Feasibility Study Work Plan

Former MGP Site
Nyack, New York

Prepared by:

The RETEC Group, Inc.
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Ithaca, New York 14850-3342

RETEC Project Number: ORAN2-04301-700

Prepared for:

Orange and Rockland Utilities, Inc.
500 Route 208
Monroe, New York 10950

April 2, 2002

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Prepared by:

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Bruce Coulombe, Project Manager

April 2, 2002

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List of Acronyms and Abbreviations

CERCLA – Comprehensive Environmental Response Compensation and Liability Act of 1980. Amended in the Superfund Amendments and Reauthorization Act (SARA) of 1986.

FEMA – Federal Emergency Management Agency

FS – Feasibility Study

GRA – General Response Action

NCP – National Contingency Plan. 40CFR1J Part 300 – National Oil and Hazardous Substances Pollution Contingency Plan

NYSDEC – New York State Department of Environmental Conservation

O&R – Orange and Rockland Utilities Company, Inc.

OU – Operable Unit

Presidential – Presidential Life Insurance Company, Inc.

RAO – Remedial Action Objective

RD – Remedial Design

RETEC – The RETEC Group, Inc.

ROD – Record of Decision

SCG – Standards, Criteria, and Guidance

TAGM – Technical and Administrative Guidance Memorandum

USEPA – United States Environmental Protection Agency

1 Introduction

This Feasibility Study (FS) Work Plan describes the scope of work which will be undertaken to complete a FS for the former manufactured gas plant (MGP) site in Nyack, New York. The purpose of the FS is to identify and evaluate a range of remedial action alternatives to support the selection of a set of alternatives which will constitute the final remedy for the site. The FS will be conducted in a manner consistent with the Comprehensive Environmental Response Compensation and Liability Act (CERCLA), the National Contingency Plan (NCP), and guidance by the New York State Department of Environmental Conservation (NYSDEC). NYSDEC guidance documents include the Technical and Administrative Guidance Memorandum (TAGM) #HWR-90-4030 "Selection of Remedial Actions at Inactive Hazardous Waste Sites" and other applicable NYSDEC guidance. A copy of TAGM 4030 is provided as Appendix A to this Work Plan.

A Remedial Investigation (RI) Report has been prepared for Orange and Rockland Utilities, Inc. (O&R) to present the findings of a comprehensive remedial investigation of environmental conditions at the site [RETEC, 2002]. The RI/FS process is being conducted in accordance with the Order on Consent (Order) #D3-0001-98-08 which O&R and NYSDEC executed on March 11, 1999 [NYSDEC, 1999].

1.1 Site Description and Subdivision

The former MGP property is currently owned by Presidential Life Insurance Company (Presidential), of Nyack, New York.

The Nyack MGP site is located adjacent to Gedney Street on the east side of the Village of Nyack, Town of Orangetown, Rockland County, New York, as shown in Figure 1-1. The site covers a total land area of approximately 4.02 acres, and is located in an urban setting where land surrounding the site is used for residential and commercial purposes.

The results of the RI were discussed in terms of the Western Parcel, along the west side of Gedney Street, and the Eastern Parcel, between the east side of Gedney Street and the Hudson River.

We recommend that the FS be structured to address four operable units at the Nyack site: the Western Parcel, the upper terrace of the Eastern Parcel, the lower terrace of the Eastern Parcel, and the submerged sediments. Because each of these areas have different physical characteristics, different MGP impacts, and different issues of concern to NYSDEC and Presidential, the FS evaluations will be done on each of these operable units, in accordance with TAGM 4030. The outcome of these evaluations will be a recommended alternative for each operable unit, which, taken together, will describe the

remedial program for the entire site. The establishment of these operable units is further described in Section 2.

1.2 The FS Process

The FS will be developed using the following five steps for each of the operable units:

1. Identification of the New York State Standards, Criteria, and Guidelines (SCGs) applicable to the site. Guidance specific to MGP sites will be highlighted, as described in Section 3 of this Work Plan.

2. Development of remedial alternatives. The five-stage process for developing remedial alternatives will be followed in accordance with TAGM 4030, as described in Section 4 of this Work Plan.

3. Preliminary screening of remedial alternatives. Effectiveness and implementability will be evaluated in this initial screening, as described in Section 5.

4. Detailed analysis of alternatives. This analysis will use the seven criteria established by NYSDEC for evaluation of alternatives. A comparative analysis of alternatives will lead to the recommendation of an alternative for each operable unit, which, taken together, will comprise the proposed remedial action plan for the site. The unique aspects of the site, including future site use plans, will receive special attention at this stage of the FS. The detailed analysis is further described in Section 5.

5. Preparation of FS Report. The FS Report will present the findings of the analysis of alternatives in narrative and summary tables, including the remedial alternative recommended for each operable unit. The scope of any pre-design investigations required for the recommended alternative will also be described. The FS report is described, with an outline, in Section 5.

1.3 Scheduling and Coordination of the Work

The three primary stakeholders involved in the FS process are O&R, Presidential, and NYSDEC. The work will be coordinated among these organizations so that early review of critical elements can occur. We recommend review by all parties at three stages of the FS: the initial stage, to review the Work Plan; mid-stage, to review the list of alternatives proposed for detailed analysis (after step 3, above), and finally to review the FS report as it is finalized.

In accordance with the Order, the FS report will be submitted to NYSDEC within 120 days of NYSDEC's acceptance of the RI. The portion of the FS addressing the Hudson River sediments will be prepared on a separate

schedule to allow the FS for the terrestrial portion of the site to proceed, while additional interpretation of sediment analyses is conducted. O&R, Presidential, and NYSDEC will provide timely reviews during the first two stages of the process. In this way, the FS report will address the requirements of all of the parties, while conforming to the submittal schedule of the Order.

A proposed schedule of the FS activities for the terrestrial portion of the site is provided in Figure 1-2. The suggested review points for each stakeholder are indicated by the symbols on the schedule chart.

2 Operable Units

The term "operable unit" (OU) means a "discrete portion of a remedial program that may address geographical portions of a site, specific site problems, or specific phases of a program; and that manages migration or that eliminates or mitigates a release, threat of release, or pathway of exposure" [NYSDEC, 1992].

At the Nyack site, designation of operable units will allow for specific remedies to be fashioned for the discrete portions of the site, with separate alternatives developed for each operable unit. This will enable a simplified FS process whereby the range of alternatives for an operable unit can be developed independently from the other operable units. This will avoid carrying superfluous permutations and combinations of alternatives through the FS process. The separation of the operable units also reflects the separate set of design limitations that affect each operable unit, especially with respect to the future uses of the property.

Four discrete geographic portions of the Nyack site are apparent, as shown in Figure 2-1. These four portions correspond to the four operable units of the site.

OU-1 - Western Parcel

The Western Parcel is comprised of 0.18-acres of land located along the west side of Gedney Street (Figure 2-1). The parcel is currently used by Presidential Life Insurance Company (Presidential) as a parking lot. The Tax Assessors Office lists the property as Section Lot 66-38-2-14. The address of the property is listed as 26 Lydecker Street; however, the vehicle access to the property is from Gedney Street. The Western Parcel is bounded by High Street then residences to the north, by Lydecker Street then residences to the south, by Gedney Street and the Eastern Parcel of the MGP site to the east, and by a commercial property (auto storage and office facility) to the west.

OU-2 - Upper Terrace

The operable unit designated as the upper terrace consists of approximately 1.1 acre in the western portion of the main site, from Gedney Street to the bottom of bank. The north and south bounds of this operable unit are designated by the extent of MGP impacts in the soil and groundwater in these directions. The north bound of the site aligns with the property line of the Nyack Boat Club. The south bound of the site extends beyond the property line, as shown on Figure 2-1. Foot and vehicle access is restricted by a low perimeter chain link fence. Two active O&R natural gas metering and regulator station pits are located immediately adjacent to the parcel along Gedney Street, outside the fenced area.

The unsaturated soils above bedrock are addressed in the upper terrace operable unit, as well as bedrock and groundwater/NAPL.

OU-3 - Lower Terrace

The operable unit designated as the lower terrace consists of approximately 1.0 acre from the bottom of bank eastward to the mean low water line along the Hudson River. The north and south bounds of this operable unit are designated by the extent of MGP impacts in the unsaturated soils in these directions. Foot and vehicle access is restricted by a low perimeter chain link fence. Saturated and unsaturated soils will be included in the lower terrace operable unit. Groundwater within the bounds of the lower terrace will be included. The lower terrace lies within the100-year flood plain of the Hudson River and is subject to the associated restrictions on development of this portion of the site.

