MAY - 7

ISLIP RESOURCE RECOVERY AGENCY

REMEDIAL INVESTIGATION / FEASIBILITY STUDY

FEASIBILITY STUDY REPORT

SONIA ROAD LANDFILL
WEST BRENTWOOD, NEW YORK

SITE REGISTRY NO. 152013

Remediation

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Dvirka and Bartilucci
Consulting Engineers

APRIL 1998

FEASIBILITY STUDY REPORT

SONIA ROAD LANDFILL
WEST BRENTWOOD, NEW YORK

(SITE REGISTRY No. 152013)

PREPARED FOR

ISLIP RESOURCE RECOVERY AGENCY

BY

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CONSULTING ENGINEERS
WOODBURY, NEW YORK

APRIL 1998

SONIA ROAD LANDFILL
FEASIBILITY STUDY REPORT

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1.0 INTRODUCTION

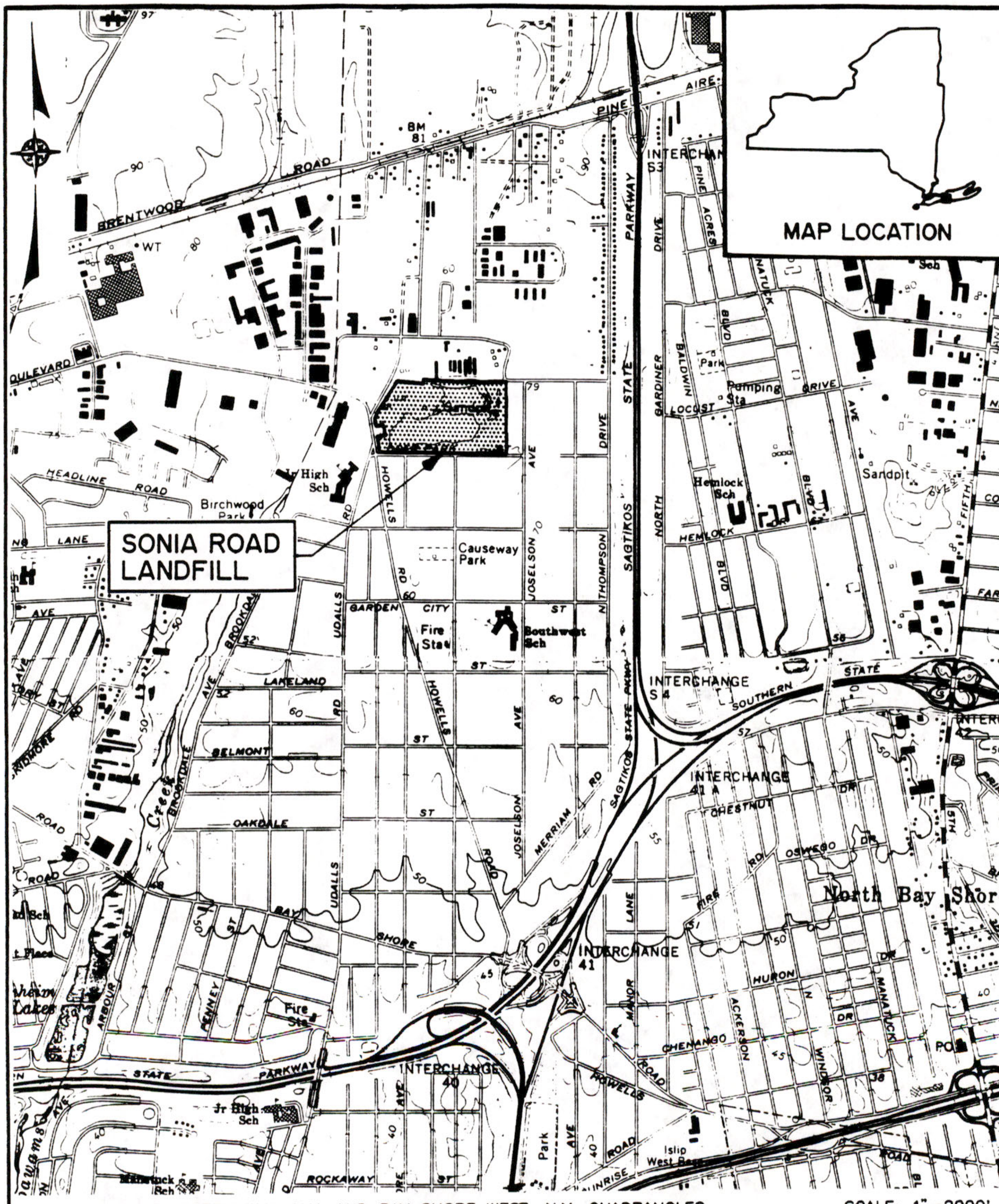
1.1 Purpose and Site Background

As part of the State of New York's Superfund Program to investigate and remediate hazardous waste sites, the New York State Department of Environmental Conservation (NYSDEC) has entered into an Order on Consent with the Town of Islip (the Town) to conduct a remedial investigation and feasibility study (RI/FS) for the Sonia Road Landfill located in West Brentwood, Suffolk County, New York (see Figure 1-1). The Sonia Road Landfill is presently listed as a Class 2 site in the NYSDEC registry of inactive hazardous waste sites (Site No. 152103). A Class 2 site is defined by the State as posing a significant threat to the public health or environment.

The purpose of this RI/FS is the following:

- Determine the nature, extent and source(s) of contamination;
- Define the limits of waste disposal;
- Determine the risk to human health and the environment;
- Prepare a Presumptive Remedy Engineering Design Report for a final cover;
- Prepare a feasibility study to identify and evaluate additional remedial alternatives, if required; and
- Recommend a cost-effective, environmentally sound, long-term remediation plan.

The Sonia Road Landfill is an inactive municipal solid waste landfill located in West Brentwood in the Town of Islip, Suffolk County, New York (see Figure 1-1). The site is bordered on the south by Deer Park Street, on the west by Corbin Avenue, on the north by industrial properties and on the east by residential properties.



SOURCE: U.S.G.S. GREENLAWN, N.Y. AND BAY SHORE WEST, N.Y. QUADRANGLES

SCALE: 1" = 2000'

SONIA ROAD LANDFILL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY

SITE LOCATION MAP

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FIGURE 1–1

The site is owned by the Town of Islip and is currently vacant. The entire landfill is fenced and main access is through a gate along Corbin Avenue. Another access gate is located along Deer Park Street toward the southeast corner of the site.

