for the ACOE Property
- Table 7-5 Final Groundwater PRGs for Commercial/Industrial Land Use for the NMPC Property
- Table 7-6 Final Groundwater PRGs for Commercial/Industrial Land Use for the ACOE Property
- Table 7-7 Final Soil PRG for Off-site Residential Land Use
- Table 7-8 Final Groundwater PRGs for off-site Residential Land Use

7.1.6 Ecological Risk

- The Hudson River corridor offers the only surface water resource within the two mile radius which could be potentially affected by PAH constituents from the Site. No fish kills related to chemical contamination have been documented in the Hudson River within the vicinity of the Troy (Smith Avenue) Site.

- Resident species (i.e., benthic communities) would have a greater potential for adverse ecological effects than migratory species due to longer periods of exposure. Within both the Hudson River and terrestrial habitats, wildlife species and habitat resources were observed for signs of stress from chemical or environmental related factors. None of the wildlife species or habitats investigated showed signs of stress.
- Detected PCBs/pesticides in the sediments do not appear to be related to the Troy Site based upon the concentration observed in on-site soils. Aroclor 1242 remained undetected in the on-site media, and its subsequent detection in sediments appears related to other sources in the Hudson River estuary.
- Extent of apparent Site-related PAH contamination remains confined in the shallow water area of the river. A sediment sample collected from a deeper station revealed no PAHs in the sediments.
- The Troy (Smith Avenue) Site is located within a highly developed and industrialized portion of the City of Troy, New York. Due to the industrialized nature of the area, it would be difficult to determine whether constituents detected within off-site soils are from Site-specific events, or are an accumulation from industry within the area. Since PAHs were detected at levels typical of soils in industrialized areas, it is believed that similar concentrations would be found throughout the Troy, New York area.
- PAHs detected in the near shore sediments were identified as being present above corresponding sediment quality criteria for the protection of aquatic life. Extent and severity of these potential impacts appear limited given that only the lower threshold effects level (i.e., chronic exposure) was exceeded for most of the PAH compounds detected.

7.1.7 Interim Remedial Measures

None of the potential pathways for exposure to Site-related residues at the Troy (Smith Avenue) Site present an imminent risk to human health or the environment. Therefore, no interim remedial measures are warranted.

7.2 COMPARISON OF PRGs TO CURRENT SITE CONDITIONS

The concentrations for the different matrices in on- and off-site AOCs were compared to the proposed PRGs presented in Section 7.1. For the soils, the average soil concentration was used for the comparison. This average concentration is the arithmetic mean of the detected concentrations and/or one half of the non-detected quantitation limits. The maximum groundwater concentration detected was utilized for the comparison to groundwater PRGs.

Section 7.2.1 presents the Commercial/Industrial Land Use PRG comparisons for soils and groundwater. Residential Land Use comparisons to soil and groundwater PRGs are presented in Section 7.2.2.

7.2.1 Commercial/Industrial Land Use

7.2.1.1 Soil

NMPC Property

The average concentrations calculated for surface and subsurface soils on the NMPC property were compared to the proposed commercial/industrial land use PRGs, as presented in Table 7-9. None of the volatile COPCs identified in the surface or subsurface soils exceeded the PRGs. Four semi-volatile constituents (benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, and dibenzo(a,h)anthracene) exceeded the PRGs identified for subsurface soil (based on the construction worker exposure scenario). In addition, arsenic in the subsurface soil exceeded the construction worker PRG. Because the NMPC property receptors will not be exposed to the subsurface soil due to the enforcement of the Site-specific HASP, subsurface soil exceedances are not expected to result in human health risks. In summary, there are no human health risks associated with the soil at the NMPC property under the current, and future projected, land use exposure scenarios and associated use restrictions.

ACOE Property

The proposed commercial/industrial land use PRGs were compared to the average surface and subsurface soil concentrations calculated for the ACOE property, and these comparisons are presented in Table 7-10. Surface soil PRGs were exceeded by concentrations of five semi-volatile COPCs. Subsurface soil PRGs were exceeded by concentrations of benzene, 10 semi-volatile COPCs, and arsenic. The higher concentration samples that are primarily responsible for exceeding PRGs were collected either from the vicinity of the former MGP holding tank (SB-10 and TP-3) or along the western boundary of the property (SB-3, SB-18, SB-21 and SB-22). The highest concentrations represent material buried within the foundation of the former MGP holding tank (SB-10 and TP-3) and are not representative of general Site conditions. In summary, both surface and subsurface soil COPCs present human health risks based on the current, and future projected, land use scenarios due to the presence of levels of PAHs in the soils.

7.2.1.2 Groundwater

NMPC Property

Commercial/industrial land use groundwater PRGs, as presented in Table 7-11, were compared to the maximum concentration detected for the groundwater sampled from beneath the NMPC property. The groundwater was evaluated for the release of vapors to indoor air as presented in Section 6. No COPCs exceeded the volatilization from groundwater to indoor air PRG. Under the current, and future predicted land use, including the HASP and the restriction against the use of groundwater as a drinking water source, the groundwater does not present a human health risk to site workers.

ACOE Property

For the ACOE property, the maximum detected groundwater concentration was compared to the commercial/industrial land use PRGs, and these comparisons are presented in Table 7-11. The ACOE groundwater was evaluated for indoor vapor and drinking water consumption. One volatile organic (benzene), one PAH (benzo(a)pyrene) and two metals (arsenic and chromium) were found to exceed the PRGs. As noted in Section 6, there is no current groundwater use at the ACOE property, which is served by the public water supply. Thus, under current land use, the groundwater does not present a human health risk. However, should the groundwater be developed for human consumption, COPC concentrations exceeding the PRGs present a potential risk to human health.

7.2.2 Off-site Residential Land Use

7.2.2.1 Soil

Table 7-12 presents the comparison of average soil concentrations in surface and subsurface soils to the proposed PRGs for the off-site (Douw Street) property. None of the COPCs in surface soils exceed the residential PRGs. The average concentrations of COPCs in subsurface soils exceed the PRGs for six semi-volatile compounds: napthalene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene and benzo(a)pyrene. However, the single subsurface soil sample responsible for these exceedances was collected from a depth of 44 to 46 feet bgs, well beyond the depths of potential exposure during residential land use. Therefore, COPCs in off-site (Douw Street) soils present no current or foreseeable future risk to human health.

7.2.2.2 Groundwater

The proposed residential land use PRGs for groundwater were compared to the maximum concentration detected for the off-site (Douw Street) property (see Table 7-11). No exceedances occurred for these residential PRGs, and no current or future human health risks were identified.

7.2.3 Ambient Air

Air samples were collected downwind of test pit excavation activities as part of a community air monitoring program. These samples, which represent a worse-case scenario for ambient air quality, contained no BTEX or PAH constituents above analytical detection limits.

7.2.4 Ecological Risk

PAHs detected in the near shore sediments were identified as being present above corresponding sediment quality criteria for the protection of aquatic life. However, the extent and severity of these potential impacts appear limited given that only the lower threshold effects level (i.e., chronic exposures) was exceeded. Furthermore, the Hudson River corridor offers the only surface water resource within the two-mile radius which could be potentially affected by PAH constituents from the site. No fish kills related to chemical contamination have been documented in the Hudson River within the vicinity of the Troy (Smith Avenue) Site. Resident species (i.e., benthic communities) would have a greater potential for adverse ecological effects than migratory species due to longer periods of exposure.

Within both the Hudson River and terrestrial habitats, wildlife species and habitat resources were observed for signs of stress from chemical or environmental related factors. None of the wildlife species or habitats investigated showed signs of stress based upon the qualitative assessment.

Detected PCBs and pesticides in the sediments do not appear to be related to the Troy (Smith Avenue) Site based upon the concentration observed in on-site soils. Aroclor-1242 remained undetected in on-site media, and its subsequent detection in sediments appears related to other sources in the Hudson River estuary.

The extent of apparent Site-related PAH contamination remains confined to samples collected from stations close to the shore adjacent to the Site. A sediment sample collected from a deeper station revealed no detectable PAHs. Therefore Site-related PAH impacts are confined to shallow water habitats adjacent to the shoreline of river and Site.

The Troy (Smith Avenue) Site is located within a highly developed and industrialized portion of the City of Troy, New York. Due to the industrialized nature of the area, it would be difficult to determine whether constituents detected within off-site soils are from Site-specific events, or are an accumulation from industry within the area. Since PAHs were detected at levels typical of soils in industrialized areas, it is believed that similar concentrations would be found throughout the Troy, New York area.

7.2.5 Summary of Findings

Table 7-13 presents the summary of the Chemicals of Concern (COCs) identified for each AOC and each environmental medium. The COCs are those CPOCs which were found to exceed the PRG developed for the applicable AOC exposure scenarios developed in Section 6.

7.3 FOCUS OF SUBSEQUENT REMEDIAL EVALUATIONS

The preliminary RAOs introduced in Section 6 were developed in this section to evaluate the applicability of remedial technologies and the effectiveness of remedial alternatives. The RAOs incorporate the proposed PRGs as the chemical-specific target clean-up goals to assist in the selection of a preferred Site remedy. The PRGs are concentration goals developed for specific media and land use combinations that are based on quantitative estimates of risk, pertinent regulatory standards and criteria, and background concentrations. The PRGs are dynamic values which may be modified throughout the course of subsequent engineering and remedial evaluations as additional Site-specific information is accumulated. When finalized, these PRGS are used to assess the extent of site remediation required to achieve a specified end use. The results of the comparisons of current site conditions to the proposed PRGs for the specified future uses of each area of the site are summarized below.

7.3.1 NMPC Property

As described in Section 6, the most plausible (and proposed controlled) future use of this portion of the site is commercial/industrial. The proposed institutional controls (deed restriction and continued application of the Site-specific HASP) would preclude consumptive and non-consumptive exposures to the shallow groundwater.

The HASP also precludes uncontrolled exposure to subsurface soils during any required intrusive activity. Consequently, any subsequent engineering or remedial evaluations for this parcel would driven by potential exposures of a Construction Worker to COPCs in either exposed surface soils or in a vapor phase derived from subsurface soils.

Comparison of the current Site conditions to the PRGs corresponding to this scenario indicates that no COPCs exceeded PRGs for surface soils or groundwater and only arsenic and four semi-volatile constituents (benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, and dibenzo(a,h)anthracene) exceeded the PRGs identified for subsurface soil (based on the Construction Worker exposure scenario). None of these COPCs partition significantly into a vapor phase. Thus, although they were evaluated in the general PRG calculations for Construction Workers, the Site-specific HASP for the NMPC property eliminates the potential for exposure to these COPCs.

Therefore, enforcement of the HASP ensures that no complete pathway is present for exposure of Construction Workers on the NMPC property to COPCs. Thus the NMPC property represents no potential health risks that must be addressed in a subsequent Feasibility Study.

7.3.2 ACOE Property

The current and projected future use of this portion of the Site is commercial/industrial. While institutional controls such as those implemented for the NMPC property may be considered in consultation with the ACOE, this property is currently not controlled by either a Site-specific HASP or a deed restriction. Therefore, current Site conditions were compared to general commercial/industrial PRGs.

Current average concentrations in ACOE surface soils exceed the PRGs for five semi-volatile constituents: benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, indeno(1,2,3cd)pyrene, and dibenzo(a,h)anthracene. Average concentrations in subsurface soils exceed the PRGs for the volatile organic compound benzene; for ten semi-volatile constituents: napthalene, acenapthylene, fluorene, benzo(a)anthracene, chrysene, benzo(k)fluoranthene, benzo(b)fluoranthene, benzo(a)pyrene, indeno(1,2,3cd)pyrene, and dibenzo(a,h)anthracene; and for arsenic.

The maximum concentrations measured in groundwater samples from the ACOE property exceeded commercial/industrial PRGs for the volatile organic compound benzene, for the semi-volatile compound benzo(a)pyrene, and for the metals arsenic and chromium. However, as noted in Section 6, there is currently no use of groundwater from beneath this Site, thus these COPCs do not represent a risk to human health.

Most of the high COPC concentrations in both surface and subsurface soils are in the vicinity of the below-grade remnants of a former gas holder sampled by soil boring SB-10 and test pit TP-3. This includes samples from soil borings SB-3, SB-18 and SB-22. PRGs are also exceeded for several PAHs in subsurface soils from soil borings SB-21, MW-5D and MW-12. These COPCs represent a potential health risk that must be addressed in the Feasibility Study.

7.3.3 Off-Site (Douw Street) Property

As described in Section 6 for this property, groundwater is not currently used as a source of potable water since this area is served by a municipal water supply. However, since it is not feasible for

NMPC to institute groundwater use restrictions in the surrounding community, the off-site PRGs were developed to assess human health risks associated with ingestion of and dermal contact with the groundwater, as well as inhalation of volatiles derived from the groundwater (see Section 6). The comparison of current site conditions to PRGs corresponding to this conservative use scenario indicates that none of the CERCLA-defined COPCs identified would represent a potential risk concern that must be addressed in the Feasibility Study.