OU-4 - Submerged Sediments

The fourth geographic designation is the area of submerged sediments consisting of approximately 1.7 acres extending from the shoreline (defined as the mean low water line) to the northern, eastern, and southern extent of MGP impacts in the sediments. Remnants of two barge mooring dolphins, a bulkhead, and an oil supply pipe which formerly serviced the MGP are still visible within this portion of the site. The Nyack Boat Club utilizes the area of the Hudson River immediately to the east of the submerged portion of the site to moor boats during the boating season.

3 Identification of the New York State Standards, Criteria, and Guidelines

Identification of the New York State Standards, Criteria, and Guidelines (SCGs) and other requirements or limitations that are applicable and relevant to the remediation of the site will be conducted in the initial stage of the FS.

For each operable unit, we anticipate drawing from several sources of SCGs and other requirements and limitations. The following sources of SCGs will be common to all of the operable units:

- NYSDEC Division of Environmental Remediation, including documents such as the TAGMs related to soil and groundwater cleanup objectives;
- NYSDEC Division of Water, including SPDES permit requirements for groundwater treatment systems;
- Department of Health (DOH) guidance;
- New York State Department of Parks, Recreation, and Historic Preservation;
- Hudson River Valley Commission;
- Rockland County;
- Town of Orangetown; and
- Village of Nyack.

The remainder of this section suggests additional sources of SCGs for specific operable units.

Western Parcel

This small, paved parcel will require a relatively simple FS process. SCGs will be dominated by NYSDEC and Department of Health guidance, with some consideration for future development of the site.

Upper Terrace

The criteria to be used as a basis for the Upper Terrace FS will include those resulting from Presidential's development plans. These plans may include construction of buildings with subfloors, basements, and foundation works

which must be taken into account in the development of remedial action alternatives.

Lower Terrace

The criteria to be used as a basis for the Lower Terrace FS will also include those resulting from Presidential's development plans. Additional criteria may be drawn from the following agencies:

- Federal Emergency Management Agency (FEMA), in consideration of the 100-year flood plain;
- US Army Corps of Engineers New York District, Permitting Department, with respect to shoreline protection;
- NYSDEC administration of Clean Water Act, Section 401 Water Quality Certification;
- New York Department of State, Coastal Zone Management Program; and
- Hudson River Estuary Program.

Submerged Sediments

Additional criteria for the Submerged Sediments operable unit may be drawn from the following agencies:

- US Army Corps of Engineers New York District, Permitting Department, with respect to Nationwide or Standard permit criteria for dredging and filling, including requirements of the Clean Water Act, Section 404;
- NYSDEC administration of Clean Water Act, Section 401 Water Quality Certification;
- New York Department of State, Coastal Zone Management Program;
- NYSDEC Division of Fish, Wildlife, and Marine Resources; and
- Hudson River Estuary Program.

4 Development of Remedial Alternatives

A representative range of applicable technologies and responses will be assembled into a set of remedial action alternatives for each of the operable units. The SCGs are brought into consideration at each step. The following five-step process will be used:

1. The Remedial Action Objectives (RAOs) will be established, specifying the contaminants and media of interest, and exposure pathways for the operable unit under consideration. An example of a RAO is to remove from the dermal contact pathway soil containing lead above 400 mg/Kg.

2. The General Response Actions (GRAs) that could be used to meet the RAOs will be presented. GRA's are overall approaches such as removal, isolation, or onsite permanent destruction. An example of a GRA, which addresses the RAO above, is removal of soils from applicable depths that contain lead above 400 mg/Kg.

3. The volumes or areas of media (soil, bedrock, groundwater, and sediment) to which GRAs could be applied will be identified. These estimates will take into account the requirements for protectiveness as identified in the RAOs, the chemical and geological characterization of the operable unit, and the practical constraints imposed by the site characteristics. For example, identification of 20,000 cubic yards of impacted soil exceeding a certain concentration of a specific chemical present from the surface to a depth of 10 feet and located in the center of the operable unit, as shown on a site plan. In accordance with NYSDEC's request, the FS will include estimates of soil volumes which exceed a range of possible cleanup levels. The estimates will include the volume of soils which contained liquid DNAPL or LNAPL, the volume of soils where total PAH content exceeds 500 ppm, and the volume of all soils which exceed TAGM 4046 cleanup levels.

4. Applicable technologies for each medium will be identified and screened. This screening process will eliminate those technologies that cannot be implemented technically at the operable unit. For example, *in situ* biological treatment is a viable technology for many MGP residuals in soil and groundwater, but would not be considered an applicable technology for DNAPL because it is not technically possible to accomplish *in situ* destruction of DNAPL using biological methods. In this way, a range of representative technologies and responses will be compiled for each medium in each operable unit.

5. A set of appropriate alternatives for each operable unit will be formed by combining selected representative technologies and responses. For

example, an appropriate alternative for sediment remediation may include *in situ* biological treatment for some areas, monitored natural attenuation for other areas, and a restriction on future site use.

5 Screening and Analysis of Alternatives

Remedial action alternatives for each operable unit at the Nyack site will be screened and analyzed in accordance with the guidance provided in the NYSDEC TAGM 4030 (provided as Appendix A). The first stage of screening will be conducted for the purpose of reducing the number of alternatives that are carried forward into the detailed analysis stage. A limited set of alternatives will then be evaluated in detail. Out of this detailed analysis will come a recommended alternative for each operable unit, which, taken together, will comprise the proposed remedial action plan for the Nyack site.

5.1 Preliminary Screening

In the preliminary screening stage, alternatives are evaluated using only the two criteria of effectiveness and implementability. Effectiveness refers to the ability of an action to protect human health and the environment. The short-term impacts during remedial construction and implementation are considered at this stage, as well as the long-term effectiveness of the action after it is in place. The expected duration of effectiveness is estimated for each alternative at this stage. For the Nyack site, substantial short-term effectiveness issues will be evaluated with regard to some of the potential deleterious effects of such technologies, such as the effects of dredging on aquatic receptors.

Implementability refers to the realistic capability to actually implement an alternative. Technical implementation of an alternative involves the ability to construct and operate the alternative, and to rely on the alternative to meet the performance requirements and consistently achieve the RAOs. In this stage of the FS, careful review of the performance of technologies will be done, especially with regard to experimental technologies or those that have not often been applied to MGP sites. Administrative implementation of an alternative involves the ability to obtain the required permits and stakeholder approvals for the action, regulatory compliance, and the availability and capacity of offsite services such as treatment, storage, and disposal facilities. For example, at the Nyack site, the administrative implementability with regard to the land owner's approval will be important to evaluate.

5.2 Detailed Analysis of Alternatives

The purpose of the detailed analysis of alternatives is to provide a systematic evaluation with regard to all of the relevant factors so that sound decisions are made in the selection of the final site remedy. Seven evaluation criteria have been established in the National Contingency Plan and adopted by NYSDEC to be used in this analysis:

- Short-term impacts and effectiveness;
- Long-term effectiveness and performance;
- Reduction of toxicity, mobility, or volume of impacted media;
- Implementability;
- Compliance with SCGs;
- Overall protection of human health and the environment; and
- Cost.

A detailed description of these criteria and their application in the FS process is provided in Appendix A.

A comparative analysis of the alternatives will be prepared for each operable unit once the evaluation of each individual alternative is complete. The comparative analysis will discuss the advantages and disadvantages of the alternatives in relation to one another so that the important issues for final remedy selection are clearly identified.

Upon completion of the individual and comparative evaluations, a proposed remedial plan will be described using the best alternatives developed for each of the operable units at the Nyack site. The proposed plan will consist of a narrative description of the combined alternatives and will be included in the FS report for the site.

5.3 From FS to Remedial Design

Once the FS is approved by O&R, Presidential, and NYSDEC, public comments will be solicited on the RI/FS. According to the Consent Order, after the close of the public comment period, NYSDEC will prepare the Record of Decision (ROD) for the site describing the selected final remedial approach for the site. O&R will then prepare a Remedial Design (RD) for implementation of the ROD, in accordance with the Consent Order for the site. The Remedial Design will include a detailed description of the remedial action, "biddable quality" drawings and specifications, a time schedule, a description of operation, maintenance and monitoring activities, a contingency plan, a health and safety plan, and a citizen participation plan. Design-related data may be collected from the site during the Remedial Design phase.