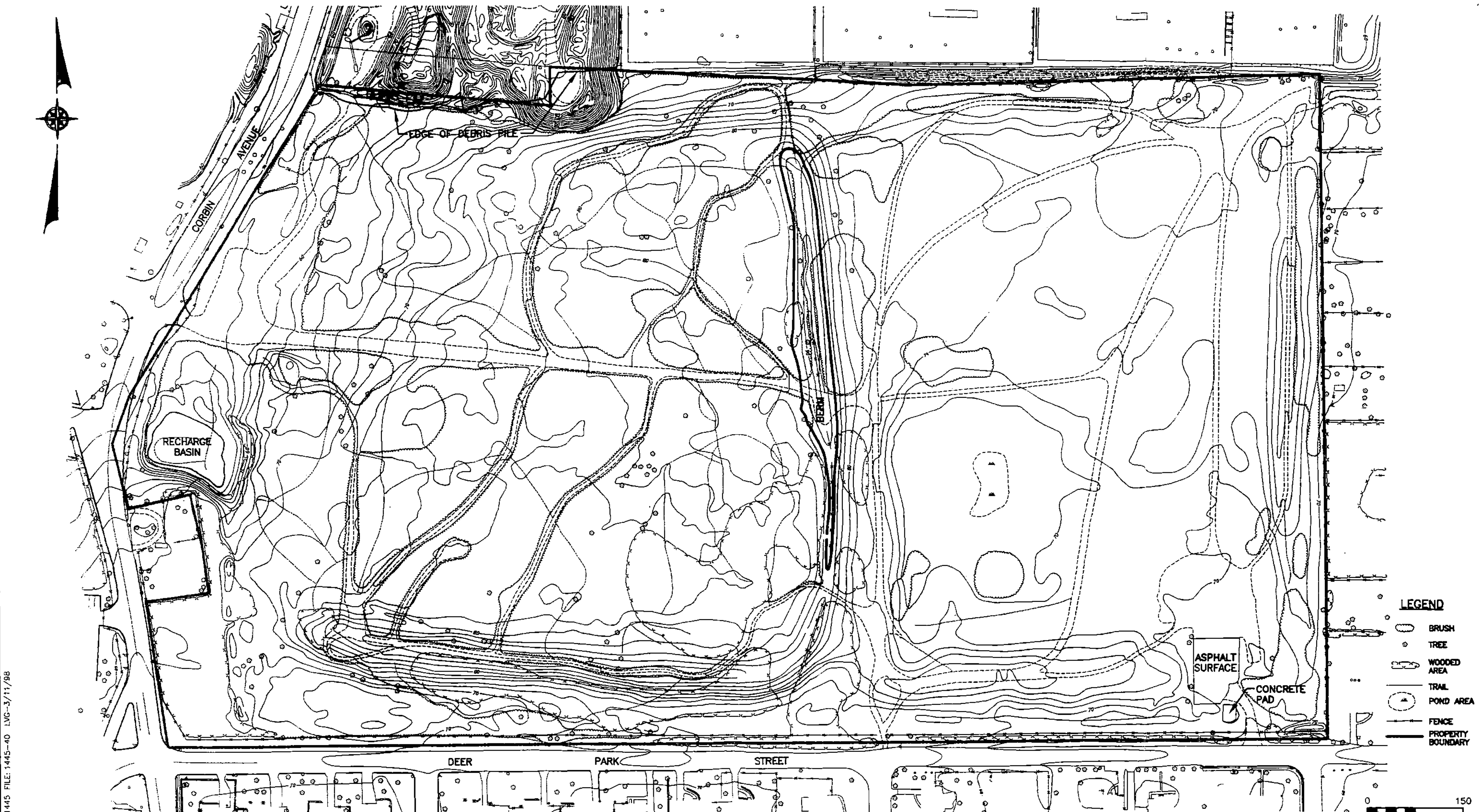
The landfill is generally rectangular in shape and comprises approximately 42 acres. The site is divided into two sections by an earthen berm which runs north and south through the approximate center of the site (see Figure 1-2). The eastern section comprises approximately 19 acres and the western section comprises about 23 acres.

Subsequent to the cessation of waste disposal, the eastern section was converted into sports fields; however, these fields have since been closed due to differential settling of waste and some refuse, in particular tires, rising to the surface. An east-west roadbed was constructed of crushed stone in the western section of the landfill to allow this section to be subdivided and sold after it was rezoned for industrial use; however, the western section was never developed.

Several dirt paths exist throughout the landfill. Tall weeds, phragmities and young trees cover most portions of the western section of the site, with more mature trees lining the southern border of the site. The flatter grade and less sparse eastern section of the site contains lower vegetative growth and young trees.

The western section of the Sonia Road Landfill is currently zoned I2 industrial use with outdoor activity and storage permitted, and the eastern section of the landfill is currently zoned I1 for manufacture and wholesaling (limited to indoor activity), except for a small area located in the southeastern portion of the landfill property which is zoned residential.

With regard to future use, the Town is planning to lease a portion of the western section of the site for construction of a tower for cellular communications. The Town intends to rezone the eastern section to I2 resulting in the entire landfill property being Zone I2.