8.0 CONCLUSIONS AND RECOMMENDATIONS

The combined results of the PSA and RI Programs at the Troy (Smith Avenue) Site are sufficient to characterize the nature and extent of hazardous constituents present on- and off-site and to determine the plausible and complete exposure pathways for evaluation of human health and ecological risk associated with Site-related constituents. This section summarizes the findings of the PSA/IRM Study and the RI and presents recommendations for the appropriate course of action at the Site.

8.1 CONCLUSIONS

Based on the data generated during the performance of the PSA and the RI, the following conclusions are presented for the Troy (Smith Avenue) Site.

8.1.1 Hydrogeological

- Four distinct geologic deposits are present beneath the Site. In descending order from the ground surface (with their range of measured thickness on the Site), they are: fill (10 to 34 feet); glacial-fluvial outwash deposits (14 to 34 feet); till (<1 to 10 feet); and bedrock (Normanskill Foundation).
- Based on the water table contour maps, groundwater flow direction is to the west-southwest, toward the Hudson River.
- The water table aquifer discharges to the Hudson River, with water table elevations near the river falling within the tidal range of surface water elevations in the river.
- The water table gradient on-site ranges from 0.013 to 0.018 feet/foot.
- MGP and petroleum residues were primarily observed/detected in the unconsolidated deposits. However, recovery of DNAPL along with groundwater sampled from the bedrock monitoring well MW-13 indicates localized migration of DNAPL into fractures within the underlying bedrock. DNAPL was also observed in sediments sampled from the Hudson River adjacent to the Site, indicating that DNAPL may have migrated either along the bedrock surface or within fractures in the upper portion of the bedrock.

8.1.2 NMPC Property

8.1.2.1 Surface Soils

- No volatile organic compounds were detected in the surface soils at concentrations greater than NYSDEC soil clean-up objectives.
- Three semi-volatile organic constituents (benzo(a)anthracene, chrysene, and benzo(a)pyrene) were detected above NYSDEC soil clean-up objectives in the surface soils.
- No pesticides or PCBs were detected in the surface soils at concentrations above NYSDEC soil clean-up objectives.
- The concentrations of metals detected in surface soil samples were generally lower than or of the same order of magnitude as the concentrations of metals in background

soils in the vicinity of the Site and/or the NYSDEC soil clean-up objectives, suggesting that these metal constituents may be naturally occurring or indications of background levels in urban soils in the area.

- All COPCs in surface soils were below the commercial/industrial PRGs for the NMPC property.

8.1.2.2 Subsurface Soils

- Three volatile organic compounds (benzene, toluene and xylenes) were detected above NYSDEC soil clean-up objectives.

- Thirteen semi-volatile constituents were present in the subsurface soils at concentrations above NYSDEC soil clean-up objectives. These SVOCs were acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)-pyrene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene.

- No pesticides or PCBs were detected above NYSDEC soil clean-up objectives in the subsurface soils.

- The concentrations of metals detected in subsurface soil samples were generally lower than or of the same order of magnitude as the concentrations of metals in background soils in the vicinity of the Site and/or the NYSDEC soil clean-up objectives, suggesting that these metal constituents may be naturally occurring or indications of background levels in urban soils in the area.

- Cyanide was detected in one NMPC property subsurface soil sample. NYSDEC has not recommended a soil clean-up objective level for cyanide.

- All volatile organic COPCs in subsurface soils were below the commercial/industrial PRGs for the NMPC property.

- Four semi-volatile constituents (benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, and dibenzo(a,h)anthracene) exceeded the PRGs identified for subsurface soil (based on the construction worker exposure scenario). However, the continued enforcement of the Site-specific HASP precludes dermal contact with or ingestion of these soils, thereby eliminating their contribution to health risks on the Site.

- Arsenic also exceeded the PRGs identified for subsurface soil (based on the construction worker exposure scenario). However, as for the semi-volatile constituents, enforcement of the HASP eliminates its contribution to health risks.

8.1.2.3 Groundwater

- Benzene, toluene, ethylbenzene and xylenes were detected in the groundwater beneath the NMPC property at concentrations greater than NYSDEC water quality standards.

- The following ten semi-volatile organic constituents were present above NYSDEC water quality standards: naphthalene, acenaphthene, fluorene, phenanthrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, and indeno(1,2,3-cd)pyrene.
- No pesticides or PCBs were detected above NYSDEC water quality standards.
- Nine metals (arsenic, barium, chromium, iron, lead, magnesium, manganese, sodium, and thallium) were present in the groundwater at concentrations greater than NYSDEC water quality standards.
- Cyanide, although detected in two of the NMPC property monitoring wells, was present below NYSDEC water quality standards.
- No COPCs exceeded the volatilization from groundwater to indoor air PRG. Under the current and future predicted land use, with inclusion of the HASP and the restriction against the use of groundwater as a drinking water source, the groundwater does not present a human health risk to Site workers.

8.1.3 ACOE Property

8.1.3.1 Surface Soils

- No volatile organic compounds were detected in the surface soils at concentrations greater than NYSDEC soil clean-up objectives.
- The following six semi-volatile constituents were detected at concentrations greater than NYSDEC soil clean-up objectives: benzo(a)anthracene, chrysene, benzo(b)-fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, and dibenzo(a,h)anthracene.
- No pesticides or PCBs were detected above NYSDEC soil clean-up objectives in the surface soils.
- The concentrations of metals detected in surface soil samples were generally lower than or of the same order of magnitude as the concentrations of metals in background soils in the vicinity of the Site and/or the NYSDEC soil clean-up objectives, suggesting that these metal constituents may be naturally occurring or indications of background levels in urban soils in the area.
- Cyanide was detected in two ACOE property surface soil samples. NYSDEC has not recommended a soil clean-up objective level for cyanide.
- No volatile organic or inorganic COPCs in surface soils exceeded the applicable commercial/industrial PRGs for the ACOE property.
- Surface soil PRGs were exceeded by concentrations of five semi-volatile COPCs: benzo(a)anthracene, benzo(b)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene.

8.1.3.2 Subsurface Soils

- Four volatile constituents (benzene, toluene, ethylbenzene and xylenes) were detected above NYSDEC soil clean-up objective levels.

- The following 18 semi-volatile organic compounds were detected in subsurface soils of the ACOE property at concentrations greater than NYSDEC soil clean-up objective levels: naphthalene, 2-methylnaphthalene, acenaphthylene, acenaphthene, dibenzofuran, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, dibenzo(a,h)anthracene, and benzo(g,h,i)perylene.

- No pesticides or PCBs were detected above NYSDEC soil clean-up objectives.

- The concentrations of metals detected in subsurface soil samples were generally lower than or of the same order of magnitude as the concentrations of metals in background soils in the vicinity of the Site and/or the NYSDEC soil clean-up objectives, suggesting that these metal constituents may be naturally occurring or indications of background levels in urban soils in the area. However, samples from soil boring SB-10 and test pit TP-3, which represent soil contained within the foundation of a former MGP structure, contained metal concentrations ranging from approximately 2.2 to 21 times greater than the comparison criteria (either NYSDEC soil clean-up objectives or maximum soil background).

- One volatile organic COPC in subsurface soils (benzene) exceeded the applicable commercial/industrial PRGs for the ACOE property.

- Ten semi-volatile COPCs exceeded PRGs: naphthalene, acenaphthylene, phenanthrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)-fluoranthene, benzo(a)pyrene, indeno(1,2,3-cd)pyrene, and dibenzo(a,h)anthracene.

- One inorganic COPC (arsenic) in subsurface soils exceeded the PRGs for the ACOE property.

8.1.3.3 Groundwater

- Four volatile organic compounds (benzene, toluene, ethylbenzene and xylenes) were detected in the groundwater at concentrations greater than NYSDEC water quality standards.

- Thirteen semi-volatile organic constituents were present above NYSDEC water quality standards, and these compounds are naphthalene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, and indeno(1,2,3-cd)pyrene.

- One pesticide (4,4'-DDT) was detected above NYSDEC water quality standards in the groundwater from ACOE monitoring well USMW-1.

- The following 16 metals were present in the groundwater beneath the ACOE property at concentrations greater than NYSDEC water quality standards: antimony, arsenic, barium, beryllium, cadmium, chromium, copper, iron, lead, magnesium, manganese, mercury, selenium, sodium, thallium, and zinc.

- One volatile organic (benzene) exceeded the commercial/industrial PRGs applied to the ACOE property. Due to the absence of NMPC control on groundwater use for the ACOE property, these PRGs account for health risks associated with ingestion of groundwater and inhalation of indoor vapor derived from groundwater use. However, groundwater is not currently used on the ACOE property, which is served by the municipal water supply. Therefore, benzene in groundwater does not currently contribute to health risks on the ACOE property.

- One PAH (benzo(a)pyrene) was found to exceed the commercial/industrial PRGs. However, as for benzene, benzo(a)pyrene in groundwater does not currently contribute to health risks on the ACOE property.

- Two metals (arsenic and chromium) were found to exceed the PRGs, but because groundwater is not currently used, do not present an actual health risk.

8.1.4 Off-Site (Douw Street) Property

8.1.4.1 Surface Soils

- No volatile organic compounds were detected in the surface soils at concentrations greater than NYSDEC soil clean-up objectives.

- Benzo(a)pyrene was the only semi-volatile organic constituent detected above NYSDEC soil clean-up objectives in the off-site surface soils (SS-16).

- No COPCs in surface soils exceed the residential PRGs.

8.1.4.2 Subsurface Soils

- No volatile organic compounds were detected in the off-site subsurface soils at concentrations greater than NYSDEC soil clean-up objectives.

- Nine semi-volatile organic compounds were detected above NYSDEC soil clean-up objectives in the subsurface soils. These nine compounds were naphthalene, phenanthrene, pyrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, and dibenzo(a,h)anthracene.

- No pesticides or PCBs were detected above NYSDEC soil clean-up objectives in the subsurface soils.

- The concentrations of metals detected in off-site subsurface soil samples were generally lower than or of the same order of magnitude as the concentrations of metals in background soils in the vicinity of the Site and/or the NYSDEC soil clean-up objectives, suggesting that these metal constituents may be naturally occurring or indications of background levels in urban soils in the area.

- No volatile organic COPCs exceed the residential PRGs.

- The average concentrations of COPCs in subsurface soils exceed the PRGs for six semi-volatile compounds: naphthalene, benzo(a)anthracene, chrysene, benzo(b)-fluoranthene, benzo(k)fluoranthene and benzo(a)pyrene. However, the single subsurface soil sample responsible for these exceedances was collected from a depth of 44 to 46 feet bgs, well beyond the depths of potential exposure during residential land use. Therefore, COPCs in off-site (Douw Street) soils present no current or foreseeable future risk to human health.

- No inorganic COPCs in subsurface soils exceed the residential PRGs.

8.1.4.3 Groundwater

- No volatile organic, semi-volatile organic or pesticide/PCB compounds were detected in the groundwater at concentrations greater than NYSDEC water quality standards.

- Four metals (iron, lead, manganese, and sodium) were present in the off-site property groundwater at concentrations greater than NYSDEC water quality standards.

- No COPCs in groundwater exceeded the residential PRGs for the off-site property.

8.1.4 Hudson River

8.1.4.1 Sediments

- No volatile organic compounds were detected in the sediments at concentrations greater than NYSDEC sediment criteria.

- Concentrations of eight semi-volatile organic compounds were detected above NYSDEC sediment criteria, including acenaphthene, phenanthrene, benzo(a)anthracene, chrysene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, and indeno(1,2,3-cd)pyrene.

- Nine pesticides and one PCB compound were detected above NYSDEC sediment criteria. These constituents were beta-BHC, delta-BHC, heptachlor, heptachlor epoxide, 4,4'-DDE, 4,4'-DDD, 4,4'-DDT, endrin aldehyde, gamma-chlordane, and Aroclor-1242.

- No metals were detected above the Severe Effect Levels for sediments.

8.1.4.2 Surface Water

- No volatile organic compounds, pesticides or PCBs were detected in the surface water samples.

- Bis(2-ethylhexyl)phthalate was detected above NYSDEC surface water quality standards for the semi-volatile constituents.

- One metal (selenium) was present in the Hudson River surface water samples at a concentration which exceeded NYSDEC water quality standards.