5.4 FS Schedule and Reporting

The progress of the FS will be included in the monthly project reports that are currently being submitted to NYSDEC for the Nyack site. The schedule for the FS activities is presented in Figure 1-2. Based on a RI approval by NYSDEC received March 18, 2002, the scheduled date for submittal of the terrestrial portion FS to NYSDEC is July 15, 2002 (120 days later). The portion of the FS addressing the Hudson River sediments will be prepared on a separate schedule to allow the FS for the terrestrial portion of the site to proceed, while additional interpretation of sediment analyses is conducted.

Upon completion of the preliminary screening step, a list of alternatives proposed for detailed analysis will be provided to Presidential and then to NYSDEC. This brief letter report will keep Presidential and NYSDEC informed of the process and allow any major comments to be incorporated into the FS process. This will avoid re-working of the FS at a later stage.

A draft FS report will be completed, generally following the guidance on FS presentations that is provided in the NYSDEC TAGM 4030 (Appendix A). The draft will be submitted to Presidential and then to NYSDEC for review and comment, followed by a final FS report.

The following outline of the FS report will be used as a guide:

1. Introduction and Background
2. Description of Operable Units
3. SCGs Applicable to Each Operable Unit
4. Volume Estimates of Impacted Media for Each Operable Unit
5. Formation and Initial Screening of Alternatives for Each Operable Unit
6. OU-1 Detailed Analysis of Alternatives
7. OU-2 Detailed Analysis of Alternatives
8. OU-3 Detailed Analysis of Alternatives
9. Proposed Plan for the Nyack Site
10. Data Required for Remedial Design

Appendix A – Volume Estimate Calculations

Appendix B – Technology Descriptions and Calculations

Appendix C – Cost Estimate Calculations

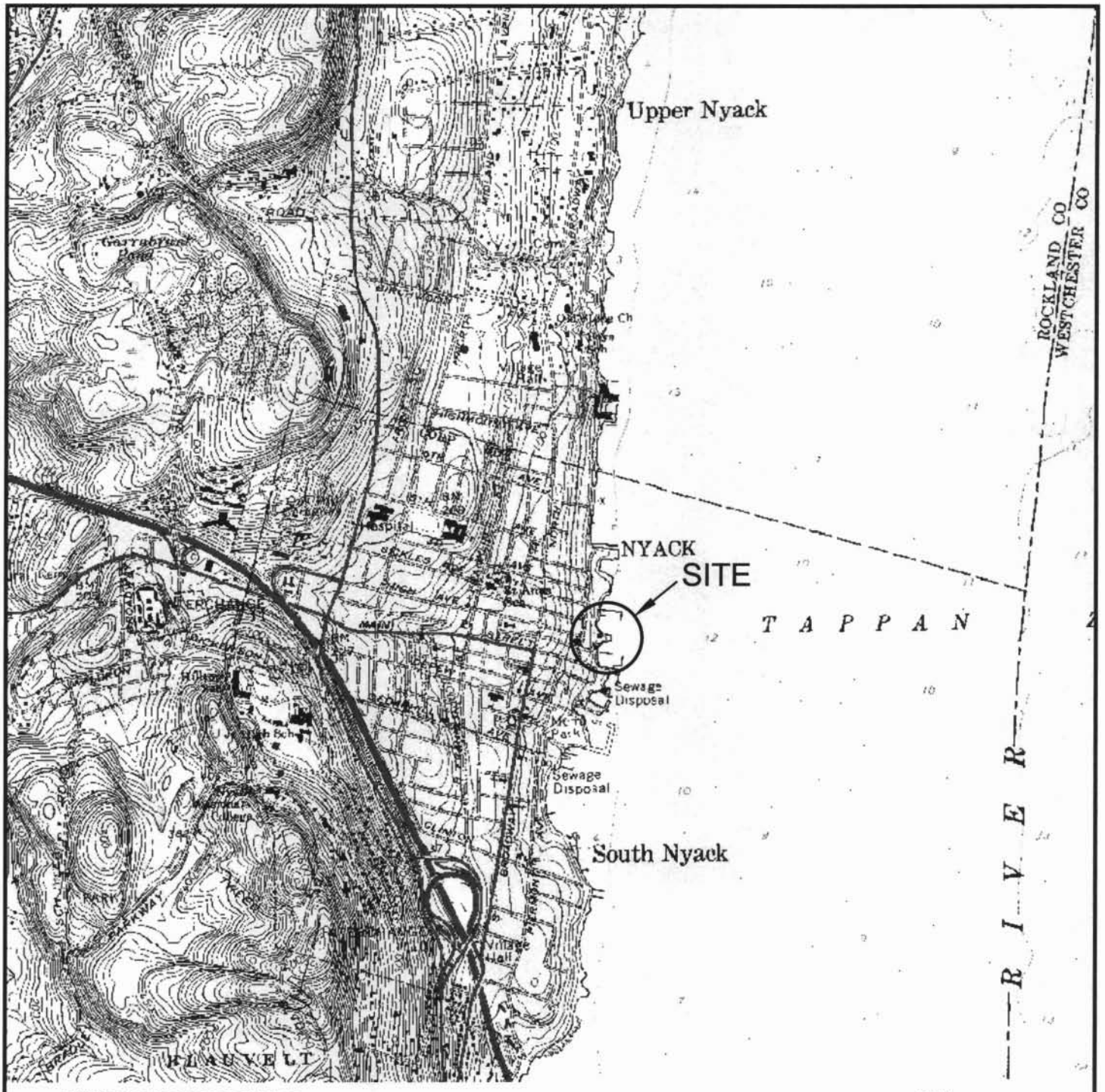
6 References

RETEC, 2002. *Remedial Investigation Report, Former Manufactured Gas Plant Site, Nyack, New York.* January 11, 2002.

NYSDEC, 1990. TAGM#4030 *Selection of Remedial Actions at Inactive Hazardous Waste Sites.*

NYSDEC, 1992. TAGM #4042 *Interim Remedial Measures*, p. 2.

NYSDEC, 1999. Order on Consent Index #D3-0001-98-08. *In the Matter of the Investigation and, if Needed, Remediation, of a Former Manufactured Gas Plant Site located at Gedney Street, Nyack, New York, by Orange and Rockland Utilities, Inc.* Executed March 11, 1999.



UNITED STATES GEOLOGIC SURVEY
NYACK QUADRANGLE
NEW YORK - NEW JERSEY

1967
7.5 MINUTE SERIES (TOPOGRAPHIC)
PHOTOREVISED 1979

SCALE 1:24000

1 1/2 0 1 MILE

1000 0 1000 2000 3000 4000 5000 6000 7000 FEET

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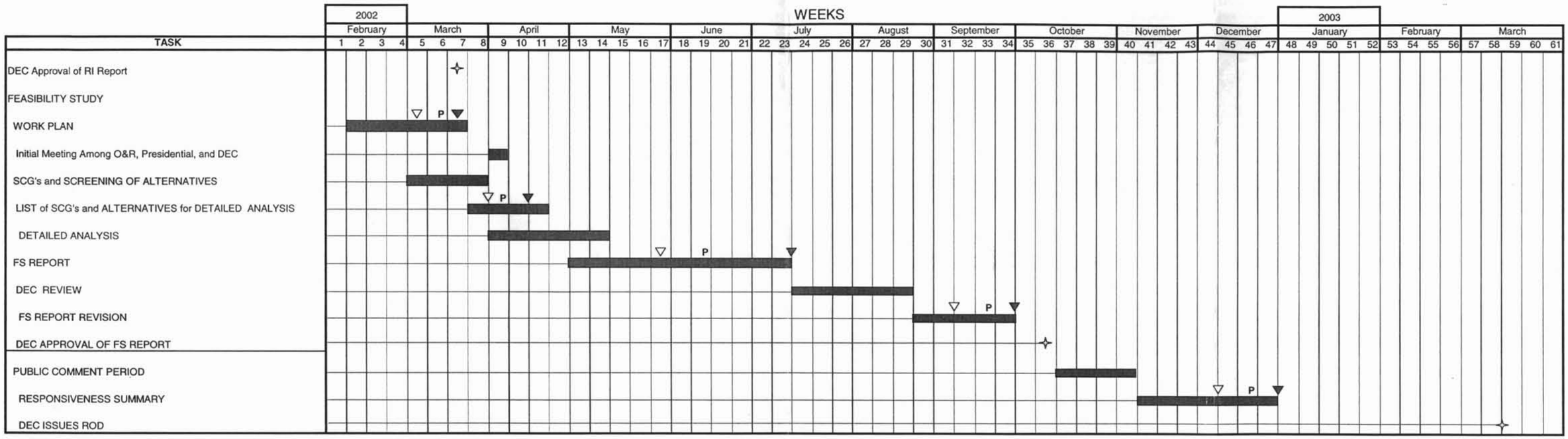
RETEC

ORANGE & ROCKLAND UTILITIES, INC. NYACK, NEW YORK ORAN2-04301-700			**SITE LOCATION MAP** **NYACK MGP SITE**	
DATE: 3/4/02	DRWN: M.W./BIL	FILE: FIG1-1	LAYOUT: Layout1	**FIGURE 1-1**

FIGURE 1-2
FS PROJECT SCHEDULE FOR OU-1, OU-2, and OU-3
FORMER NYACK MGP SITE



LEGEND

✧ Authorization

▽ Draft to Orange and Rockland for Review

P Draft to Presidential for Review

▼ Final to NYSDEC.