DIR: 1445 FILE: 1445-40 LVG-3/11/98

SOURCE: GEOMAPS INTERNATIONAL, MARCH 1995

SONIA ROAD LANDFILL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY

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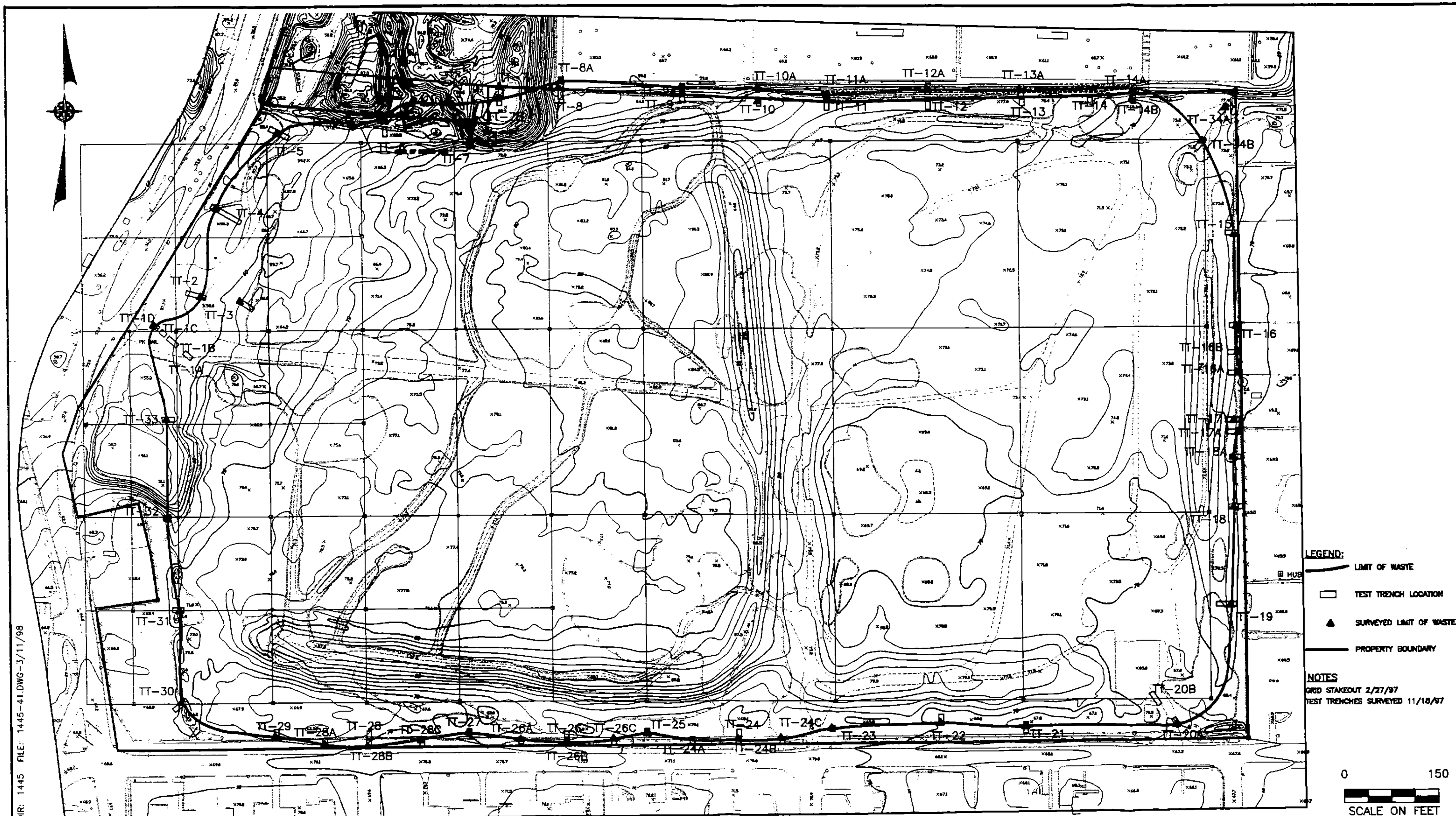
SITE FEATURES MAP

FIGURE 1-2

The site is presently covered with soil ranging in thickness from 3 inches to 30 inches, with the average being approximately 12 inches. The soil cover is greater in the eastern section (average of approximately 18 inches) likely resulting from former development of this section as sports fields. The limits of waste have been defined for the site and comprise essentially the entire property except for an area along the western perimeter (see Figure 1-3). Waste has been disposed beyond the property boundary along portions of the northern perimeter. The landfill is bordered to the north and west by industrial areas, and to the east and south by residential areas. One residential property is located adjacent to the site on Corbin Avenue and the landfill surrounds this property on the northern, eastern and southern sides. Southwest of the site along Udalls Road is the Brentwood West Middle School.

This feasibility study for the Sonia Road Landfill has been prepared in accordance with the Comprehensive Emergency Response, Compensation and Liability Act (CERCLA), Superfund Amendments and Reauthorization Act (SARA) and the New York State Superfund Program, including NYSDEC guidance as prescribed in the Technical and Administrative Guidance Memorandum (TAGM HWR-90-4030) for "Selection of Remedial Actions at Inactive Hazardous Waste Sites" and "Accelerated Remedial Actions at Class 2, Non-RCRA Regulated Landfills" (TAGM HWR-92-4044) (see Appendices A and B, respectively).