8.2 RECOMMENDATIONS

Based on the data generated during performance of the PSA and the RI, and the conclusions outlined above, the “maximum remedial alternative” evaluated during the feasibility study (FS) for the Troy (Smith Avenue) Site should include all environmental media for which the concentrations of Site-related constituents exceed NYSDEC clean-up objectives. However, on the basis of the human health and ecological risk assessment and PRG development presented in Sections 6 and 7, a lesser remedial alternative should include evaluation of only the following Areas of Concern, within which the concentrations of COPCs exceed human health and/or ecological risk-based PRGs.

- The subsurface remnants of the former gas holder on the southern portion of the ACOE property, which are represented by soil samples from SB-10 and TP-3 and by groundwater samples from USMW-1.
- Subsurface soils on NMPC property with COPC concentrations in excess of NYSDEC clean-up objectives. Although no human health or ecological risks are associated with soil at the NMPC property under current or projected future land use scenarios, the potential for future impacts to off-site groundwater will be evaluated.
- Surface and subsurface soils within the ACOE property, primarily those along the western border of the property, e.g., in the vicinity of SB-3, SB-18, SB-21 and SB-22.
- Groundwater beneath the ACOE property.
- Sediments within the Hudson River adjacent to the Site.

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TABLE 3-1
GROUNDWATER LEVEL MEASUREMENTS

WELL NUMBER	SCREENED INTERVAL	ELEVATION OF INNER WELL CASING (MSL)	9/8/94		12/13/95		9/30/97		ELEVATION OF WATER (MSL)		
			Time	Depth to Water (ft)	Time	Depth to Water (ft)	Time	Depth to Water (ft)	9/8/94	12/13/95	9/30/97
MW-1	WT	34.73	1432	24.04	0900	23.78	0928	22.64	10.69	10.95	12.09
MW-2A	WT	27.52	1450	25.65	0930	24.70	1403	24.71	1.87	2.82	2.81
MW-3	WT	31.43	1441	28.50	0942	28.18	1606	27.82	2.93	3.25	3.61
MW-4A	WT	32.17	1437	26.98	0910	26.74†	1611	26.72	5.19	5.43	5.45
MW-5S	T	29.97	--	--	1026	25.20	1126	25.62	--	4.77	4.35
MW-5D	DOB	30.27	--	--	1024	24.91	1134	25.37	--	5.36	4.90
MW-6	DOB	31.11	1445	28.68	0950	27.59	1611	27.11	2.43	3.52	4.00
USMW1	WT	28.77	--	--	1043	2.05	1654	3.83	--	26.72‡	24.94‡
USMW2	WT	18.98	--	--	1037	15.53	1740	15.16	--	3.45	3.82
US201	WT	23.30	--	--	1016	19.81	**	**	--	3.49	**
US204	WT	30.03	--	--	1007	26.74	1639	26.46	--	3.29	3.57
US206	DOB	16.07	--	--	**	**	1715	11.62	--	**	4.45
MW-7S	WT	28.01	*	*	*	*	1436	25.41	*	*	2.60
MW-7D	DOB	28.27	*	*	*	*	1439	25.08	*	*	3.19
MW-8	DOB	25.97	*	*	*	*	1050	18.15	*	*	7.82
MW-9S	WT	24.23	*	*	*	*	1230	23.15	*	*	1.08
MW-9D	DOB	24.32	*	*	*	*	1217	23.20	*	*	1.12
MW-12	BR	31.01	*	*	*	*	1102	58.17	*	*	-27.16***
MW-13	BR	32.35	*	*	*	*	1755	28.52	*	*	3.83
MW-14	BR	27.69	*	*	*	*	1354	26.11	*	*	1.58
MW-15	BR	35.20	*	*	*	*	0937	24.05	*	*	11.15
MW-16	DOB	34.87	*	*	*	*	0950	23.83	*	*	11.04

NOTES:

All elevations are presented in feet above mean sea level.

† A floating product layer, with a thickness of 0.06 feet, was present during the PSA investigation.

‡ Water is perched within intact gas holder foundation.

"--" indicates that the well depth was not measured due to access restrictions.

* No data collected; well was not yet installed.

** No data collected. Adjacent inclinometer was mistakenly measured.

*** Well recharged extremely slowly. Measured elevation does not likely reflect static water table.

TABLE 5-1
Summary of Behavioral Characteristics that Affect Environmental Fate and Transport

Constituent	Aqueous Solubility	Volatility	Adsorptive Affinity	Biodegradation/ Biotransformation	Photolysis Susceptibility	Hydrolysis Susceptibility	Oxidation	Bioconcentration IP Fish
BTEX Constituents	High to Very High	High to Very High	Very Low to Medium	High to Very High	Very Low	Very Low	Very Low	Very Low
PAH Constituents	Low	Low	High	Medium to High	Low	Very Low	Low	Low to Medium

	Mobility under pH Conditions			Immobilization Factors		
	Acid (< 5.5)	Neutral (5.5 - 7.0)	Alkaline (> 7.0)	Fe/Mn Oxides	Organic Matter	Other
Arsenic	Medium	Medium	Medium	Yes	--	Sulfide; clay
Barium	Low	Low	Low	--	--	Sulfate; reducing conditions carbonate; clay
Beryllium	Low	Low	Low	Yes	Yes	Clays
Chromium	Very Low	Very Low	Very Low	--	--	
Cobalt	High	Medium	Very Low to Low	Yes	--	
Copper	High	Medium to Low	Very Low	Yes	Yes	Sulfide; adsorption
Lead	Low	Low	Low	--	--	Insoluble carbonate, sulfate, phosphate; reducing conditions
Manganese	High	High	High to Very Low	Yes	--	Clays
Mercury (aq)	Medium	Low	Low	Yes	--	Sulfide
Mercury (vap)	High	High	High	--	--	
Nickel	High	Medium to Low	Very Low	--	--	Sulfide; adsorption; silicate minerals
Selenium	High	High	Very High	Yes	--	Adsorption; reducing conditions
Thallium	Low	Low	Low	--	--	Silicate minerals; adsorption; reducing conditions
Vanadium	High	High	Very High	--	--	Silicate minerals; reducing conditions; adsorption
Zinc	High	High to Medium	Low to Very Low	Yes	Yes	Sulfide; carbonate; phosphate

TABLE 6-1 Summary of Chemicals of Potential Concern by Medium for Each Area of Concern	NMPC Property and ACOE Property			Off-Site (Douw Street) Property		
	Surface Soil	Subsurface Soil	Ground Water	Surface Soil	Subsurface Soil	Ground Water
VOLATILE ORGANICS						
Acetone	--	YES	YES	--	--	--
Benzene	--	YES	YES	--	--	--
Toluene	--	YES	YES	--	--	--
Ethylbenzene	--	YES	YES	--	YES	--
Styrene	--	YES	--	--	--	--
Xylenes (Total)	--	YES	YES	--	YES	YES
SEMI-VOLATILE ORGANICS						
Naphthalene	YES	YES	YES	----	YES	YES
2--Methylnaphthalene	----	YES	YES	----	----	YES
Acenaphthylene	YES	YES	YES	----	YES	--
Acenaphthene	----	YES	YES	----	YES	YES
Dibenzofuran	----	YES	YES	----	----	--
Diethylphthalate	----	YES	--	----	----	--
Fluorene	YES	YES	YES	YES	YES	YES
Phenanthrene	YES	YES	YES	YES	YES	YES
Anthracene	YES	YES	YES	YES	YES	--
Carbazole	YES	YES	YES	--	--	--
Fluoranthene	YES	YES	YES	--	YES	--
Pyrene	YES	YES	YES	YES	YES	YES
Benzo(a)anthracene	YES	YES	YES	YES	YES	--
Chrysene	YES	YES	YES	YES	YES	--
Bis(2--ethylhexyl)phthalate	--	YES	--	--	--	--
Benzo(b)fluoranthene	YES	YES	YES	YES	YES	--
Benzo(k)fluoranthene	YES	YES	YES	YES	YES	--
Benzo(a)pyrene	YES	YES	YES	YES	YES	--
Indeno(1,2,3cd)pyrene	YES	YES	YES	--	YES	--
Dibenzo(a,h)anthracene	YES	YES	--	--	YES	--
Benzo(g,h,i)perylene	YES	YES	YES	--	YES	--
PESTICIDES/PCBS/PCBs						
Aldrin	YES	YES	--	--	--	--
Heptachlor epoxide	--	YES	--	--	--	--
Dieldrin	YES	YES	--	--	--	--
Endrin	YES	YES	YES			--
Endosulfan II	YES	YES	--	--	--	--
4,4'-DDE	YES	YES	--	--	--	--
4,4'--DDD	YES	--	--	--	--	--
Endosulfan sulfate	YES	YES	--	--	--	--
4,4'--DDT	YES	YES	--	--	--	--
Methoxychlor	--	YES	--	--	--	--
Aldehyde	--	YES	--	--	--	--
alpha--Chlordane	YES	--	--	--	--	--
gamma--Chlordane	--	YES	--	--	--	--
Aroclor--1260	--	YES	--	--	--	--
INORGANICS AND CYANIDE						
Aluminum	YES	--	--	--	--	--
Arsenic	YES	YES	YES	--	--	--
Barium	YES	--	--	--	--	--
Beryllium	--	--	YES	--	--	--
Chromium (Total)	YES	YES	YES	--	--	--
Cobalt	YES	YES	YES	--	--	--
Copper	YES	--	YES	--	--	--
Lead	YES	--	--	--	--	
Manganese	YES	YES	--	--	--	--
Mercury	YES	YES	--	--	--	--
Nickel	YES	YES	--	--	--	--
Selenium	YES	YES	--	--	--	--
Thallium	YES	YES	--	--	--	--
Vanadium	YES	YES	YES	--	--	--
Zinc	YES	--	--	--	--	--
Cyanide	YES	YES	--	--	--	--
Note: --: No COPC						

TABLE 6-2
Summary of Potentially Exposed Populations for the Areas of Concern at the Troy (Smith Avenue) Site

Receptor	Exposure Pathway	NMPC Property	ACOE Property	Off-Site Residential Property
Adult Commercial Worker	Direct dermal contact with surface soil	C/F	C/F	NA
	Incidental ingestion of surface soil	C/F	C/F	NA
	Inhalation of entrained surface soil particulates	NA	C/F	NA
	Inhalation of volatiles from soil and groundwater impacting indoor air	C/F	C/F	NA
	Ingestion of groundwater as domestic potable water supply.	NA	F	NA
Adult Utility/ Maintenance Worker	Direct dermal contact with surface and subsurface soil	NA(1)	C/F	NA
	Incidental ingestion of surface and subsurface soil	NA(1)	C/F	NA
	Inhalation of entrained surface and subsurface soil particulates	NA(1)	C/F	NA
	Inhalation of volatiles from exposed soil	NA(1)	C/F	NA
Adult Construction Worker	Direct dermal contact with surface and subsurface soil	NA(1)	F	NA
	Incidental ingestion of surface and subsurface soil	NA(1)	F	NA
	Inhalation of entrained surface and subsurface soil particulates	NA(1)	F	NA
	Inhalation of volatiles from exposed soil	NA	F	NA
Adolescent Trespasser	Direct dermal contact with surface soil	C/F	C/F	NA
	Incidental ingestion of surface soil	C/F	C/F	NA
Resident (Child/Adult)	Inhalation of volatiles from domestic groundwater use	NA	NA	C/F
	Inhalation of entrained surface soil particulates.	NA	NA	C/F
	Ingestion of groundwater as domestic potable water supply.	NA	NA	C/F
	Direct dermal contact with groundwater used to fill swimming pools	NA	NA	C/F

NOTES:
NA = Not Applicable
(1) = Potential pathway assumed to be inapplicable due to continued enforcement of the NMPC Health and Safety Plan
(2) = Completeness of pathway depends on depth to groundwater and the locations of existing or potential future utilities
C = Current potential exposure pathway
F = Future potential exposure pathway

TABLE 6-3 Mean, Minimum and Maximum Concentrations of Compounds and Elements Detected in Surface Waters of the Troy (Smith Avenue) Site Applicable Criteria						
Compounds/Elements	Background (ug/L)	Frequency of Detection	Detected Concentrations (ug/L) Mean	Min.	Max.	NYSDEC Chronic WQC ug/L
Semi-Volatile Organics						
Diethylphthalate	**ND**	**1/4**	**1.0**	**1.0**	**1.0**	50
bis(2-Ethylhexyl)phthalate	**ND**	**2/4**	**1.0**	**1.0**	**1.0**	**0.6**
Metals						
Cadmium[1]	**ND**	**1/4**	**0.58**	**0.58**	**0.58**	0.86
Cobalt	**ND**	**1/4**	**2.1**	**2.1**	**2.1**	5.0
Lead[1]	**ND**	**3/4**	**1.8**	**1.6**	**2**	2.1
Mercury	**ND**	**1/4**	**0.04**	**0.04**	**0.04**	0.2

[1]Hardness derived criteria calculated using minimum observed hardness value of 70.5 mg/L.
ND = non-detected.
Bold values indicate observed concentation exceeds background or corresponding benchmark data.