NOTE: OU-4, Hudson River Sediment FS, will be completed on a separate schedule, to be provided at a later date.

Rev 1 April 2, 2002

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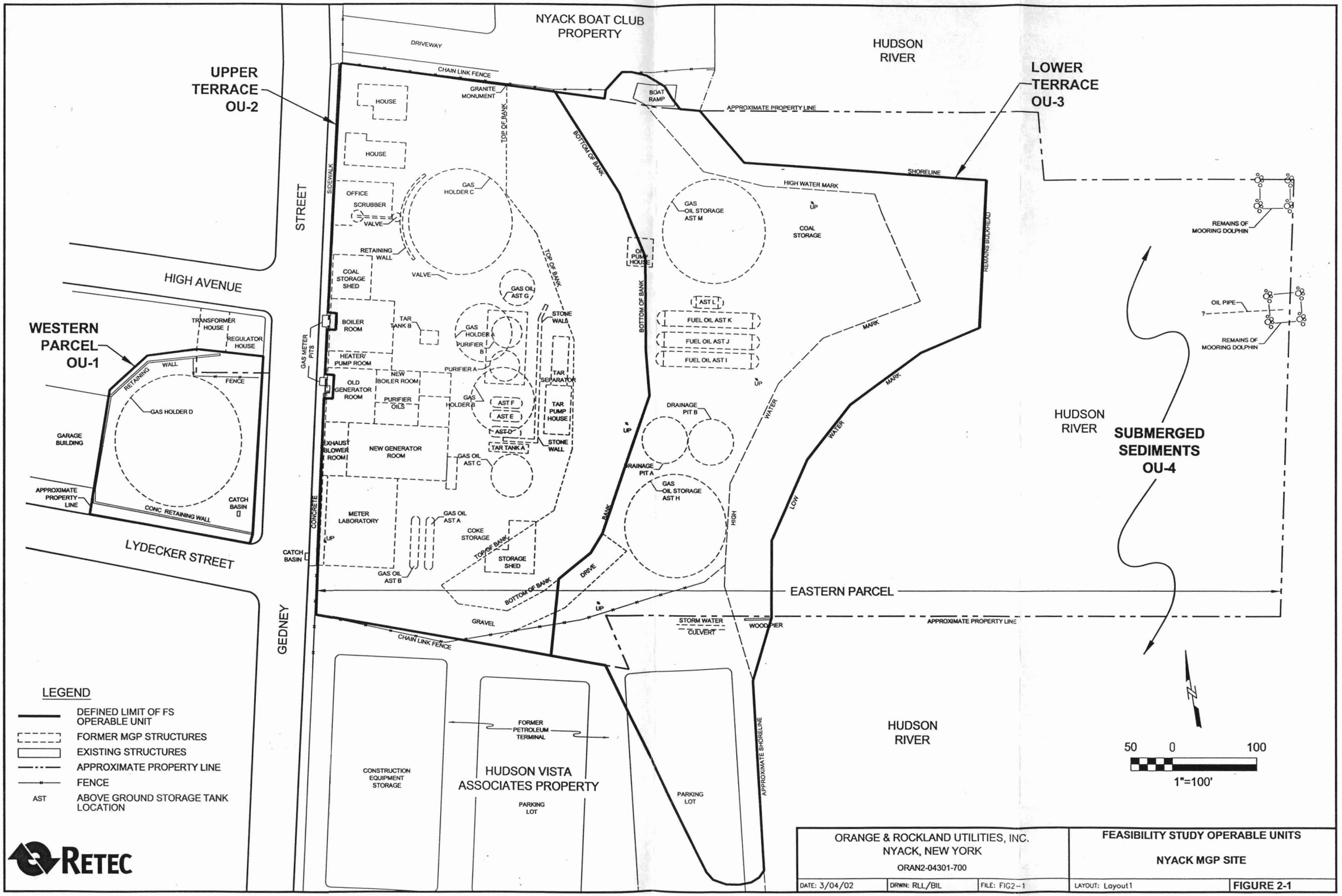
NYACK BOAT CLUB PROPERTY
HUDSON RIVER
UPPER TERRACE OU-2
LOWER TERRACE OU-3
DRIVEWAY
CHAIN LINK FENCE
APPROXIMATE PROPERTY LINE
HOUSE
HOUSE
GRANITE MONUMENT
BOAT RAMP
TOP OF BANK
BOTTOM OF BANK
SHORELINE
HIGH WATER MARK
STREET
SIDEWALK
OFFICE
SCRUBBER
VALVE
GAS HOLDER C
GAS OIL STORAGE AST M
COAL STORAGE
OIL PUMP HOUSE
REMAINS BULKHEAD
RETAINING WALL
COAL STORAGE SHED
GAS OIL AST G
AST L
FUEL OIL AST K
FUEL OIL AST J
FUEL OIL AST I
HIGH AVENUE
WESTERN PARCEL OU-1
TRANSFORMER HOUSE
REGULATOR HOUSE
RETAINING WALL
FENCE
GAS METER PITS
BOILER ROOM
TAR TANK B
STONE WALL
GAS HOLDER B
PURIFIER B
HEATER/ PUMP ROOM
PURIFIER A
NEW BOILER ROOM
OLD GENERATOR ROOM
PURIFIER OILS
GAS HOLDER A
AST F
AST E
AST D
TAR SEPARATOR
TAR PUMP HOUSE
STONE WALL
TAR TANK A
DRAINAGE PIT B
GARAGE BUILDING
GAS HOLDER D
EXHAUST BLOWER ROOM
NEW GENERATOR ROOM
GAS OIL AST C
DRAINAGE PIT A
GAS OIL STORAGE AST H
WATER
MARK
HIGH
LOW
APPROXIMATE PROPERTY LINE
CONC. RETAINING WALL
CATCH BASIN
METER LABORATORY
GAS OIL AST A
COKE STORAGE
TOP OF BANK
STORAGE SHED
CONCRETE
CATCH BASIN
GAS OIL AST B
DRIVE
BOTTOM OF BANK
LYDECKER STREET
GEDNEY
EASTERN PARCEL
GRAVEL
STORM WATER CULVERT
WOOD PIER
APPROXIMATE PROPERTY LINE
CHAIN LINK FENCE
REMAINS OF MOORING DOLPHIN
OIL PIPE
?
REMAINS OF MOORING DOLPHIN
HUDSON RIVER
SUBMERGED SEDIMENTS OU-4
FORMER PETROLEUM TERMINAL
CONSTRUCTION EQUIPMENT STORAGE
HUDSON VISTA ASSOCIATES PROPERTY
PARKING LOT
PARKING LOT
APPROXIMATE SHORELINE
HUDSON RIVER
N
50 0 100
1"=100'
LEGEND
DEFINED LIMIT OF FS OPERABLE UNIT
FORMER MGP STRUCTURES
EXISTING STRUCTURES
APPROXIMATE PROPERTY LINE
FENCE
AST ABOVE GROUND STORAGE TANK LOCATION
RETEC
ORANGE & ROCKLAND UTILITIES, INC.
NYACK, NEW YORK
ORAN2-04301-700
FEASIBILITY STUDY OPERABLE UNITS
NYACK MGP SITE
DATE: 3/04/02
DRWN: RLL/BIL
FILE: FIG2-1
LAYOUT: Layout1
FIGURE 2-1

Appendix A

TAGM 4030 Selection of Remedial Actions at Inactive Hazardous Waste Sites

TECHNICAL AND ADMINISTRATIVE GUIDANCE MEMORANDUM #4030

SELECTION OF REMEDIAL ACTIONS AT INACTIVE HAZARDOUS WASTE SITES

TO: Regional Haz. Waste Remediation Engineers, Bureau Directors, and Section Chiefs

FROM: Michael J. O'Toole, Jr., Director, Division of Hazardous Waste Remediation

SUBJECT: DIVISION TECHNICAL AND ADMINISTRATIVE GUIDANCE MEMORANDUM -- SELECTION OF REMEDIAL ACTIONS AT INACTIVE HAZARDOUS WASTE SITES

DATE: 05/15/90

Michael J. O'Toole, Jr. (signed)

Attached is the revised Division Technical and Administrative Guidance Memorandum on Selection of Remedial Actions at Inactive Hazardous Waste Sites in its final form. The revisions are minor in nature and do not change the contents of the TAGM, originally issued on September 13, 1989.