The degree of remediation required to protect human health and the environment at the Sonia Road Landfill and surrounding area is a function of the current and future use of the site. Use of the site and off-site impacts will define potential receptors, possible contaminant migration pathways, and the frequency and intensity of exposures that may occur as a result of contact with existing or residual contamination remaining on the site, which in turn affects the remedy chosen. For this site, since it is currently zoned and planned for industrial use, potential receptors who are presently or will be in the future exposed to contamination at the site will likely comprise adult workers and the routes of exposure may be vapors, dust, dermal contact with soil and surface runoff. Off-site impacts could potentially affect children, adult residents and adult workers in the vicinity and downgradient of the landfill.



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WASTE DELINEATION MAP

FIGURE 1-3

This feasibility study addresses the general requirements of the guidance documents for preparation of both a feasibility study and Presumptive Remedy, while at the same time considers the future use of the site, and cost-effective and cost-beneficial remedial measures that will be compatible with and support site development and improvement.

1.2 Remedial Investigation Results

The following is a summary of the findings and conclusions resulting from the remedial investigation conducted for the Sonia Road Landfill as a function of the media investigated. These findings and conclusions are based on comparison of the investigation results to standards, criteria and guidelines selected for the site. The results of the investigation are described in detail in the Remedial Investigation Report dated April 1998.

Soil Vapor/Explosive Gas

Soil vapor screening for total organic vapors and the analytical results of the soil vapor samples did not indicate elevated levels of volatile organic compounds (VOCs). Therefore, the release of VOCs from the landfill into ambient air is not a concern at the Sonia Road Landfill. However, based on methane measurements obtained during this investigation and previous monitoring results, the potential for off-site migration of methane gas exists and the potential is expected to become greater after implementation of the selected Presumptive Remedy for the landfill, which is placement of a low permeability geomembrane over the landfill site. As a result, soil vapor/methane gas is a medium of concern.

Surface Soil

The concentrations of contaminants detected in surface soil, exclusive of iron and zinc found in a limited area of stressed vegetation in the central portion of the landfill, are not significant and are consistent with background levels. Although the surface soil in the area of stressed vegetation could possibly be considered a medium of concern if there was frequent and long-term exposure to this soil, which does not appear to have occurred in the past, the Presumptive Remedy (capping) selected for the site will mitigate future potential migration of and contact with this soil. Therefore, surface soil is not a medium of concern relative to past, present and planned use of the site.

Waste and Subsurface Soil

Elevated concentrations of contaminants, typical of municipal solid waste, were detected in samples collected from waste buried in the landfill. However, significant levels of VOCs were not detected in the waste samples, and only low levels of contaminants were detected in soil immediately below the waste material. Although waste could be considered a medium of concern, the landfill is currently covered with soil which mitigates the potential for contact with the buried material. In addition, the landfill is planned to be capped, which will further reduce concern relative to potential direct contact with the waste material and will mitigate leaching of contaminants to groundwater.

Groundwater

Samples of shallow groundwater collected immediately downgradient of the landfill indicated the presence of elevated concentrations of leachate parameters. However, no VOCs were detected, except for low levels of chloroethane (less than 10 ug/l). The presence of leachate parameters extends downgradient from the landfill and into deeper groundwater in the Upper Glacial aquifer. However, it appears that leachate impacts on groundwater are being naturally attenuated at the landfill site based on the finding of lower levels of leachate parameters in groundwater immediately contiguous to the site as compared to downgradient. This attenuation is likely attributable to the aging of waste material in the landfill which last received waste nearly 25 years ago.

Although the presence of leachate parameters in groundwater could be considered a medium of concern, this groundwater is not expected to impact human health as a result of 1) all properties (except possibly for one abandoned house) supplied with public water within 1.5 miles downgradient of the landfill; 2) the landfill site and downgradient areas being underlain by the Gardiners Clay, which is a low permeability barrier to prevent migration of contaminants; 3) the distance of the closest public water supply wells being over 2 miles downgradient of the landfill; and 4) the depth of the public water supply wells downgradient of the landfill being greater than 400 feet. Based upon the above-referenced factors, there is little concern for this medium. In addition, implementation of the selected Presumptive Remedy (capping) for the Sonia Road Landfill will significantly mitigate the generation of leachate in the future and further lessen this concern.