TABLE 6-4
Comparison of Mean, Minimum and Maximum Concentrations of Volatile and Semi-Volatile Organics Detected in Hudson River Sediments Adjacent to the Troy (Smith Avenue) Site.

						Criteria		
						NYSDEC		
	Background		Detected Concetrations (ug/Kg)			Chronic	Persaud et al. (1993)	
	Detected Range	Frequency of				SQC[1]	LEL	SEL[1]
Compound	(ug/Kg)	Detection	Mean	Min.	Max.	ug/Kg	ug/Kg	ug/Kg
Volatile Organics								
Benzene	ND	1/4	-	2	2	NA	NA	NA
Ethylbenzene	ND	1/4	-	6	6	NA	NA	NA
Xylene (total)	ND	1/4	-	3	3	NA	NA	NA
Semi-Volatile Organics								
Naphthalene	**ND**	**1/4**	**-**	**399.5**	**399.5**	NA	NA	NA
2-Methylnaphthalene	**ND**	**1/4**	**-**	**160**	**160**	NA	NA	NA
Acenaphthylene	**ND**	**3/4**	**185.3**	**160**	**450**	NA	NA	NA
Acenaphthene	**ND**	**3/4**	**2886.6**	110	**5650**	**1,204.00**	NA	NA
Dibenzofuran	**ND**	**1/4**	**-**	**186.5**	**186.5**	NA	NA	NA
Fluorene	**ND**	**2/4**	**1225**	**65**	**2385**	NA	**190.0**	**1,380.0**
Phenanthrene	**41.0 - 51.0**	**3/4**	**1296.6**	**260**	**3200**	**1,032.00**	**560.0**	8,170.0
Anthracene	**ND**	**3/4**	**596.6**	**61**	**1630**	NA	**220.0**	3,180.0
Carbazole	**ND**	**1/4**	**-**	**110**	**110**	NA	NA	NA
Fluoranthene	**94.0**	**3/4**	**1100**	**400**	**2000**	8,772.00	**750.0**	8,770.0
Pyrene	**50.0**	**3/4**	**1001.6**	**350**	**1555**	NA	**490.0**	7,310
Benzo(a)anthracene	**ND**	**3/4**	**503**	**180**	**950**	NA	**320.0**	12,730.0
Chrysene	**ND**	**3/4**	**590**	**210**	**1070**	NA	**340**	3,960
Benzo(b)fluoranthene	**ND**	**3/4**	**348.3**	**150**	**525**	NA	NA	NA
Benzo(k)fluoranthene	**ND**	**3/4**	**330**	**130**	**510**	NA	**240**	11,520.0
Benzo(a)pyrene	**ND**	**3/4**	**363.3**	**130**	**660**	NA	**370**	12,380.0
Indeno(1,2,3-cd)pyrene	**ND**	**1/4**	**-**	**69.5**	**69.5**	NA	200	2,750.0
Benzo(g,h,i)perylene	**ND**	**1/4**	**-**	**55**	**55**	NA	170	2,750.0
Total PAHs	**145.0**	**-**	**9384.7**	**3186.5**	**21,566**	NA	**4,000**	86,000.0

[1]NYSDEC SQC and Persaud et.al. (1993)
SEL normalized to observed average TOC content (0.86 percent).
Bold values indicate observed concentration exceeds background or corresponding benchmark data.

TABLE 6-5
Comparison of Mean, Minimum and Maximum Concentrations of Metals Detected in Hudson River Sediments Adjacent to the Troy (Smith Avenue) Site.

Elements	Background Detected Range (mg/Kg)	Frequency of Detection	Detected Concetrations (mg/Kg) Mean	Min.	Max.	NYSDEC SQC LEL mg/Kg	SEL mg/Kg
Antimony	**1.2 - 1.9**	**4/4**	**1.81**	0.94	**2.8**	**2.0**	25.0
Arsenic	3.2 - 6.3	4/4	5.18	3.3	6.8	6.0	33.0
Cadmium	**.05 - .06**	**2/4**	**0.235**	**0.21**	**0.61**	**0.6**	9.0
Chromium	**12.3 - 15.6**	**4/4**	**20.6**	12.5	**23.9**	26.0	110.0
Cobalt	5.5 - 9.4	4/4	8.2	5.8	9.85	-	-
Copper	**13.7 - 31.6**	4/4	27.0	17.0	**42.5**	**16.0**	110.0
Iron	**3850 - 5480**	**4/4**	**23,662.5**	**16,900.0**	**33,300.0**	**40000.0**	80000.0
Lead	**12.7 - 31.0**	**4/4**	**56.7**	25.3	**98.9**	**31.0**	110.0
Manganese	333.0 - 420.0	4/4	342.5	190.0	**446**	460.0	1100.0
Mercury	**0.05 -0.06**	**4/4**	**0.13**	**0.06**	**0.23**	**0.2**	1.3
Selenium	**ND**	**1/4**	**2.1**	**2.1**	**2.1**	-	-
Silver	**ND**	**2/4**	**0.225**	**0.19**	**0.26**	1.0	2.2
Zinc	**69.6 - 110**	**4/4**	**112.5**	73.1	**154.0**	**120.0**	270.0

Bolded values indicate observed concentration exceeds background or corresponding benchmark values.

TABLE 6-6
Comparison of Mean, Minimum and Maximum Concentrations of PCBs and Pesticides Detected in Hudson River Sediments Adjacent to the Troy (Smith Avenue) Site.

Compound	Background Detected Range (ug/Kg)	Frequency of Detection	Detected Concetrations (ug/Kg) Mean	Min.	Max.	Criteria: NYSDEC Chronic SQC[1] ug/Kg	Persaud et al. (1993) LEL ug/Kg	SEL[1] ug/Kg
beta-BHC	ND	1/4	2.3	2.3	2.3	-	5.0	180.0
delta-BHC	ND	1/4	9.2	9.2	9.2	-	**3.0**	10.0
Heptachlor	ND	4/4	5.1	2.0	12	**0.86**	-	-
Heptachlor epoxide	ND	1/4	0.78	0.78	0.78	**0.77**	5.0	40.0
Endosulfan I	ND	1/4	1.4	1.4	1.4	-	-	-
4,4'-DDE	ND	3/4	4.8	3.7	6.5	8.6	**5.0**	160.0
Endrin	ND	1/4	3.0	3.0	3.0	34.4	**3.0**	1120.0
4,4'-DDD	ND	2/4	6.2	4.7	7.7	8.6	8.0	50.0
4,4'-DDT	2.5	1/4	4.6	4.6	4.6	8.6	7.0	100.0
gamma-Chlordane	1.1	4/4	4.5	2.0	8.9	**0.26**	**7.0**	50.0
Aroclor-1242	54 - 190	4/4	497.5	190.0	1000.0	**166.0**	**70.0**	**456.0**

[1]NYSDEC SQC and Persaud et al. (1993).
SEL normalized to observed average TOC content (0.86 percent).
Bolded values indicate observed concentration exceeds background or corresponding benchmark values.

Table 7-1
Summary of Surface and Subsurface Soil
Human Health Risk-Based Preliminary Remediation Goals

COPC	Commercial Worker	Utility/ Maintenance Worker	Construction Worker	Adolescent Trespasser	Child/Adult Resident@
Volatile Organics (mg/kg)					
Acetone	-	70,386	70,000	-	-
Benzene	-	33	22	-	-
Toluene	-	10,654	2,516	-	-
Ethylbenzene	-	20,017	3,275	-	-
Styrene	-	51,598	7,860	-	-
Xylenes (Total)	-	1,235,492	131,701	-	-
Semi-volatile Organics (mg/kg)					
Naphthalene	0.05	27	6	4,635	-
2-Methylnaphthalene	4,424	28,154	-	-	-
Acenaphthylene	-	-	-	-	-
Acenaphthene	-	24,886	31,937	-	-
Dibenzofuran	-	1,892	229	-	-
Diethylphthalate	-	-	-	-	-
Fluorene	2,607	16,591	21,292	2,517	793,642,219
Phenanthrene	-	-	-	-	-
Anthracene	14,276	90,850	131,362	13,378	5,952,316,644
Carbazole	52	331	1,004	213	-
Fluoranthene	2,607	16,591	21,292	2,517	-
Pyrene	1,955	12,443	15,969	1,888	595,231,664
Benzo(a)anthracene	1.2	8	26	5.0	267265
Chrysene	12	80	255	50	2672654
Bis(2-ethylhexyl)phthalate	-	1,591	2,340	-	-
Di-n-octylphthalate	-	-	-	-	-
Benzo(b)fluoranthene	1.2	8	26	5.0	267265
Benzo(k)fluoranthene	12	80	255.2	50	2672654
Benzo(a)pyrene	0.12	1	3	0.50	26727
Indeno(1,2,3cd)pyrene	1.2	8	25.5	5.0	-
Dibenzo(a,h)anthracene	0.23	1	3	1.0	-
Benzo(g,h,i)perylene	-	-	-	-	-
Pesticides/PCBs (mg/kg)					
Aldrin	0.04	0.28	1.0	0.18	-
Heptachlor epoxide	-	-	-	-	-
Dieldrin	0.05	0.3	1.0	0.19	-
Endrin	16	103	14	15	-
4,4'-DDE	2.7	17	33	11	-
Endosulfan II	391	2,489	319	378	-
4,4'-DDD	3.2	20	69	12	-
Endosulfan sulfate	391	2,489	319	378	-
4,4'-DDT	2.7	17	27	11	-
Methoxychlor	-	2,074	266	-	-
Endrin aldehyde	-	-	-	-	-
alpha-Chlordane	1.8	-	-	9	-
gamma-Chlordane	-	12	5.0	-	-
Aroclor-1260	-	-	-	-	-

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Table 7-1
Summary of Surface and Subsurface Soil
Human Health Risk-Based Preliminary Remediation Goals

Inorganics/Cyanide (mg/kg)					
Aluminum	215,976	1,374,391	89,806	281,853	-
Arsenic	2.0	13	21	11	-
Barium	15,118	96,207	6,286	19,730	-
Beryllium	-	-	-	-	-
Chromium (Total)	594	3,783	1,446	633	-
Cobalt	38,876	247,390	16,165	16,911	-
Copper	755,916	4,810,368	-	986,486	-
Lead	-	-	-	-	-
Manganese	30,237	192,415	12,573	39,459	-
Mercury	51	324	249	60	-
Nickel	807	5,133	783	747	-
Selenium	1,745	11,103	506	3,300	-
Thallium	24	151	78	38	-
Vanadium	1,512	9,621	629	1,973	-
Zinc	75,000	477,271	28,077	106,311	-
Cyanide	924	5,880	859	864	-

Notes:

-: Not applicable for receptor or media or no dose response values available to evaluate compound.

@ = Calculated to reflect the exposure of off-site residents to on-site soils via resuspended particulates.

Table 7-2
Summary of Leaching-Based Preliminary Remediation Goals

COPC	Commercial Worker	Child/Adult Resident
Volatile Organics (mg/kg)		
Acetone	-	-
Benzene	2.0E+00	-
Toluene	6.6E+02	-
Ethylbenzene	2.3E+03	-
Styrene*	-	-
Xylenes (Total)	-	-
Semi-volatile Organics (mg/kg)		
Naphthalene	1.7E+02	-
2-Methylnaphthalene	-	-
Acenaphthylene	-	-
Acenaphthene	-	-
Dibenzofuran	-	-
Diethylphthalate	-	-
Fluorene	-	-
Phenanthrene	-	-
Anthracene	-	-
Carbazole	-	-
Fluoranthene	-	-
Pyrene	-	-
Benzo(a)anthracene	-	-
Chrysene	-	-
Bis(2-ethylhexyl)phthalate	-	-
Di-n-octylphthalate*	-	-
Benzo(b)fluoranthene	-	-
Benzo(k)fluoranthene	-	-
Benzo(a)pyrene	-	-
Indeno(1,2,3cd)pyrene	-	-
Dibenzo(a,h)anthracene	-	-
Benzo(g,h,i)perylene	-	-
Pesticides/PCBs (mg/kg)		
Aldrin*	-	-
Heptachlor epoxide*	-	-
Dieldrin	-	-
Endrin*	-	-
4,4'-DDE*	-	-
Endosulfan II	-	-

Table 7-2
Summary of Leaching-Based Preliminary Remediation Goals

COPC	Commercial Worker	Child/Adult Resident
4,4'-DDD*		
Endosulfan sulfate	-	-
4,4'-DDT*	-	-
Methoxychlor*	-	-
Endrin aldehyde	-	-
alpha-Chlordane	-	-
gamma-Chlordane*	-	-
Aroclor-1260	-	-
Inorganics/Cyanide (mg/kg)		
Aluminum	-	-
Arsenic	-	-
Barium	-	-
Beryllium	-	-
Chromium (Total)*	-	-
Cobalt	-	-
Copper	-	-
Lead	-	-
Manganese	-	-
Mercury	-	-
Nickel	-	-
Selenium	-	-
Thallium	-	-
Vanadium	-	-
Zinc	-	-
Cyanide	-	-

Notes:

-: Not applicable for receptor or media or no dose response values available to evalute compound.