The revision of the September 13, 1989 TAGM includes the following:

1. "Hierarchy Remedial Technologies"
   Section 2.1 is revised to clarify the desirability of off-site land disposal of hazardous wastes.

2. Since New York State does not have ARARs in its statute and to avoid misinterpretation of New York State requirements, changes are made to replace "ARARs" with New York State Standards, Criteria nad Guidelines (SCGs).

3. In accordance with the referenced TAGM, an alternative which does not meet the State Standards, Criteria and Guidelines (SCGs) and if a waiver to a SCG is not appropriate or justifiable such an alternative should not be further considered. It is possible that several alternatives may be dropped during the detailed analysis. Section 5.2.3 is rearranged so that alternatives are evaluated for criteria in the following order:

   (i) Compliance with New York SCGs;

   (ii) Protection of human health and the environment;

   (iii) Short-term effectiveness;

(iv) Long-term effectiveness and permanence;
(v) Reduction of toxicity, mobility and volume;
(vi) Implementability; and
(vii) Cost.

This TAGM has been effective since September 13, 1989 and should be used for evaluation and selection of remedial alternatives for all new RI/FS and some on-going projects.

(Note: For this on-line version, all references to the outdated scoring system have been deleted, including Tables 4.1 and 5.1 to 5.7)

Attachment

NEW YORK STATE DEPARTMENT OF
ENVIRONMENTAL CONSERVATION
DIVISION OF HAZARDOUS WASTE REMEDIATION
ALBANY, NEW YORK 12233-7010

TECHNICAL AND ADMINISTRATIVE GUIDANCE MEMORANDUM

FOR THE

SELECTION OF REMEDIAL ACTIONS AT

INACTIVE HAZARDOUS WASTE SITES

1. **INTRODUCTION:** The use of treatment technologies at Inactive Hazardous Waste Sites has been underutilized primarily as a result of cost of such technologies. Recent federal Superfund Amendment and Reauthorization Act (SARA) and RCRA amendments which restrict land burial provide incentives to use treatment technologies in remedial programs. SARA added a more stringent statutory criteria governing the appropriate extent of clean-up. SARA requires that preference be given to remedies that permanently reduce the toxicity, volume, or mobility of the hazardous substances, pollutants or contaminants, and to remedies using alternative treatment technologies (SARA Section 121). In addition, the 1984 amendments to RCRA restricted land disposal of several types of wastes. The land disposal restrictions have several effects which include:

    - Prohibition of continued land disposal of untreated hazardous wastes beyond specified dates unless the waste meets treatment standards based upon the Best Demonstrated Available Technology (BDAT);
    - United States Environmental Protection Agency's (USEPA) requirement to develop specified levels or methods of treatment which achieve substantial reduction of toxicity and mobility;
    - Prohibition of storage of restricted hazardous wastes except for accumulation to facilitate recovery, treatment or disposal; and
    - Statutory "hammer provisions" that prohibit land disposal of hazardous wastes if USEPA does not promulgate standards by statutory dates.

    This TAGM provides guidelines to select an appropriate remedy at Federal Superfund,

State Superfund, and Potentially Responsible Party (PRP) sites. This document also sets forth a hierarchy of remedial technology treatments which will be consistent with SARA and RCRA land disposal restrictions. It presents detailed guidelines for evaluation and selection of remedial alternatives for some on-going and all new Remedial Investigation/Feasibility Study (RI/FS) projects. The Division of Hazardous Waste Remediation (DHWR) would consider exempting an inactive hazardous waste site from this document if deemed appropriate. For example, if a remedial action for a site is readily apparent, it would not be beneficial to select remedies using the procedures set forth in this TAGM.

2. **IMPLEMENTATI0N OF REMEDIAL ACTIONS:** SARA clearly gives preference to treatment technologies "that, in whole or in part, will result in a permanent and significant decrease in the toxicity, mobility, or volume of hazardous substances, pollutants or contaminants," to the maximum extent practicable. The Department concurs with this position. In order to eliminate the significant threat to public health and the environment, the Department believes it is important to implement permanent remedies wherever practicable.

   It should be emphasized, however, that there will be many instances where permanent remedies will not be practicable. For example, it is likely that conventional isolation and control technologies with pumping and treatment of leachate/groundwater may be selected as appropriate remedial action for municipal landfill sites which are now classified as inactive hazardous waste sites. When remedies such as conventional isolation and/or control technologies are selected, the Record of Decision (ROD) shall discuss why a remedial action resulting in a permanent and significant reduction in the toxicity, volume, or mobility of hazardous wastes was not selected. If a remedial action that leaves any hazardous wastes at the site is selected, such remedial action shall be reviewed no less than once each five years after completion of the remedial action to assure that human health and the environment are being protected by the implemented remedial action; this review will take place in addition to the regularly scheduled monitoring and operation and maintenance, even if the monitoring data indicates that the implemented remedy does not contravene any "cleanup criteria or standards." The objective of the review will be to evaluate if the implemented remedy protects human health and the environment and to identify any "permanent" remedy available for the site. In addition, if upon such review, it is the judgement of the Deputy Commissioner, Office of Environmental Remediation, that action is appropriate at such site, the Department shall take or require such action. Before taking or requiring any action, all interested parties including the responsible parties and the public shall be provided an opportunity to comment on the Department's decision.

   2.1 Hierarchy of Remedial Technologies: The following provides the hierarchy of remedial technologies for hazardous waste disposal sites, from most desirable to least desirable. **The Department shall consider only on-site or off-site destruction or separation/treatment or solidification/chemical fixation of inorganic wastes as permanent remedies.** However, solidification/chemical fixation of wastes containing "low" level organic constituents may be considered as a permanent remedy if justified.

   1. Destruction: This type of remedy will irreversibly destroy or detoxify all or most of the hazardous wastes to "acceptable clean-up levels". The treated materials will have no residue containing unacceptable levels of hazardous wastes. **This**

type of remedy will result in permanent reduction in the toxicity of all or most of the hazardous wastes to "acceptable clean-up level(s)";

2. Separation/Treatment: Using on-site mobile or transportable unit, this type of remedial action will separate or concentrate the hazardous wastes from the wastes; this remedy would leave a treated waste stream with acceptable levels of hazardous wastes and a concentrated waste stream with high levels of contaminants - e.g. treatment of contaminated leachate by granular activated carbon. **This type of remedy will result in permanent and significant reduction in volume of waste mixed with hazardous wastes.** In these instances where the concentrated waste stream can be destroyed or detoxified as in (a) above, preference shall be given to this additional treatment;

3. Solidification/Chemical Fixation: This type of remedy will, for a site containing predominantly inorganic hazardous wastes significantly reduce the mobility of inorganic hazardous wastes. **This type of remedy may not significantly reduce the toxicity or volume of the inorganic hazardous wastes, but will significantly and permanently reduce the mobility and the availability of the inorganic hazardous wastes toward environmental transport and uptake.**

4. Control and Isolation Technologies: This type of remedial action will significantly reduce the mobility of the hazardous wastes, but will not significantly reduce the volume or toxicity of the hazardous wastes. It also includes construction of physical barriers to control migration of leachate, contaminated groundwater and surface runoff, solidification/fixation of organic hazardous wastes, and pumping and treatment of contaminated leachate/groundwater.

5. Off-Site Land Disposal: This type of remedy will remove contaminated soil, sediment, leachate, groundwater, etc. and land dispose the wastes at an off-site permitted facility.

In evaluating treatment technologies, the Department should give or require that preference be given to technologies which have:

1. been successfully demonstrated on a full scale or a pilot scale under Federal Superfund Innovative Technology Evaluation (SITE) Program;

or

2. been successfully demonstrated on a full scale or pilot scale at a Federal Superfund site, at a Federal facility, at a State Superfund site anywhere in the country, at a PRP site overseen by a State environmental agency or USEPA;

or

3. a RCRA Part B permit;

or

4. a RCRA Research and Development permit;

or

5. a documented history of successful treatment such as granulated activated carbon unit.