With regard to samples of deep groundwater collected in the vicinity of the Sonia Road Landfill, significant levels of volatile organic compounds were detected in a few deep monitoring wells immediately downgradient of the landfill; however, elevated levels were also detected upgradient of the landfill, including deep monitoring immediately upgradient of the landfill. There are a number of potential sources of VOC contamination upgradient of the Sonia Road Landfill, in particular the Baron Blakeslee site which is a documented significant source of the same contaminants detected in groundwater at the landfill. A plume of highly contaminated groundwater has previously been determined as migrating from the Baron Blakeslee site and potentially beneath the northeast corner of the landfill where the highest VOC concentrations were detected during this investigation. In addition, the finding of VOC contamination in the deep upgradient well on the western boundary of the landfill indicates other sources of groundwater contamination in the industrial area northwest of the landfill.

Based on documented sources of contamination upgradient of the landfill, and the finding of significant VOC contamination only in the deep wells at the landfill site and the lack of correlation of leachate parameters with the VOCs detected in the deep wells, it is unlikely that the Sonia Road Landfill is the cause of volatile organic chemical contamination. Therefore, although deep VOC-contaminated groundwater is a medium of concern in the study area, since it does not appear to be related to the landfill, it is not a medium of concern relative to the Sonia Road Landfill.

1.3 Risk Assessment Exposure Pathways and Potential Receptors

The following is a summary of the findings and conclusions of the qualitative risk assessment performed for the Sonia Road Landfill, also as a function of the media investigated. The risk assessment identifies the potential human and environmental exposure pathways that are of concern at the landfill site and surrounding area, and the need for remediation.

Each potential exposure pathway was evaluated for functionality and completeness. Functional pathways were identified based on the potential existence of a physical mechanism by which contaminants can be transported into the environment. From among those pathways considered functional, complete pathways were identified on the basis of a potential receptor population and a potential exposure and uptake mechanism. Based on the criteria used to identify chemicals of concern that may pose health risks, and the analysis of functional and complete pathways at the site, a number of concerns were identified which are discussed below. A detailed discussion of the risk assessment is provided in the Qualitative Risk Assessment Report dated April 1998.

Waste and Soils

The waste and soils at the Sonia Road Landfill pose low/little risk to residents now because the waste is covered with soil and people gain only limited unauthorized access to the fenced landfill. Exposure is infrequent and on a short-term basis. In the past, soils posed low/little risk to children and adults who visited the sports fields on the landfill because their exposure was infrequent and of short duration. Exposure was additionally minimized because the sports fields were distant to the area of stressed vegetation. In the future, there will be no/little risk to residents because the landfill will be capped under the Presumptive Remedy selected for the site, and they will have no or minimal direct contact with soils or waste.

Groundwater

Current levels of contaminants in the groundwater pose a health risk to humans in the area if they are exposed because levels of contaminants exceed the risk-based concentration (RBC) for drinking water. Since the concentration of the chemicals in the groundwater exceeded the RBC, the lifetime excess cancer risk of 10^{-6} was exceeded. This is the basis upon which the RBC was calculated, assuming "standard" exposure scenarios to calculate RBCs. Excess cancer risk of 10^{-6} means that there is one additional cancer in a population of a million people due to the presence of the carcinogen at a given concentration in the environmental medium. Therefore, the carcinogens in the groundwater do pose excess cancer risk and are, in fact, an important human health concern, especially if people will be exposed to these contaminants.

Sixteen chemicals of concern were found in the groundwater: benzene, tetrachloroethene, trichloroethene, vinyl chloride, 1,1-dichloroethene, chloroethane, 1,2-dichloroethene (total), bis(2-ethylhexyl)phthalate, arsenic, beryllium, iron, manganese, chloroform, bromodichloromethane, 1,1,2,2-tetrachloroethane, and ammonia. Of these sixteen chemicals, eleven are carcinogens and their presence in the groundwater presents an important human health concern from a toxicological point of view. Benzene and vinyl chloride (Group 1 carcinogens) have been proven to produce cancers in humans. Other carcinogens (those in Groups 2A and 2B) have been shown to produce cancers in animals. Additionally, the excess cancer risk for all the carcinogens in the groundwater is even greater than 10^{-6} because the excess cancer risk for each chemical is additive in determining the total excess cancer risk for the entire group of compounds. Total excess cancer risks between 10^{-7} and 10^{-4} serve as action levels for EPA. If the computed total excess cancer risk for an exposure route is greater than 10^{-4}, it suggests a remedial action.