*: Groundwater PRG only calculated for estimating soil levels protective of soil to groundwater leaching.

Table 7-3
Summary of Leaching-Based Preliminary Remediation Goals

COPC	NMPC Commercial Worker	ACOE Commercial Worker	Child/Adult Resident
Volatile Organics (µg/L)			
Acetone	-	2,044	-
Benzene	382	6	-
Toluene	76,439	3,880	-
Ethylbenzene	155,267	2,017	-
Xylenes (Total)	-	40,880	426,734
Semi-volatile Organics			
Naphthalene	-	818	8,579
2-Methylnaphthalene	-	818	-
Acenaphthylene	-	-	-
Acenaphthene	-	1,226	12,244
Dibenzofuran	-	82	-
Fluorene	-	818	8,004
Phenanthrene	-	-	-
Anthracene	-	6,132	-
Carbazole	-	14	-
Fluoranthene	-	818	-
Pyrene	-	613	5,085
Benzo(a)anthracene	-	0.39	-
Chrysene	-	3.9	-
Benzo(b)fluoranthene	-	0.392	-
Benzo(k)fluoranthene	-	4	-
Benzo(a)pyrene	-	0.039	-
Indeno(1,2,3cd)pyrene	-	0.392	-
Benzo(g,h,i)perylene	-	-	-
Pesticides/PCBs			
Endrin*	-	6.1	-
Inorganics/Cyanide			
Arsenic	-	0.19	-
Beryllium	-	0.067	-
Chromium (Total)*	-	102	-
Cobalt	-	3,679	-
Copper	-	71,540	-
Vanadium	-	143	-

Notes:

-: Not applicable for receptor or media or no dose response values available to evaluate compound.

*: Groundwater PRG only calculated for estimating soil levels protective of soil to groundwater leaching.

Table 7-4
Soil Health-Based PRGs, SCGs and Other Values Pertinent to PRG Selection
for Commercial/Industrial Land Use for the NMPC Property and the ACOE Property

Land Use: Commercial/ Industrial	Health-Based PRGs Soil (mg/kg)	Receptor Driver	Method Detection Level (mg/kg)	Local Background Levels Surface/Subsurface (mg/kg)	TAGM-4046 Soil Clean-up Objectives/Levels (mg/kg)	PROPOSED PRG (mg/kg)
VOLATILE ORGANICS						
Acetone	70,000	CON	0.01	NNO	0.2 [1a]	70,000 [5]
Benzene	2	LEACH	0.01	NNO	0.06 [1a]	2 [5]
Toluene	658	LEACH	0.01	NNO	1.5 [1a]	658 [5]
Ethylbenzene	2,293	LEACH	0.01	NNO	5.5 [1a]	2,293 [5]
Styrene	7,860	CON	0.01	NNO	NA [1a]	7,860 [5]
Xylenes (Total)	131,701	CON	0.01	NNO	1.2 [1a]	131,701 [5]

Table 7-4
Soil Health-Based PRGs, SCGs and Other Values Pertinent to PRG Selection
for Commercial/Industrial Land Use for the NMPC Property and the ACOE Property

Land Use: Commercial/ Industrial	Health-Based PRGs Soil (mg/kg)	Receptor Driver	Method Detection Level (mg/kg)	Local Background Levels Surface/Subsurface (mg/kg)	TAGM-4046 Soil Clean-up Objectives/Levels (mg/kg)		PROPOSED PRG (mg/kg)
SEMI-VOLATILE ORGANICS							
Naphthalene	0.05	COM	0.33	NNO	13	[1a]	13 TAGM
2-Methylnaphthalene	4,424	COM	0.33	NNO	36	[1a]	4424 [5]
Acenaphthylene	-	-	0.33	NNO	41	[1a]	41 TAGM
Acenaphthene	24,886	U/M	0.33	NNO	50	[2]	24886 [5]
Dibenzofuran	229	CON	0.33	NNO	6.2	[1a]	229 [5]
Diethylphthalate	-	-	0.33	NNO	7.1	[1a]	7 TAGM
Fluorene	2,517	TRES	0.33	NNO	50	[2]	2517 [5]
Phenanthrene	-	-	0.33	NNO	50	[2]	50 TAGM
Anthracene	13,378	TRES	0.33	NNO	50	[2]	13378 [5]
Carbazole	52	COM	0.33	NNO	NA	[1a]	52 [5]
Fluoranthene	2,517	TRES	0.33	NNO	50	[2]	2517 [5]
Pyrene	1,888	TRES	0.33	NNO	50	[2]	1888 [5]
Benzo(a)anthracene	1.2	COM	0.33	NNO	0.224	[1a]	1 [5]
Chrysene	12	COM	0.33	NNO	0.4	[1a]	12 [5]
Bis(2-ethylhexyl)phthalate	1,591	U/M	0.33	NNO	50	[2]	1591 [5]
Di-n-octylphthalate	-	-	0.33	NNO	50	[2]	50 TAGM
Benzo(b)fluoranthene	1.2	COM	0.33	NNO	1.1	[1a]	1 [5]
Benzo(k)fluoranthene	12	COM	0.33	NNO	1.1	[1a]	12 [5]
Benzo(a)pyrene	0.12	COM	0.33	NNO	0.61	[1a]	0.6 TAGM
Indeno(1,2,3cd)pyrene	1.2	COM	0.33	NNO	3.2	[1a]	3 TAGM
Dibenzo(a,h)anthracene	0.23	COM	0.33	NNO	0.14	[1a]	0.3 MDL
Benzo(g,h,i)perylene	-	-	0.33	NNO	50	[2]	50 TAGM

Table 7-4
Soil Health-Based PRGs, SCGs and Other Values Pertinent to PRG Selection
for Commercial/Industrial Land Use for the NMPC Property and the ACOE Property

Land Use: Commercial/ Industrial	Health-Based PRGs Soil (mg/kg)	Receptor Driver	Method Detection Level (mg/kg)	Local Background Levels Surface/Subsurface (mg/kg)	TAGM-4046 Soil Clean-up Objectives/Levels (mg/kg)	PROPOSED PRG (mg/kg)
INORGANICS AND CYANIDE						
Aluminum	89806	CON	2	NV	-	89,806 [5]
Arsenic	2	COM	0.1	NV	7.5	8 TAGM
Barium	6286	CON	2	NV	300	6,286 [5]
Beryllium	-	-	0.05	NV	0.16	0.16 TAGM
Chromium (Total)	594	COM	0.1	NV	10	594 [5]
Cobalt	16165	CON	0.5	NV	30	16,165 [5]
Copper	755916	COM	0.25	NV	25	755,916 [5]
Lead*	-	-	0.03	NV	1000	1,000 TAGM
Manganese	12573	CON	0.15	NV	-	12,573 [5]
Mercury	51	COM	0.002	NV	0.1	51 [5]
Nickel	747	TRES	0.4	NV	13	747 [5]
Selenium	506	CON	0.05	NV	2	506 [5]
Thallium	24	COM	0.1	NV	-	24 [5]
Vanadium	629	CON	0.5	NV	150	629 [5]
Zinc	28077	CON	0.2	NV	20	28,077 [5]
Cyanide	859	CON	0.1	NV	-	859 [5]

NOTES:
[1] TAGM-4046 Recommended Soil Clean-Up Objectives calculated for foc of 1% - Reflects protection for residential exposures: (a) without consideration of groundwater protection or (b) with consideration of groundwater protection.
[2] Total VOCs < 10 ppm; Total SVOCs < 500 ppm; Individual SVOCs , 50 ppm
[3] Total pesticides , 10 ppm
[4] Shallow Soil value / Subsurface Soil value
[5] Health-based screening value based on a Construction Worker or Utility/Maintenance Worker scenario used for comparison.
MDL = Method Detection Limit
NNO = Not Naturally Occurring
NV = No Value, Surface soil background not determined
Receptor Driver = Receptor associated with the most stringent health-based PRG
COM = Commercial Worker
TRES = Adolescent Trespasser
U/M = Utility/Maintenance Worker
CON = Construction Worker
LEACH = Leaching to Groundwater

Table 7-4
Soil Health-Based PRGs, SCGs and Other Values Pertinent to PRG Selection
for Commercial/Industrial Land Use for the NMPC Property and the ACOE Property

Land Use: Commercial/ Industrial	Health-Based PRGs Soil (mg/kg)	Receptor Driver	Method Detection Level (mg/kg)	Local Background Levels Surface/Subsurface (mg/kg)	TAGM-4046 Soil Clean-up Objectives/Levels (mg/kg)	PROPOSED PRG (mg/kg)
PESTICIDES/PCBS						
Aldrin	0.04	COM	0.008	NNO	0.041	0.04 [5]
Heptachlor epoxide	-	-	0.008	NNO	0.02	0.02 TAGM
Dieldrin	0.05	COM	0.016	NNO	0.044	0.05 [5]
Endrin	14	CON	0.008	NNO	0.1	14 [5]
4,4'-DDE	2.7	COM	0.016	NNO	2.1	3 [5]
Endosulfan II	319	CON	0.0033	NNO	0.9	319 [5]
4,4'-DDD	3.2	COM	0.016	NNO	2.9	3 [5]
Endosulfan sulfate	319	CON	0.0033	NNO	1	319 [5]
4,4'-DDT	2.7	COM	0.016	NNO	2.1	3 [5]
Methoxychlor	266	CON	0.08	NNO	10 [3]	266 [5]
Endrin aldehyde	-	-	0.017	NNO	NA	0.017 MDL
alpha-Chlordane	1.8	COM	0.08	NNO	0.54	2 [5]
gamma-Chlordane	5.0	CON	0.08	NNO	0.54	5 [5]
Aroclor-1260	-	-	0.0017	NNO	1/10 [4]	1/10 TAGM

Table 7-5
Groundwater Health-Based PRGs, SCGs and Other Values Pertinent to PRG Selection for Commercial/Industrial Land Use for the NMPC Property

Land Use: Commercial/ Industrial	Health-Based PRGs Groundwater (ug/L)	Receptor Driver	Method Detection Level (ug/L)	Local Background Level (ug/L)	TOGS 1.1.1 Class GA Groundwater Standard/ Criteria (ug/L)	MCL (ug/L)	PROPOSED PRG (ug/L)
VOLATILE ORGANICS							
Acetone	-		10	NNO	50		50 TOGS
Benzene	382	COM	10	NNO	0.7	5	382 [2]
Toluene	76,439	COM	10	NNO	5	1000	76,439 [2]
Ethylbenzene	155,267	COM	10	NNO	5	700	155,267 [2]
Xylenes (Total)	-		10	NNO	5	10000	10,000 MCL

Table 7-5

Groundwater Health-Based PRGs, SCGs and Other Values Pertinent to PRG Selection for Commercial/Industrial Land Use for the NMPC Property

Land Use: Commercial/ Industrial	Health-Based PRGs Groundwater (ug/L)	Receptor Driver	Method Detection Level (ug/L)	Local Background Level (ug/L)	TOGS 1.1.1 Class GA Groundwater Standard/ Criteria (ug/L)	MCL (ug/L)	PROPOSED PRG (ug/L)
SEMI-VOLATILE ORGANICS							
Naphthalene	-		10	NNO	10		- [3]
2-Methylnaphthalene	-		10	NNO	50		- [3]
Acenaphthylene	-		10	NNO	20		- [3]
Acenaphthene	-		10	NNO	20		- [3]
Dibenzofuran	-		10	NNO	5		- [3]
Fluorene	-		10	NNO	50		- [3]
Phenanthrene	-		10	NNO	50		- [3]
Anthracene	-		10	NNO	50		- [3]
Carbazole	-		10	NNO	-		- [3]
Fluoranthene	-		10	NNO	50		- [3]
Pyrene	-		10	NNO	50		- [3]
Benzo(a)anthracene	-		10	NNO	0.002		- [3]
Chrysene	-		10	NNO	0.002		- [3]
Benzo(b)fluoranthene	-		10	NNO	0.002		- [3]
Benzo(k)fluoranthene	-		10	NNO	0.002		- [3]
Benzo(a)pyrene	-		10	NNO	0.002	0.2	- [3]
Indeno(1,2,3cd)pyrene	-		10	NNO	0.002		- [3]
Benzo(g,h,i)perylene	-		10	NNO	5		- [3]