3. **DEVELOPMENT OF REMEDIAL ALTERNATIVES:** Alternatives are typically developed, concurrently with the Remedial Investigation (RI). In developing alternatives, two important activities take place. First, volumes or areas of environmental media (air; water, soil/sediment) are identified where contamination is present; the media to be treated are determined by information on the nature and extent of contamination, applicable or relevant and appropriate New York State Standards, Criteria and Guidelines (SCGs), cleanup criteria/standards, etc. SCGs also include federal standards which are more stringent than State Standards, Criteria, and Guidelines. Second, the remedial action alternatives and associated technologies including alternative treatment technologies are screened to identify those that would be effective for the hazardous wastes and media of interest at the site. The information obtained during these two activities is used in assembling technologies and the media to which they will be applied into alternatives for the site or specific operable unit. This process should consist of five general steps as briefly presented below:

    1. Develop remedial action objectives specifying the contaminants and media of interest, and exposure pathways. The objectives developed are based on contaminant-specific cleanup criteria.
    2. Develop general response actions for each medium of interest that may be taken to satisfy the remedial action objectives for the site or specific operable unit.
    3. Identify volumes or areas of media to which general response actions might be applied, taking into account the requirements for protectiveness as identified in the remedial action objectives and the chemical and geological characterization of the site or a specific operable unit.
    4. Identify and screen the technologies applicable to each medium of interest to eliminate those technologies that cannot be implemented technically at the site for that medium.
    5. Assemble the selected representative technologies into appropriate alternatives.

4. **PRELIMINARY SCREENING OF REMEDIAL ALTERNATIVES:** The screening of alternatives follows the conceptual development of alternatives and precedes the detailed analysis of alternatives. Prior to screening, technologies should be identified and combined into alternatives, although specific details of the alternatives may not be defined. Initial set of alternatives developed shall include appropriate remedial technologies that are representative of each of the four categories of remedial technologies as described in Section 2.1. During the screening, the extent of remedial action (e.g., quantities of media to be affected), the sizes and capacities of treatment units, and other details of each alternative should be further defined, as necessary, so that screening evaluations can be conducted.

    The objective of remedial alternatives screening is to narrow the list of potential alternatives that will be evaluated in detail. In some situations, the number of viable alternatives to address site problems may be limited such that screening may be unnecessary or minimized.

    Screening is used as a tool throughout the alternative selection process to narrow the

options being considered. When alternatives are being developed, individual remedial technologies should be screened primarily on their ability to meet medium-specific remedial action objectives, their implementability and their short-term and long-term effectiveness. **At this time, cost should not be used to guide the initial development and screen remedial technologies or alternatives.** Because the purpose of the screening evaluation is to reduce the number of alternatives that will undergo a more thorough and extensive analysis, alternatives should be evaluated more generally in this phase than during the detailed analysis.

4.1 Effectiveness Evaluation: A key aspect of the screening evaluation is the effectiveness of each alternative in protecting human health and the environment. Each alternative should be evaluated as to the extent to which it will eliminate significant threats to public health and the environment through reductions in toxicity, mobility and volume of the hazardous wastes at the site. Both short-term and long-term effectiveness should be evaluated; short-term referring to the construction and implementation period, and long-term referring to the period after the remedial action is in place and effective.

The expected lifetime or duration of effectiveness should be identified for each alternative. The control and isolation technologies may fail if any of the following is expected to take place:

1. significant loss of the surface cover such as a clay cap with a potential for exposure of waste material underneath the cap;
2. contamination of the groundwater by the leachate from the waste material;
3. contamination of the adjoining surface water by the leachate from the waste material or by the contaminated groundwater;
4. structural failure of the control or isolation technology.

4.2 Implementability Evaluation: Implementability is a measure of both the technical and administrative feasibility of constructing, operating, and maintaining a remedial action alternative. Technical feasibility refers to the ability to construct, reliably operate and meet technical specifications or criteria, and the availability of specific equipment and technical specialist to operate necessary process units. It also includes operation, maintenance, replacement, and monitoring of technical components of an alternative, if required, into the future after the remedial action is complete. Administrative feasibility refers to compliance with applicable rules, regulations and statutes and the ability to obtainapprovals from other offices and agencies, the availability of treatment, storage, and disposal services and capacity.

Determinations of an alternative not being technically feasible and not being available for implementation will preclude it from further consideration unless steps can be taken to change the conditions responsible for the determination. Often, this type of fatal flaw would have been identified during technology development, and an alternative which is not feasible would not have been assembled. **Remedial alternatives which will be difficult to implement administratively should not be eliminated from further consideration for this reason alone.**

5. DETAILED ANALYSIS OF ALTERNATIVES:

5.1 Introduction

5.1.1 Purpose of the Detailed Analysis of Alternatives: The detailed analysis of alternatives is the analyses and presentation of the relevant information needed to allow decision-makers to select a site remedy. During the detailed analysis, each alternative is assessed against the seven evaluation criteria described in this chapter.

The specific requirements that must be addressed in the Feasibility Study (FS) report are listed below:

- Be protective of human health and the environment
- Attain SCGs (explain why compliance with SCGs was not needed to protect public health and the environment)
- Satisfy the preference for treatment that significantly and permanently reduces toxicity, mobility, or volume of hazardous wastes as a principal element (or provide an explanation in the ROD as to why it does not)
- Be cost-effective

Seven evaluation criteria have been developed to address the requirements and considerations listed above. These evaluation criteria serve as the basis for conducting the detailed analyses during the FS and for subsequently selecting an appropriate remedial action. The evaluation criteria are:

- Short-term impacts and effectiveness
- Long-term effectiveness and performance
- Reduction of toxicity, mobility, or volume
- Implementability
- Compliance with SCGs
- Overall protection of human health and the environment
- Cost

5.1.2 The Context of Detailed Analysis: The detailed analysis of alternatives follows the development and preliminary screening of alternatives and precedes the actual selection of a remedy. The extent to which alternatives are analyzed during the detailed analysis is influenced by the available data, the number and types of alternatives being analyzed, and the degree to which alternatives were previously analyzed during their development and screening.

The evaluations conducted during the detailed analysis phase build on previous evaluations conducted during the development and preliminary screening of alternatives. This phase also incorporates any treatability study data and additional site characterization information that may have been collected during the RI. The results of the detailed analysis serve to document the evaluations of alternatives and provide the basis for selecting a remedy.

5.2 Detailed Analysis of Remedial Alternatives

5.2.1 Alternative Definition: The alternatives that remain after preliminary screening may need to be refined more completely prior to the detailed analysis. Alternatives have already been developed and initially screened to match contaminated media with appropriate treatment processes. This matching is done by identifying specific remedial response objectives and sizing process units to attain the objective.

The information developed to define alternatives at this stage in the RI/FS process may consist of preliminary design calculations, process flow diagrams, sizing of key process components, preliminary site layouts, and a discussion of the limitations, assumptions, and uncertainties concerning each alternative.

5.2.2 Overview of Evaluation Criteria: The detailed analysis provides the rationale for a remedy selection. The FS analysis must provide sufficient quantity and quality of information to support the selec listed encompass technical, cost, and institutional considerations, and compliance with specific statutory requirements.

The level of detail required to analyze each alternative against these evaluation criteria will depend on the type and complexity of the site, the type of technologies and alternatives being considered, and other project-specific considerations. The analysis should be conducted in sufficient detail such that decision-makers understand the significant aspects of each alternative and any uncertainties associated with their evaluation.

Each of the seven evaluation criteria has been further divided into specific factors to allow a thorough analysis of the alternatives. These factors are discussed in the following sections.

5.2.3 Analysis of Individual Alternatives

5.2.3.1 Compliance with Applicable New York State Standards, Criteria and Guidelines (SCGs)

This evaluation criterion is used to determine how each alternative complies with applicable or relevant and appropriate New York State Standards, Criteria, and Guidelines (SCGs). As stated in Section 3, the SCGs should also include federal standards which are more stringent than the State Standards, Criteria, and Guidelines. There are three general categories of SCGs: chemical-, location-, and action-specific. SCGs for each category are identified in previous stages of the RI/FS process (e.g. chemical-specific SCGs should be preliminarily identified during scoping of the project). The detailed analysis should summarize which requirements are applicable or relevant and appropriate to an alternative and describe how the alternative meets these requirements. When a SCG is not met, justification for use of one of the six waivers allowed under CERCLA and SARA should be discussed.