There are two plumes of contaminated groundwater in the vicinity of the Sonia Road Landfill, one of which contains landfill leachate constituents (such as iron, manganese and ammonia), and the other which contains volatile organic chemicals (such as benzene, vinyl chloride and trichloroethene). The source of the volatile organic chemicals is primarily the industrial areas located upgradient of the landfill. The chemicals which pose the greatest risk to human health, such as the Group 1 carcinogens, are likely the result of the upgradient sources.

Under current site conditions, chemicals of concern detected in the groundwater pose a high risk to the health of humans who are exposed, but because the groundwater pathway is now considered incomplete, due to the absence of potential receptors, the contaminated groundwater currently poses a low overall risk to humans due to low potential for exposure.

In the future, if people become exposed to the contaminated groundwater (i.e., it is ingested or used in the future for gardening or recreational purposes), the situation should be re-assessed under actual exposure scenarios and remediation of groundwater should be considered because the groundwater contains carcinogens that pose a high human health risk and noncarcinogens.

Air

For the air, levels of benzene, 1,1-dichloroethene, and chloroethane detected in the soil vapor gases at the Sonia Road Landfill pose a low human health risk. Therefore, under current site conditions, chemicals of concern detected in the soil vapor pose a low human health risk to those people who gain unauthorized access to the landfill and to residents and workers surrounding area and are exposed to these chemicals.

In the future, the landfill will be capped. During construction of the landfill cap, workers will be exposed to contaminants; however, their exposure is expected to be low and of short duration, and the human health risk will be low. In addition, before commencing any excavation or other activities that may cause exposure to contaminants at the site (both vapors and soil), involved parties should be informed of the appropriate safety precautions and personal protection requirements. This is especially recommended because two of the chemicals (benzene and 1,1-dichloroethene) detected in the soil vapor gas at the landfill are carcinogens.

For residents and workers who live and work around the landfill, future capping of the landfill will maintain the volatilization exposure pathway, but the vapor level in ambient air is expected to be very low and the landfill gases will be controlled and treated if necessary. People will still frequent the landfill site in the future because the site is zoned for industrial purposes and is planned to be developed. For residents who live and work around the area, the human health risk after capping the landfill is not expected to be of a concern because exposure to gases is expected to be very low

1.4 Remedial Action Objectives

Remedial action objectives are goals developed for the protection of human health and the environment. Definition of these objectives requires an assessment of the contaminants and media of concern, migration pathways, exposure routes and potential receptors. Typically, remediation goals are established based upon standards, criteria and guidelines (SCGs) to protect human health and the environment. SCGs for the Sonia Road Landfill, which were developed as part of the remedial investigation, include NYSDEC Recommended Soil Cleanup Objectives, New York Class GA Groundwater Standards and Guidance Values, and NYSDEC Air Guide-1 Guidelines for the Control of Toxic Ambient Air Contaminants. Based on these SCGs and the results of the remedial investigation, the remedial action objectives developed for the Sonia Road Landfill are the following:

1. Protect public health and the environment;
2. Prevent direct contact exposure (dermal absorption, inhalation and incidental ingestion) with waste and contaminated soil;
3. Prevent surface runoff from surficially contaminated portions of the site and transport contaminants off-site;
4. Prevent precipitation from infiltrating through waste and contaminated soil and adversely impacting groundwater;
5. Protect the sole source aquifer;

6. Provide hydraulic control and appropriate treatment of contaminated groundwater to prevent further migration of contaminated groundwater, if necessary;