Table 7-5

Groundwater Health-Based PRGs, SCGs and Other Values Pertinent to PRG Selection for Commercial/Industrial Land Use for the NMPC Property

Land Use: Commercial/ Industrial	Health-Based PRGs Groundwater (ug/L)	Receptor Driver	Method Detection Level (ug/L)	Local Background Level (ug/L)	TOGS 1.1.1 Class GA Groundwater Standard/ Criteria (ug/L)	MCL (ug/L)	PROPOSED PRG (ug/L)
PESTICIDES/PCBS							
Endrin	-		0.05	NNO	0.01	2	- [3]

Table 7-5

Groundwater Health-Based PRGs, SCGs and Other Values Pertinent to PRG Selection for Commercial/Industrial Land Use for the NMPC Property

Land Use: Commercial/ Industrial	Health-Based PRGs Groundwater (ug/L)	Receptor Driver	Method Detection Level (ug/L)	Local Background Level (ug/L)	TOGS 1.1.1 Class GA Groundwater Standard/ Criteria (ug/L)	MCL (ug/L)	PROPOSED PRG (ug/L)
INORGANICS AND CYANIDE							
Aluminum	-		200	538000	33000	-	- [3]
Arsenic	-		2.7	18.3	12	50	- [3]
Barium	-		200	22900	600	2	- [3]
Beryllium	-		0.08	1.57	1.75	4	- [3]
Chromium (Total)*	-		10	46.6	40	100	- [3]
Cobalt	-		10	81.4	60	-	- [3]
Copper	-		2	240	50	1300	- [3]
Lead	-		1.6	245	-	15	- [3]
Manganese	-		10	96000	5000	-	- [3]
Mercury	-		0.04	1.3	0.2	2	- [3]
Nickel	-		1.6	244	25	100	- [3]
Selenium	-		2.8	64.7	3.9	50	- [3]
Thallium	-		3.9	31.2	-	2	- [3]
Vanadium	-		1.7	80.9	300	-	- [3]
Zinc	-		4.1	275	50	-	- [3]
Cyanide	-		10	10	10	200	- [3]

NOTES:

[1] From TAGM 4046/TOGS 1.1.1 {NYSCRR, Title 6, Chapter X, Parts 700-705 for organics and NYSDEC LL-ASP, Part V for inorganics}-based on residential use.

[2] Based on Human Health Risk for commercial / industrial receptor.

[3] Constituent not a volatile, Not considered for the applicable (inhalation) pathway

MDL = Method Detection Limit

ND = Non-Detect

NV = No Value

SOL = Solubility Limit

* Chromium (total) assumed to be Cr VI for health based risk assessment.

Receptor Driver = Receptor associated with the most stringent health-based PRG

COM = Commercial Worker - Inhalation of indoor vapors

CON = Construction Worker - Not ingestion-based

Table 7-6
Groundwater Health-Based PRGs, SCGs and Other Values Pertinent to PRG Selection
for Commercial/Industrial Land Use for the ACOE Property

Land Use: Commercial/ Industrial	Health-Based PRGs Groundwater (ug/L)	Receptor Driver	Method Detection Level (ug/L)	Local Background Level (ug/L)	TOGS 1.1.1 Class GA Groundwater Standard/ Criteria (ug/L)	MCL (ug/L)	PROPOSED PRG (ug/L)
VOLATILE ORGANICS							
Acetone	2,044	COM	10	NNO	50	-	2,044 [2]
Benzene	6	COM	10	NNO	0.7	5	5 MCL
Toluene	3,880	COM	10	NNO	5	1000	1,000 MCL
Ethylbenzene	2,017	COM	10	NNO	5	700	700 MCL
Xylenes (Total)	40,880	COM	10	NNO	5	10000	10,000 MCL

Table 7-6
Groundwater Health-Based PRGs, SCGs and Other Values Pertinent to PRG Selection
for Commercial/Industrial Land Use for the ACOE Property

Land Use: Commercial/ Industrial	Health-Based PRGs Groundwater (ug/L)	Receptor Driver	Method Detection Level (ug/L)	Local Background Level (ug/L)	TOGS 1.1.1 Class GA Groundwater Standard/ Criteria (ug/L)	MCL (ug/L)	PROPOSED PRG (ug/L)
SEMI-VOLATILE ORGANICS							
Naphthalene	818	COM	10	NNO	10	-	818 [2]
2-Methylnaphthalene	818	COM	10	NNO	50	-	818 [2]
Acenaphthylene	-	-	10	NNO	20	-	20 TOGS
Acenaphthene	1,226	COM	10	NNO	20	-	1,226 [2]
Dibenzofuran	82	COM	10	NNO	5	-	82 [2]
Fluorene	818	COM	10	NNO	50	-	818 [2]
Phenanthrene	-	-	10	NNO	50	-	50 TOGS
Anthracene	6,132	COM	10	NNO	50	-	6,132 [2]
Carbazole	14	COM	10	NNO	-	-	14 [2]
Fluoranthene	818	COM	10	NNO	50	-	818 [2]
Pyrene	613	COM	10	NNO	50	-	613 [2]
Benzo(a)anthracene	0.39	COM	10	NNO	0.002	-	10 MDL
Chrysene	4	COM	10	NNO	0.002	-	10 MDL
Benzo(b)fluoranthene	0.39	COM	10	NNO	0.002	-	10 MDL
Benzo(k)fluoranthene	4	COM	10	NNO	0.002	-	10 MDL
Benzo(a)pyrene	0.04	COM	10	NNO	0.002	0.2	0.2 MCL
Indeno(1,2,3cd)pyrene	0.39	COM	10	NNO	0.002	-	10 MDL
Benzo(g,h,i)perylene	-	-	10	NNO	5	-	10 MDL

Table 7-6
Groundwater Health-Based PRGs, SCGs and Other Values Pertinent to PRG Selection
for Commercial/Industrial Land Use for the ACOE Property

Land Use: Commercial/ Industrial	Health-Based PRGs Groundwater (ug/L)	Receptor Driver	Method Detection Level (ug/L)	Local Background Level (ug/L)	TOGS 1.1.1 Class GA Groundwater Standard/ Criteria (ug/L)	MCL (ug/L)	PROPOSED PRG (ug/L)
PESTICIDES/PCBS							
Endrin	6	COM	0.05	NNO	0.01	2	2 [MCL]

Table 7-6
Groundwater Health-Based PRGs, SCGs and Other Values Pertinent to PRG Selection
for Commercial/Industrial Land Use for the ACOE Property

Land Use: Commercial/ Industrial	Health-Based PRGs Groundwater (ug/L)	Receptor Driver	Method Detection Level (ug/L)	Local Background Level (ug/L)	TOGS 1.1.1 Class GA Groundwater Standard/ Criteria (ug/L)	MCL (ug/L)	PROPOSED PRG (ug/L)
INORGANICS AND CYANIDE							
Arsenic	0.2	COM	2.7	18.3	12	50	50 MCL
Beryllium	0.07	COM	0.08	1.57	1.75	4	4 MCL
Chromium (Total)*	102	COM	10	46.6	40	100	100 MCL
Cobalt	3,679	COM	10	81.4	60	-	3,679 [2]
Copper	71,540	COM	2	240	50	1300	1,300 MCL
Vanadium	143	COM	1.7	80.9	300	-	300 TOGS

NOTES:

[1] From TAGM 4046/TOGS 1.1.1 {NYSCRR, Title 6, Chapter X, Parts 700-705 for organics and NYSDEC LL-ASP, Part V for inorganics}-based on residential use.
[2] Based on Human Health Risk for Residential Receptors
MDL = Method Detection Limit
NNO = Not Naturally Occurring
Receptor Driver = Receptor associated with the most stringent health-based PRG
U/M = Utility/Maintenance Worker - Not ingestion-based
CON = Construction Worker - Not ingestion-based
COM = Commercial Worker - Inhalation and ingestion
MCL = Maximum Contaminant Level

Table 7-7
Soil SCGs and Other Values Pertinent to PRG Selection
for Residential Land Use for the Off-Site (Douw Street) Property

Land Use: Residential	Method Detection Level (mg/kg)	Local Background Levels Surface/Subsurface (mg/kg)	TAGM-4046 Soil Clean-up Objectives/Levels (mg/kg)	PROPOSED PRG (mg/kg)
VOLATILE ORGANICS				
Acetone	0.01	NNO	0.2 [1a]	0.2 TAGM
Benzene	0.01	NNO	0.06 [1a]	0.1 TAGM
Toluene	0.01	NNO	1.5 [1a]	1.5 TAGM
Ethylbenzene	0.01	NNO	5.5 [1a]	5.5 TAGM
Styrene	0.01	NNO	NA [1a]	0.01 MDL
Xylenes (Total)	0.01	NNO	1.2 [1a]	1.2 TAGM

Table 7-7
Soil SCGs and Other Values Pertinent to PRG Selection
for Residential Land Use for the Off-Site (Douw Street) Property

Land Use: Residential	Method Detection Level (mg/kg)	Local Background Levels Surface/Subsurface (mg/kg)	TAGM-4046 Soil Clean-up Objectives/Levels (mg/kg)	PROPOSED PRG (mg/kg)
SEMI-VOLATILE ORGANICS				
Naphthalene	0.33	NNO	13 [1a]	13 TAGM
2-Methylnaphthalene	0.33	NNO	36 [1a]	36 TAGM
Acenaphthylene	0.33	NNO	41 [1a]	41 TAGM
Acenaphthene	0.33	NNO	50 [2]	50 TAGM
Dibenzofuran	0.33	NNO	6.2 [1a]	6.2 TAGM
2,4-Dinitrotoluene	0.33	NNO	NA [1a]	0.3 MDL
Diethylphthalate	0.33	NNO	7.1 [1a]	7.1 TAGM
Fluorene	0.33	NNO	50 [2]	50 TAGM
Phenanthrene	0.33	NNO	50 [2]	50 TAGM
Anthracene	0.33	NNO	50 [2]	50 TAGM
Carbazole	0.33	NNO	NA [1a]	0.3 MDL
Fluoranthene	0.33	NNO	50 [2]	50 TAGM
Pyrene	0.33	NNO	50 [2]	50 TAGM
Benzo(a)anthracene	0.33	NNO	0.224 [1a]	0.3 MDL
Chrysene	0.33	NNO	0.4 [1a]	0.4 TAGM
Bis(2-ethylhexyl)phthalate	0.33	NNO	50 [2]	50 TAGM
Benzo(b)fluoranthene	0.33	NNO	1.1 [1a]	1.1 TAGM
Benzo(k)fluoranthene	0.33	NNO	1.1 [1a]	1.1 TAGM
Benzo(a)pyrene	0.33	NNO	0.61 [1a]	0.6 TAGM
Indeno(1,2,3cd)pyrene	0.33	NNO	3.2 [1a]	3.2 TAGM
Dibenzo(a,h)anthracene	0.33	NNO	0.14 [1a]	0.3 MDL
Benzo(g,h,i)perylene	0.33	NNO	50 [2]	50 TAGM

Table 7-7
Soil SCGs and Other Values Pertinent to PRG Selection
for Residential Land Use for the Off-Site (Douw Street) Property

Land Use: Residential	**Method Detection Level** (mg/kg)	**Local Background Levels Surface/Subsurface** (mg/kg)	**TAGM-4046 Soil Clean-up Objectives/Levels** (mg/kg)	**PROPOSED PRG** (mg/kg)
PESTICIDES/PCBS				
Aldrin	0.008	NNO	0.041	0.041 TAGM
Heptachlor epoxide	0.008	NNO	0.02	0.020 TAGM
Dieldrin	0.016	NNO	0.044	0.044 TAGM
Endrin	0.008	NNO	0.1	0.1 TAGM
4,4'-DDE	0.016	NNO	2.1	2.1 TAGM
Endosulfan II	0.0033	NNO	0.9	0.9 TAGM
4,4'-DDD	0.016	NNO	2.9	2.9 TAGM
Endosulfan sulfate	0.0033	NNO	1	1.0 TAGM
4,4'-DDT	0.016	NNO	2.1	2.1 TAGM
Methoxychlor	0.08	NNO	10 [3]	10.0 TAGM
Endrin aldehyde	0.017	NNO	NA	0.017 MDL
alpha-Chlordane	0.08	NNO	0.54	0.5 TAGM
gamma-Chlordane	0.08	NNO	0.54	0.5 TAGM
Aroclor-1260	0.0017	NNO	1/10 [4]	0.002 MDL

Table 7-7
Soil SCGs and Other Values Pertinent to PRG Selection
for Residential Land Use for the Off-Site (Douw Street) Property

Land Use: Residential	Method Detection Level (mg/kg)	Local Background Levels Surface/Subsurface (mg/kg)	TAGM-4046 Soil Clean-up Objectives/Levels (mg/kg)	PROPOSED PRG (mg/kg)
INORGANICS AND CYANIDE				
Aluminum	2	NV	-	2 MDL
Arsenic	0.1	NV	7.5	7.5 TAGM
Barium	2	NV	300	300 TAGM
Chromium (Total)	0.1	NV	10	10 TAGM
Cobalt	0.5	NV	30	30 TAGM
Copper	0.25	NV	25	25 TAGM
Lead*	0.03	NV	400	400 USEPA
Manganese	0.15	NV	-	0.2 MDL
Mercury	0.002	NV	0.1	0.1 TAGM
Nickel	0.4	NV	13	13 TAGM
Selenium	0.05	NV	2	2 TAGM
Thallium	0.1	NV	-	0.1 MDL
Vanadium	0.5	NV	150	150 TAGM
Zinc	0.2	NV	20	20 TAGM
Cyanide	0.1	NV	-	0.1 MDL

NOTES:

[1] TAGM-4046 Recommended Soil Clean-Up Objectives calculated for foc of 1% - Reflects protection for residential exposures: (a) without consideration of 'groundwater protection or (b) with consideration of groundwater protection.