The following should be addressed for each alternative during the detailed analysis of SCGs:

1. Compliance with chemical-specific SCGs (e.g. groundwater standards) - This factor addresses whether the SCGs will be met and, if not, the basis for a waiver.
2. Compliance with action-specific SCGs (e.g. RCRA minimum technology standards) - It should be determined whether SCGs will be met and, if not, the basis for a waiver.
3. Compliance with location-specific SCGs - As with other SCG-related factors, this involves a consideration of whether the SCGs will be met and, if not, the basis for a waiver.

The actual determination of which requirements are applicable or relevant and

appropriate is made by the DEC in consultation with the DOH. A summary of these SCGs and whether they will be attained by a specific alternative should be presented.

It is to be pointed out that **if an alternative does not meet the SCGs and a waiver to the SCGs is not appropriate or justifiable, such an alternative should not be further considered.**

5.2.3.2 Overall Protection of Human Health and the Environment

This evaluation criterion provides a final check to assess whether each alternative meets the requirement that it is protective of human health and the environment. The overall assessment of protection is based on a composite of factors assessed under other evaluation criteria, especially long-term effectiveness and performance, short-term effectiveness, and compliance with SCGs.

Evaluation of the overall protectiveness of an alternative during the RI/FS should focus on how a specific alternative achieves protection over time and how site risks are reduced. The analysis should indicate how each source of contamination is to be eliminated, reduced, or controlled for each alternative.

5.2.3.3 Short-term Impacts and Effectiveness : This evaluation criterion assesses the effects of the alternative during the construction and implementation phase until remedial response objectives are met. Under this criterion, alternatives should be evaluated with respect to their effects on human health and the environment during implementation of the remedial action. The following factors of this analysis criterion should be addressed for each alternative:

1. Protection of the community during remedial actions - This aspect of short-term effectiveness addresses any risk that results from implementation of the proposed remedial action, such as dust from excavation or air-quality impacts from the operation of an incinerator.
2. Environmental impacts - This factor addresses the potential adverse environmental impacts that may result from the implementation of an alternative and evaluates how effective available mitigation measures would be in preventing or reducing the impacts.
3. Time until remedial response objectives are achieved - This factor includes an estimate of the time required to achieve protection for either the entire site or individual elements associated with specific site areas or threats.
4. Protection of workers during remedial actions - This factor assesses threats that may be posed to workers and the effectiveness and reliability of protective measures that could be taken.

Analysis of the factor "protection of workers during remedial actions," should be used to design appropriate safety measures for on-site workers.

5.2.3.4 Long-term Effectiveness and Permanence

This evaluation criterion addresses the results of a remedial action in terms of its permanence and quantity/nature of waste or residual remaining at the site after response objectives have been met. The primary focus of this evaluation is the extent and effectiveness of the controls that may be required to manage the waste or residual

remaining at the site andoperating system necessary for the remedy to remain effective. The following components of the criterion should be addressed for each alternative:

- Permanence of the remedial alternative.
- Magnitude of remaining risk - The potential remaining risk may be expressed quantitatively, such as by cancer risk levels, or margins of safety over NOELs for non-carcinogenic effects, or by the volume or concentration of contaminants in waste, media or treatment residuals remaining at the site. The characteristics of the residuals that should be considered to the degree that they remain hazardous, taking into account their toxicity, mobility, and propensity to bio-accumulate.
- Adequacy of controls - This factor assesses the adequacy and suitability of control, if any, that are used to manage treatment residuals or untreated wastes that remain at the site. It may include an assessment of containment systems and institutional controls to determine if they are sufficient to ensure that any exposure to human and environmental receptors is within protective levels.
- Reliability of controls - This factor assesses the long-term reliability of management controls for providing continued protection from residuals. It includes the assessment of the potential need to replace components of the alternative, such as a cap, a slurry wall, or a treatment system; the potential exposure pathway; and the risks posed should the remedial action need replacement. This factor should also include systems to warn the failure of remedial alternative, once in place.

5.2.3.5 Reduction of Toxicity, Mobility and Volume

This evaluation criterion assesses the remedial alternative's use for treatment technologies that permanently and significantly reduce toxicity, mobility, or volume of the hazardous wastes as their principal element. As a matter of the Department's policy, it is preferred to use treatment to eliminate any significant threats at a site through destruction of toxic contaminants, reduction of the total mass of toxic contaminants, irreversible reduction in contaminants mobility, or reduction of total volume of contaminated media.

This evaluation would focus on the following specific factors for a particular remedial alternative:

- The amount of hazardous materials that will be destroyed or treated, including how the principal threat(s) will be addressed
- The degree of expected reduction in toxicity, mobility, or volume measured as a percentage of reduction (or order of magnitude)
- The degree to which the treatment will be irreversible
- The type and quantity of treatment residuals that will remain following treatment

5.2.3.6 Implementability

The implementability criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of various services and materials required during its implementation. This criterion involves analysis of the following factors:

- Technical feasibility

Construction and operation - This relates to the technical difficulties and unknowns associated with a technology. This was initially identified for specific technologies during the development and preliminary screening of alternatives and is addressed again in the detailed analysis of the alternative as a whole.

Reliability of technology - This focuses on the ability of a technology to meet specified process efficiencies or performance goals. The likelihood that technical problems will lead to schedule delays should be considered as well.

Ease of undertaking additional remedial action - This includes a discussion of what, if any, future remedial actions may need to be undertaken and how difficult it would be to implement such additional actions. This is particularly applicable for an FS addressing an interim action at a site where additional operable units may be analyzed at a later time.

Monitoring considerations - This addresses the ability to monitor the effectiveness of the remedy and includes an evaluation of the risks of exposure should monitoring be insufficient to detect a system failure.

- Administrative Feasibility

  Activities needed to coordinate with other offices and agencies (e.g. obtaining permits for off-site activities or rights-of-way for construction)

- Availability of Services and Materials

  Availability of adequate off-site treatment, storage capacity, and disposal services

  Availability of necessary equipment, specialists and skilled operators and provisions to ensure any necessary additional resources

  Availability of services and materials, plus the potential for obtaining competitive bids, which may be particularly important for alternative remedial technologies.

5.2.3.7 Cost

The application of cost estimates to evaluation of alternatives is discussed in the following paragraphs.

1. Capital Costs. Capital costs consist of direct (construction) and indirect (non-construction and overhead) costs. Direct costs include expenditures for the equipment, labor and materials necessary to install remedial actions. Indirect costs include expenditures for engineering and other services that are not part of actual installation activities but are required to complete the installation of remedial alternatives. Capital costs that must be incurred in the future as part of the remedial action alternative should be identified and noted for the year in which they will occur.

   Direct capital costs may include the following:

- Construction costs - Costs of materials, labor (including fringe benefits and worker's compensation), and equipment required to install a remedial action
- Equipment costs - Costs of remedial action and service equipment necessary to enact the remedy; (these materials remain until the site remedy is complete)
- Land and site-development costs - expenses associated with the purchase of land and the site preparation costs of existing property
- Buildings and services costs - Costs of process and non-process buildings, utility connections, purchased services, and disposal costs
- Relocation expenses - Costs of temporary or permanent accommodations for affected nearby residents
- Disposal costs - Costs of transporting and disposing of waste material such as drums, contaminated soils and residues.

Indirect capital costs may include:

- Engineering expenses - Costs of administration, design, construction supervision, drafting, and treatability testing
- Legal fees and license or permit costs - Administrative and technical costs necessary to obtain licenses and permits for installation and operation
- Start up and shakedown costs - Costs incurred during remedial action start up
- Contingency allowances - Funds to cover costs resulting from unforeseen circumstances, such as adverse weather conditions, strikes, and inadequate site characterization.

2. Operation & Maintenance Costs. Annual costs are post-construction costs necessary to ensure the continued effectiveness of a remedial action. The following annual cost components should be considered:

- Operating labor costs - Wages, salaries, training, overhead, and fringe benefits associated with the labor needed for post-construction operations
- Maintenance materials and labor costs - Costs for labor, parts and other resources required for routine maintenance of facilities and equipment
- Auxiliary materials and energy - Costs of such items as chemicals and electricity for treatment plant operations, water and sewer services, and fuel
- Disposal of residues - Costs to treat or dispose of residuals such as sludges from treatment processes or spent activated carbon
- Purchased services - Sampling costs, laboratory fees, and professional fees for which the need can be predicted
- Administrative costs - Costs associated with the administration of remedial actionO&M not included under other categories
- Insurance, taxes and licensing costs - Costs of such items as liability and sudden accidental insurance; real estate taxes on purchased land or rights-of-way; licensing fees for certain technologies; and permit renewal and reporting costs
- Replacement costs - Cost for maintaining equipment or structures that wear out over time

- Costs of periodic site reviews - Costs for periodic site reviews (to be conducted every five years) if a remedial action leaves any hazardous substances, pollutants or contaminants at the site.