[2] Total VOCs <10 ppm; Total SVOCs <500 ppm; Individual SVOCs, 50 ppm.

[3] Total Pesticides, 10 ppm.

[4] Shallow soil value / Subsurface soil value.

* No toxicity values for lead.

MDL = Method Detection Limit

NNO = Not Naturally Occurring

NV = No Value, surface soil background not determined

USEPA For lead the USEPA Action level for residential soils

Table 7-8

Groundwater Health-Based PRGs, SCGs and Other Values Pertinent to PRG Selection for Residential Land Use for the Off-Site (Douw Street) Property

Land Use: Residential	Health-Based PRGs Groundwater (ug/L)	Receptor Driver	Method Detection Level (ug/L)	Local Background Level (ug/L)	TOGS 1.1.1 Class GA Groundwater Standard/ Criteria (ug/L)	MCL (ug/L)	PROPOSED PRG (ug/L)
VOLATILE ORGANICS							
Xylenes (Total)	426,734	RES	10	NNO	5	10000	10,000 MCL

Table 7-8
Groundwater Health-Based PRGs, SCGs and Other Values Pertinent to PRG Selection
for Residential Land Use for the Off-Site (Douw Street) Property

Land Use: Residential	Health-Based PRGs Groundwater (ug/L)	Receptor Driver	Method Detection Level (ug/L)	Local Background Level (ug/L)	TOGS 1.1.1 Class GA Groundwater Standard/ Criteria (ug/L)	MCL (ug/L)	PROPOSED PRG (ug/L)
SEMI-VOLATILE ORGANICS							
Naphthalene	8,579	RES	10	NNO	10	-	8,579 [2]
2-Methylnaphthalene	-	-	10	NNO	50	-	50 TOGS
Acenaphthene	12,244	RES	10	NNO	20	-	12,244 [2]
Fluorene	8,004	RES	10	NNO	50	-	8,004 [2]
Phenanthrene	-	-	10	NNO	50	-	50 TOGS
Anthracene	-	-	10	NNO	50	-	50 TOGS
Pyrene	5,085	RES	10	NNO	50	-	5,085 [2]
Butylbenzylphthalate	-	-	10	NNO	50		50 TOGS
Benzo(a)anthracene	-	-	10	NNO	0.002	-	10 MDL
Chrysene	-	-	10	NNO	0.002	-	10 MDL
Bis(2-ethylhexyl)phthalate	-	-	10	NNO	50	-	50 TOGS
Di-n-octylphthalate	-	-	10	NNO	50		50 TOGS
Benzo(b)fluoranthene	-	-	10	NNO	0.002	-	10 MDL
Benzo(k)fluoranthene	-	-	10	NNO	0.002	-	10 MDL
Benzo(a)pyrene	-	-	10	NNO	0.002	0.2	10 MDL
Indeno(1,2,3cd)pyrene	-	-	10	NNO	0.002	-	10 MDL
Dibenzo(a,h)anthracene	-	-	10	NNO	50	-	50 TOGS
Benzo(g,h,i)perylene	-	-	10	NNO	5	-	10 MDL

NOTES:
[1] From TAGM 4046/TOGS 1.1.1 {NYSCRR, Title 6, Chapter X, Parts 700-705 for organics and NYSDEC LL-ASP, Part V for inorganics}-based on <u>residential</u> use.
[2] Based on Human Health Risk for Residential Receptors
MDL = Method Detection Limit
ND = Non-Detect
NV = No Value
NNO = Not Naturally Occurring
Receptor Driver = Resident (lowest PRG of Child non-carcinogen, Adult non-carcinogen or composite child/adult carcinogen)
MCL = Maximum Contaminant Level

Table 7-9
Comparison of Average Soil Concentrations to PRGs for the NMPC Property

NMPC Property	PROPOSED COMMERCIAL / INDUSTRIAL PRG (mg/kg)	Average Surface Soil Concentration [1] (mg/kg)	Commercial / Industrial PRG Exceeded? (Yes / No)	Average Subsurface Soil Concentration [1] (mg/kg)	Commercial / Industrial PRG Exceeded? (Yes / No)
VOLATILE ORGANICS					
Benzene	2	0.0055	No	0.06	No
Toluene	658	0.0056	No	0.18	No
Ethylbenzene	2,293	0.0046	No	0.15	No
Xylenes (Total)	131,701	0.0050	No	0.27	No

Table 7-9
Comparison of Average Soil Concentrations to PRGs for the NMPC Property

NMPC Property	PROPOSED COMMERCIAL / INDUSTRIAL PRG (mg/kg)	Average Surface Soil Concentration [1] (mg/kg)	Commercial / Industrial PRG Exceeded? (Yes / No)	Average Subsurface Soil Concentration [1] (mg/kg)	Commercial / Industrial PRG Exceeded? (Yes / No)
SEMI-VOLATILE ORGANICS					
Naphthalene	13	0.1780	No	0.75	No
2-Methylnaphthalene	4424	0.1750	No	1.21	No
Acenaphthylene	41	0.1360	No	2.30	No
Acenaphthene	24886	0.1780	No	1.86	No
Dibenzofuran	229	0.1750	No	0.474	No
Diethylphthalate	7.1	0.1750	No	0.245	No
Fluorene	2,517	0.1780	No	2.12	No
Phenanthrene	50	0.1500	No	3.25	No
Anthracene	13,378	0.0950	No	2.22	No
Carbazole	52	0.0410	No	0.751	No
Fluoranthene	2,517	0.3590	No	3.20	No
Pyrene	1,888	0.2230	No	4.771	No
Benzo(a)anthracene	1.25	0.1630	No	2.84	**Yes**
Chrysene	12.50	0.1860	No	3.12	No
Bis(2-ethylhexyl)phthalate	1591	0.0720	No	0.608	No
Benzo(b)fluoranthene	1.2	0.1560	No	1.72	**Yes**
Benzo(k)fluoranthene	12.5	0.2180	No	2.13	No
Benzo(a)pyrene	0.6	0.1800	No	3.08	**Yes**
Indeno(1,2,3cd)pyrene	3.2	0.1160	No	1.70	No
Dibenzo(a,h)anthracene	0.33	0.1780	No	0.902	**Yes**
Benzo(g,h,i)perylene	50	0.0650	No	1.75	No

Table 7-9
Comparison of Average Soil Concentrations to PRGs for the NMPC Property

NMPC Property	PROPOSED COMMERCIAL / INDUSTRIAL PRG (mg/kg)	Average Surface Soil Concentration [1] (mg/kg)	Commercial / Industrial PRG Exceeded? (Yes / No)	Average Subsurface Soil Concentration [1] (mg/kg)	Commercial / Industrial PRG Exceeded? (Yes / No)
PESTICIDES/PCBS					
Aldrin	0.04	0.0009	No	0.0018	No
Heptachlor epoxide	0.02	0.0009	No	0.0027	No
Endrin	14	0.0033	No	0.0049	No
4,4'-DDD	3	0.0017	No	0.0034	No
4,4'-DDE	3	0.0024	No	0.0041	No
Endosulfan sulfate	319	0.0017	No	0.0068	No
4,4'-DDT	3	0.0086	No	0.0079	No
Endrin aldehyde	0.017	0.0017	No	0.0123	No
alpha-Chlordane	2	0.0014	No	0.0018	No
Aroclor-1260 [2]	1/10	0.0170	No	0.0273	No

Table 7-9
Comparison of Average Soil Concentrations to PRGs for the NMPC Property

NMPC Property	PROPOSED COMMERCIAL / INDUSTRIAL PRG (mg/kg)	Average Surface Soil Concentration [1] (mg/kg)	Commercial / Industrial PRG Exceeded? (Yes / No)	Average Subsurface Soil Concentration [1] (mg/kg)	Commercial / Industrial PRG Exceeded? (Yes / No)
INORGANICS AND CYANIDE					
Aluminum	89,806	8340	No	9432	No
Arsenic	8	5.1	No	8.7	**Yes**
Barium	6,286	58.3	No	79	No
Chromium (Total)	594	13.1	No	15.8	No
Cobalt	16,165	7.3	No	12	No
Copper	755,916	16.5	No	34.6	No
Lead*	1,000	25	No	133	No
Manganese	12,573	420	No	718	No
Nickel	747	14.8	No	23.3	No
Thallium	24	0.84	No	1.3	No
Vanadium	629	16.2	No	22.7	No
Zinc	28,077	60.9	No	75	No

Notes:

[1] Average detected soil concentration is the arithmetic mean of the soil concentrations and half the non-detected quantitation limit.

[2] Shallow soil concentration / subsurface soil concentration.

* No toxicity values for lead.

Table 7-10
Comparison of Average Soil Concentrations to PRGs for the ACOE Property

ACOE PROPERTY	PROPOSED COMMERCIAL / INDUSTRIAL PRG (mg/kg)	Average Surface Soil Concentration [1] (mg/kg)	Commercial / Industrial PRG Exceeded? (Yes / No)	Average Subsurface Soil Concentration [1] (mg/kg)	Commercial / Industrial PRG Exceeded? (Yes / No)
VOLATILE ORGANICS					
Acetone	70,000	0.006	No	0.008	No
Benzene	2	0.006	No	33.6	**Yes**
Toluene	658	0.006	No	65.3	No
Ethylbenzene	2,293	0.006	No	48.8	No
Styrene	7,860	0.006	No	12.6	No
Xylenes (Total)	131,701	0.006	No	80.7	No

Table 7-10
Comparison of Average Soil Concentrations to PRGs for the ACOE Property

ACOE PROPERTY	PROPOSED COMMERCIAL / INDUSTRIAL PRG (mg/kg)	Average Surface Soil Concentration [1] (mg/kg)	Commercial / Industrial PRG Exceeded? (Yes / No)	Average Subsurface Soil Concentration [1] (mg/kg)	Commercial / Industrial PRG Exceeded? (Yes / No)
SEMI-VOLATILE ORGANICS					
Naphthalene	13	1.059	No	577.9	**Yes**
2-Methylnaphthalene	4424	0.195	No	895.7	No
Acenaphthylene	41	2.949	No	131.8	**Yes**
Acenaphthene	24886	1.986	No	72.3	No
Dibenzofuran	229	0.195	No	18.6	No
Fluorene	2,517	0.904	No	140.4	No
Phenanthrene	50	3.545	No	284.3	**Yes**
Anthracene	13,378	1.449	No	97.6	No
Carbazole	52	0.195	No	18.3	No
Fluoranthene	2,517	8.692	No	79.7	No
Pyrene	1,888	10.330	No	121.7	No
Benzo(a)anthracene	1.2	5.573	**Yes**	45.0	**Yes**
Chrysene	12.5	7.050	No	44.5	**Yes**
Benzo(b)fluoranthene	1.2	4.247	**Yes**	13.1	**Yes**
Benzo(k)fluoranthene	12.5	4.727	No	15.2	**Yes**
Benzo(a)pyrene	0.6	7.280	**Yes**	23.4	**Yes**
Indeno(1,2,3cd)pyrene	3.2	4.020	**Yes**	9.0	**Yes**
Dibenzo(a,h)anthracene	0.33	1.808	**Yes**	6.1	**Yes**
Benzo(g,h,i)perylene	50	4.555	No	8.1	No

Table 7-10
Comparison of Average Soil Concentrations to PRGs for the ACOE Property

ACOE PROPERTY	PROPOSED COMMERCIAL / INDUSTRIAL PRG (mg/kg)	Average Surface Soil Concentration [1] (mg/kg)	Commercial / Industrial PRG Exceeded? (Yes / No)	Average Subsurface Soil Concentration [1] (mg/kg)	Commercial / Industrial PRG Exceeded? (Yes / No)
PESTICIDES/PCBS					
Aldrin	0.04	0.0013	No	0.0017	No
Dieldrin	0.05	0.0026	No	0.0028	No
Endrin	14	0.0020	No	0.0160	No
4,4'-DDE	2.7	0.0096	No	0.0033	No
Endosulfan II	319	0.0025	No	0.0210	No
4,4'-DDD	3.2	0.0026	No	0.0290	No
Endosulfan sulfate	319	0.0020	No	0.0046	No
4,4'-DDT	2.7	0.0210	No	0.0091	No
Methoxychlor	266	0.01	No	0.0539	No
gamma-Chlordane	5.0	0.0010	No	0.0004	No

Table 7-10

Comparison of Average Soil Concentrations to PRGs for the ACOE Property

ACOE PROPERTY	PROPOSED COMMERCIAL / INDUSTRIAL PRG (mg/kg)	Average Surface Soil Concentration [1] (mg/kg)	Commercial / Industrial PRG Exceeded? (Yes / No)	Average Subsurface Soil Concentration [1] (mg/kg)	Commercial / Industrial PRG Exceeded? (Yes / No)
INORGANICS AND CYANIDE					
Aluminum	89,806	9360.00	No	9575.9	No
Arsenic	8	6.00	No	10.7	**Yes**
Barium	6,286	68.80	No	83.6	No
Chromium (Total)	594	12.20	No	16.1	No
Cobalt	16,165	7.30	No	8.6	No
Copper	755,916	21.70	No	32.1	No
Lead*	1,000	141.00	No	180.4	No
Manganese	12,573	491.00	No	721.1	No
Mercury	51	0.16	No	1.4	No
Nickel	747	16.10	No	19.8	No
Selenium	506	0.85	No	4.2	No
Thallium	24	4.00	No	3.3	No
Vanadium	629	19.40	No	17.0	No
Zinc	28,077	156.00	No	171.4	No
Cyanide	859	0.51	No	0.29	No

Notes:

[1] Average detected soil concentration is the arithmetic mean of the soil concentrations and half the non-detected quantitation limit. If the average exceeds Maximum Detect, Maximum Detect is used.

* No toxicity values for lead.

Table 7-11
Comparison of Maximum Detected Groundwater Concentrations to PRGs for the Former NMPC MGP Site

GROUNDWATER ASSOCIATED WITH FORMER MGP SITE	PROPOSED ACOE Commercial / Industrial PRG (ug/L)	Maximum Detected ACOE Parcel Concentration (ug/L)	Commercial / Industrial PRG Exceeded? (Yes / No)	PROPOSED NMPC Commercial / Industrial PRG (ug/L)	Maximum Detected NMPC Property Concentration (ug/L)	Commercial/ Industrial PRG Exceeded? (Yes / No)	PROPOSED Residential PRG (ug/L)	Maximum Detected Off-site (Douw Street) Parcel Concentration (ug/L)	Residential PRG Exceeded? (Yes/No)
VOLATILE ORGANICS									
Acetone	2,044	11	No	50	-	No	50	-	No
Benzene	5	69	Yes	382	280	No	5	-	No
Toluene	1,000	16	No	76,439	21	No	1,000	1	No
Ethylbenzene	700	52	No	155,267	1200	No	700	-	No
Xylenes (Total)	10,000	42	No	10,000	570	No	10,000	-	No

Table 7-11
Comparison of Maximum Detected Groundwater Concentrations to PRGs for the Former NMPC MGP Site

GROUNDWATER ASSOCIATED WITH FORMER MGP SITE	PROPOSED ACOE Commercial / Industrial PRG (ug/L)	Maximum Detected ACOE Parcel Concentration (ug/L)	Commercial / Industrial PRG Exceeded? (Yes / No)	PROPOSED NMPC Commercial / Industrial PRG (ug/L)	Maximum Detected NMPC Property Concentration (ug/L)	Commercial/ Industrial PRG Exceeded? (Yes / No)	PROPOSED Residential PRG (ug/L)	Maximum Detected Off-site (Douw Street) Parcel Concentration (ug/L)	Residential PRG Exceeded? (Yes / No)
SEMI-VOLATILE ORGANICS									
Naphthalene	818	20.0	No	-	6600	No	8,579	9	No
2-Methylnaphthalene	818	-	No	-	610	No	50	3	No
Acenaphthylene	20	20	No	-	85	No	-	-	No
Acenaphthene	1,226	330	No	-	310	No	12,244	4	No
Dibenzofuran	82	13	No	-	14	No	-	-	No
Fluorene	818	120	No	-	120	No	8,004	2	No
Phenanthrene	50	31	No	-	62	No	50	4	No
Anthracene	6,132	17	No	-	16	No	50	-	No
Carbazole	14	1	No	-	2	No	-	-	No
Fluoranthene	818	18	No	-	8	No	-	-	No
Pyrene	613	29	No	-	10	No	5,085	1	No
Benzo(a)anthracene	10	7	No	-	2	No	10	-	No
Chrysene	10	7	No	-	2	No	10	-	No
Bis(2-ethylhexyl)phth	50	-	No	-	-	No	50	-	No
Benzo(b)fluoranthene	10	2	No	-	-	No	10	-	No
Benzo(k)fluoranthene	10	3	No	-	-	No	10	-	No
Benzo(a)pyrene	0.2	5	Yes	-	1	No	10	-	No
Indeno(1,2,3cd)pyrene	10	1	No	-	-	No	10	-	No
Dibenzo(a,h)anthracen	50	-	No	-	-	No	50	-	No
Benzo(g,h,i)perylene	10	1	No	-	-	No	-	-	No

Table 7-11

Comparison of Maximum Detected Groundwater Concentrations to PRGs for the Former NMPC MGP Site

GROUNDWATER ASSOCIATED WITH FORMER MGP SITE	PROPOSED ACOE Commercial / Industrial PRG (ug/L)	Maximum Detected ACOE Parcel Concentration (ug/L)	Commercial / Industrial PRG Exceeded? (Yes / No)	PROPOSED NMPC Commercial / Industrial PRG (ug/L)	Maximum Detected NMPC Property Concentration (ug/L)	Commercial/ Industrial PRG Exceeded? (Yes / No)	PROPOSED Residential PRG (ug/L)	Maximum Detected Off-site (Douw Street) Parcel Concentration (ug/L)	Residential PRG Exceeded? (Yes / No)
PESTICIDES/PCBS									
Endrin	46	0.058	No	-	-	No	46	-	No

Table 7-11

Comparison of Maximum Detected Groundwater Concentrations to PRGs for the Former NMPC MGP Site

GROUNDWATER ASSOCIATED WITH FORMER MGP SITE	PROPOSED ACOE Commercial / Industrial PRG (ug/L)	Maximum Detected ACOE Parcel Concentration (ug/L)	Commercial / Industrial PRG Exceeded? (Yes / No)	PROPOSED NMPC Commercial / Industrial PRG (ug/L)	Maximum Detected NMPC Property Concentration (ug/L)	Commercial/ Industrial PRG Exceeded? (Yes / No)	PROPOSED Residential PRG (ug/L)	Maximum Detected Off-site (Douw Street) Parcel Concentration (ug/L)	Residential PRG Exceeded? (Yes / No)
INORGANICS AND CYANIDE									
Aluminum	33,000	-	No	-	-	No	33,000	-	No
Arsenic	50	158	Yes	-	-	No	50		No
Barium	600	128	No	-	-	No	600	-	No
Beryllium	50	5.4	No	-	-	No	50	-	No
Chromium	100	212	Yes	-	-	No	100	-	No
Cobalt	3,679	120	No	-	-	No	60	-	No
Copper	1,300	431	No	-	-	No	1,300	-	No
Manganese	5,000	-	No	-	-	No	5,000	-	No
Mercury	2	-	No	-	-	No	2	-	No
Nickel	100	-	No	-	-	No	100	-	No
Selenium	50	-	No	-	-	No	50	-	No
Silver	1	-	No	-	-	No	1	-	No
Vanadium	300	199	No	-	-	No	300	-	No
Zinc	50	-	No	-	-	No	50	-	No
Cyanide	200	-	No	-	-	No	200	-	No

Table 7-12

Comparison of Average Soil Concentrations to PRGs for the Off-Site (Douw Street) Property

SOIL ASSOCIATED WITH THE OFF-SITE (DOUW STREET) PROPERTY	PROPOSED RESIDENTIAL PRG (mg/kg)	Average Surface Soil Concentration [1] (mg/kg)	Residential PRG Exceeded? (Yes / No)	Average Subsurface Soil Concentration [1] (mg/kg)	Residential PRG Exceeded? (Yes / No)
VOLATILE ORGANICS					
Ethylbenzene	6	0.0065	No	0.167	No
Xylenes (Total)	1	0.0065	No	0.221	No

Table 7-12
Comparison of Average Soil Concentrations to PRGs for the Off-Site (Douw Street) Property

SOIL ASSOCIATED WITH THE OFF-SITE (DOUW STREET) PROPERTY	PROPOSED RESIDENTIAL PRG (mg/kg)	Average Surface Soil Concentration [1] (mg/kg)	Residential PRG Exceeded? (Yes / No)	Average Subsurface Soil Concentration [1] (mg/kg)	Residential PRG Exceeded? (Yes / No)
SEMI-VOLATILE ORGANICS					
Naphthalene	13	0.22	No	20.96	Yes
Acenaphthylene	41	0.22	No	1.07	No
Acenaphthene	50	0.22	No	11.65	No
Fluorene	50	0.22	No	6.63	No
Phenanthrene	50	0.18	No	32.86	No
Anthracene	50	0.044	No	9.34	No
Fluoranthene	50	0.39	No	12.19	No
Pyrene	50	0.12	No	18.66	No
Benzo(a)anthracene	0.33	0.12	No	6.17	Yes
Chrysene	0.4	0.14	No	5.43	Yes
Benzo(b)fluoranthene	1.1	0.24	No	2.28	Yes
Benzo(k)fluoranthene	1.1	0.19	No	2.69	Yes
Benzo(a)pyrene	1	0.17	No	5.43	Yes
Indeno(1,2,3cd)pyrene	3	0.22	No	0.54	No
Dibenzo(a,h)anthracene	0.33	0.22	No	0.20	No
Benzo(g,h,i)perylene	50	0.22	No	0.64	No

NOTES:

[1] Average detected soil concentrations the arithmetic mean of the soil concentrations and half the non-detected quantitation limit.

Table 7-13

Summary of the Chemicals of Concern Identified for the AOCs at the Troy (Smith Avenue) Site

	NMPC Property			ACOE Propery			Off-Site (Douw Streeet) Property			Hudson River[1]	
	Surface Soil	Subsurface Soil	Groundwater	Surface Soil	Subsurface Soil	Groundwater	Surface Soil	Subsurface Soil	Groundwater	Surface Water	Sediment
VOLATILE ORGANICS											
Benzene	NO	NO	NO	NO	YES	YES	NO	NO	NO	NO	NO
SEMI-VOLATILE ORGANICS											
Naphthalene	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	NO
Acenaphthylene	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	YES
Fluorene	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES
Phenanthrene	NO	NO	NO	NO	YES	NO	NO	NO	NO	NO	YES
Anthracene	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES
Fluoranthene	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES
Pyrene	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES
Benzo(a)anthracene	NO	NO	NO	YES	YES	NO	NO	NO	NO	NO	YES
Chrysene	NO	NO	NO	YES	YES	NO	NO	NO	NO	NO	YES
Benzo(b)fluoranthene	NO	NO	NO	YES	YES	NO	NO	NO	NO	NO	NO
Benzo(k)fluoranthene	NO	NO	NO	YES	YES	NO	NO	NO	NO	NO	YES
Benzo(a)pyrene	NO	NO	NO	YES	YES	YES	NO	NO	NO	NO	YES
Indeno(1,2,3cd)pyrene	NO	NO	NO	YES	YES	NO	NO	NO	NO	NO	YES
Dibenzo(a,h)anthracene	NO	NO	NO	YES	YES	NO	NO	NO	NO	NO	NO
INORGANICS AND CYANIDE											
Antimony	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES
Arsenic	NO	NO	NO	NO	YES	YES	NO	NO	NO	NO	NO
Cadmium	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES
Chromium (Total)	NO	NO	NO	NO	NO	YES	NO	NO	NO	NO	YES
Copper	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Iron	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES
Lead	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES
Mercury	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES
Zinc	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES

Notes

[1] These constituents exceed only the low effect level (LEL) criteria (NYSDEC,1993; Persaud et al., 1993).

No COPCs in surface water or sediments exceed severe effect level (SEL) criteria (NYSDEC,1993; Persaud et al., 1993).

Yes - Chemical was identified as a COC in medium.

No - Chemical was not identified as a COC in medium.