3. Future Capital Costs: The costs of potential future remedial actions should be addressed and if appropriate should be included when there is a reasonable expectation that a major component of the remedial alternative will fail and require replacement to prevent significant exposure to contaminants. It is not expected that a detailed statistical analysis will be required to identify probable future costs. Rather, qualitative engineering judgment should be used and the rationale should be well documented in the FS report.

4. Cost of Future Land Use: Any remedial action that leaves hazardous wastes at a site may affect future land use and perhaps groundwater use. Access or use of such sites will be restricted, resulting in loss of business activities, residential development and taxes to the local, State and federal governments. During the feasibility study, potential future land use of the site should be considered. Based on this potential land use, economic loss attributable to such use should be calculated and included as a cost of the remedial alternative. In addition, the continuing presence of an inactive hazardous waste site, even though remediated, may have a negative effect on surrounding property values. This loss in value should also be considered as a cost of the remedial program developed for the site. Economic loss due to the future land use should be derived based on comparison with a neighboring community not affected by any of hazardous waste sites.

   Cost of future land use should be determined for sites only when such cost is **deemed appropriate and significant**. When cost of land surrounding an inactive hazardous waste site located in the urban/suburban area is determined to be significant in relation to the cost of a remedial alternative, then cost of future land use as described above should be determined for inclusion in the present worth analysis of the remedial alternative.

   Accuracy of Cost Estimates. Site characterization and treatability investigation information should permit the user to refine cost estimates for remedial action alternatives. It is important to consider the accuracy of costs developed for alternatives in the FS. Typically, the "study estimate" costs made during the FS are expected to provide an accuracy of 50 percent to -30 percent and are prepared using data available from the RI. Costs developed with expected accuracies other than +50 percent to -30 percent should be identified as such in the FS.

   Present Worth Analysis. A present worth analysis is used to evaluate expenditures that occur over different time periods by discounting all future costs to a common base year, usually the current year. This allows the cost of remedial action alternatives to be compared on the basis of a single figure representing the amount of money that, if invested in the base year and disbursed as needed, would be sufficient to cover all costs associated with the remedial action over its planned life.

   In conducting the present worth analysis, assumptions must be made regarding the discount rate and the period of performance. It is recommended that a

discount rate equivalent to the 30-year U.S. treasury bond rate taxes and after inflation be used in determining the present worth of an alternative. The period of performance should not exceed 30 years.

Cost Sensitivity Analysis. After the present worth of each remedial action alternative is calculated, individual costs may be evaluated through a sensitivity analysis if there is sufficient uncertainty concerning specific assumptions. A sensitivity analysis assesses the effect that variations in specific assumptions associated with the design, implementation, operation, discount rate, and effective life of an alternative have on the present worth for the alternative. These assumptions depend on the accuracy of the data developed during the site characterization and treatability investigation and on predictions of the future behavior of the technology. Therefore these assumptions are subject to varying degrees of uncertainty from site to site. The potential effect on the cost of an alternative because of these uncertainties can be observed by varying the assumptions and noting the effects on estimated costs. Sensitivity analyses can also be used to optimize the design of a remedial action alternative, particularly when design parameters are interdependent (e.g., incinerator capacity for contaminated soil and the length of the period of performance).

Use of sensitivity analyses should be considered for the factors that can significantly change overall costs of an alternative with only small changes in their values, especially if the factors have a high degree of uncertainty associated with them. Other factors chosen for analysis may include those factors for which the expected (or estimated) value is highly uncertain. The results of such an analysis can be used to identify worst-case scenarios and to revise estimates of contingency or reserve funds.

The following factors are potential candidates for consideration in conducting a sensitivity analysis:

- The effective life of a remedial action
- The O&M costs
- The duration of cleanup
- The volume of contaminated material, given the uncertainty about site conditions
- Other design parameters (e.g. the size of the treatment system)
- The discount rate (a range of 3 to 10 percent may be used to investigate uncertainties)

The results of a sensitivity analysis should be discussed during the comparison of alternatives. Areas of uncertainty that may have a significant effect on the cost of an alternative should be highlighted, and a rationale should be presented for selection of the most probable value of the parameter.

5.2.4 Presentation of Individual Analysis

The analysis of individual alternatives against the seven criteria should be presented in the FS report as a narrative discussion accompanied by a summary table. This information will be used to compare the alternatives and support a subsequent analysis of the alternatives made by the decision-maker in the remedy selection process. The

narrative discussion should, for each alternative, provide (1) a description of the alternative and (2) a discussion of the individual criteria assessment.

The alternative description should provide data on technology components (use of innovative technologies should be identified), quantities of hazardous materials handled, time required for implementation, process sizing, implementation requirements, and assumptions. These descriptions will also serve as the basis for selecting the New York SCGs. Therefore, the key SCGs for each alternative should be identified and integrated into these discussions.

The narrative discussion of the analysis should, for each alternative, present the assessment of the alternative against each of the seven criteria. This discussion should focus on how, and to what extent, the various factors within each of the seven criteria are addressed.

The uncertainties associated with specific alternatives should be included when changes in assumptions or unknown conditions could affect the analysis. The FS should also include a summary table highlighting the assessment of each alternative with respect to each of the seven criteria.

5.2.5 Comparative Analysis of Alternatives

Once the alternatives have been individually assessed against the seven criteria, a comparative analysis should be conducted to evaluate the relative performance of each alternative in relation to each specific evaluation criterion. This analysis is in contrast to the preceding analysis in which each alternative was analyzed independently without the consideration of interrelationships between alternatives. The purpose of this comparative analysis is to identify the advantages and disadvantages of each alternative relative to one another so that the key trade-offs to be evaluated by the decision-maker can be identified.

The first five criteria (short-term effectiveness; long-term effectiveness,and permanence; reduction of toxicity, mobility, and volume; implementability; and cost) will generally require more discussion than the remaining criteria because the key trade-offs or concerns among alternatives will most frequently relate to one or more of these five. The overall protectiveness and compliance with the SCGs criteria will generally serve as threshold determinations in that they either will or will not be met. Community preference will likely be evaluated only preliminarily during the RI/FS because such information frequently is not available. Community preference can be addressed more thoroughly once comments on the RI/FS report and the proposed remedial action plan have been received and a final remedy selection decision is being made.

5.2.6 Presentation of Comparative Analysis

The comparative analysis should include a narrative discussion describing the strengths and weaknesses of the alternatives relative to one another with respect to each criterion, and how reasonable variations of key uncertainties could change the expectations of their relative performance. If destruction and treatment technologies are being considered, their potential advantages in cost or performance and the degree of uncertainty in their expected performance (as compared with conventional/isolation

technologies) should also be discussed. The comparative analysis should also summarize the total sizing for each alternative.

The presentation of differences between alternatives can be measured either qualitatively or quantitatively, as appropriate, and should identify substantive differences (e.g. greater short-term effectiveness concerns greater cost, etc.) between alternatives. Quantitative information that was used to assess the alternatives (e.g. specific cost estimates, time until response objectives would be obtained, and levels of residual contamination) should be included in these discussions.

The Final Draft RI/FS or the Proposed Remedial Action Plan (PRAP) should present the remedial alternative recommended for the site and clear rationale for the recommendation.

6. **COMMUNITY ASSESSMENT:** This assessment incorporates public comment into the selection of a remedy. There are several points in the RI/FS process at which the public may have previously provided comments (e.g. first phase of the RI/FS). The Department will solicit public comments on the remedial alternatives and the recommended alternative in accordance with the New York State Inactive Hazardous Waste Site Citizen Participation Plan and statutory and regulatory requirements. A document titled, "New York State Inactive Hazardous Waste Site Citizen Participation Plan," dated August 30, 1988, should be used as a guidance to solicit the public comments on the remedial alternatives and the recommended alternative. The public comments shall be considered. The remedy for the site will be selected and documented in accordance with the Organization and Delegation Memorandum #89-05 Policy - Records of Decision for Remediation of Class 2 Inactive Hazardous Waste Disposal Sites.