7. Prevent or reduce the release of contaminants to on-site and off-site ambient air; and

8. Continue to collect the data needed to monitor site impacts and effectiveness of controls, if required.

In addition to consideration of SCGs to meet the remedial action objectives, Applicable or Relevant and Appropriate Requirements (ARARs) are to be considered when formulating, screening and evaluating remedial alternatives, and selecting a remedial action. ARARs may be categorized as contaminant-specific, location-specific or action-specific. Federal statutes, regulations and programs may apply to the site where state or county standards do not exist. Potentially applicable contaminant-specific, location-specific and action-specific ARARs for the Sonia Road Landfill, along with guidance, advisories, criteria, memoranda and other information issued by regulatory agencies to be considered (TBC), are presented in Tables 1-1, 1-2 and 1-3. As a note, many of the NYSDEC ARARs include federal requirements which have been delegated to New York State. Generally, federal ARARs are referenced when state requirements do not exist.

1.5 Feasibility Study Description

The Technical and Administrative Guidance Memorandum (TAGM) prepared by NYSDEC entitled, "Selection of Remedial Actions at Inactive Hazardous Waste Sites," describes the feasibility study as a process to identify and screen potentially applicable remedial technologies, combine technologies into alternatives and evaluate appropriate alternatives in detail, and select an appropriate remedial action plan. The objective of this feasibility study is to meet the goal of the guidance document, while at the same time, develop alternatives that will consider future land use and development of the site.

In discussion with NYSDEC in the initial phase of the RI/FS process, in conformance with closure procedures for landfills, at a minimum, capping, which is a Presumptive Remedy for

Table 1-1

POTENTIALLY APPLICABLE CHEMICAL SPECIFIC ARARs/TBCs
SONIA ROAD LANDFILL

Citation/ Reference	Title	Applicable Media	Potential ARAR/TBC	Regulatory Agency
6 NYCRR 212	General Process Emission Sources	Air	ARAR	NYSDEC
6 NYCRR 257	Air Quality Standards	Air	ARAR	NYSDEC
6 NYCRR 360	Solid Waste Management Facilities	Solid Waste	ARAR	NYSDEC
6 NYCRR 371	Identification and Listing of Hazardous Waste	Hazardous Waste	ARAR	NYSDEC
6 NYCRR 376	Land Disposal Restrictions	Hazardous Waste	ARAR	NYSDEC
6 NYCRR 700-705	Surface Water and Groundwater Classifications and Standards	Surface Water/ Groundwater	ARAR	NYSDEC
6 NYCRR 750-758	State Pollutant Discharge Elimination System	Wastewater Discharge	ARAR	NYSDEC
State Sanitary Code - Part 5	Drinking Water Supply	Water Supply	ARAR	NYSDOH
TOGS 1.1.1	Ambient Water Quality Standards and Guidance Values	Surface Water/ Groundwater	TBC	NYSDEC
TOGS 1.3.1	Waste Assimilative Capacity Analysis & Allocation for Setting Water Quality Based Effluent Limits	Wastewater Discharge	TBC	NYSDEC
TOGS 1.3.1C	Development of Water Quality Based Effluent Limits for Metals Amendment	Wastewater Discharge	TBC	NYSDEC
TOGS 1.3.2	Toxicity Testing in the SPDES Program	Wastewater Discharge	TBC	NYSDEC
Air Guide No. 1	Guideline for the Control of Toxic Ambient Air Contaminants	Air	TBC	NYSDEC
TAGM HWR-4046	Determination of Soil Cleanup Objectives and Cleanup Levels	Soil	TBC	NYSDEC

Table 1-2

POTENTIALLY APPLICABLE LOCATION SPECIFIC ARARs/TBCs
SONIA ROAD LANDFILL

Citation/ Reference	Title	Applicable Media	Potential ARAR/TBC	Regulatory Agency
6 NYCRR 256	Air Quality Classification System	Air	ARAR	NYSDEC
6 NYCRR 307	Suffolk County (Air Quality Classification)	Air	ARAR	NYSDEC
6 NYCRR 360	Solid Waste Management Facilities	Solid Waste	ARAR	NYSDEC
6 NYCRR 608	Use and Protection of Waters	Surface Water	ARAR	NYSDEC
6 NYCRR 664	Freshwater Wetlands Maps and Classification	Wetlands	ARAR	NYSDEC
6 NYCRR 885	Classes and Standards of Quality and Purity Assigned to Fresh Surface and Tidal Salt Waters (Nassau County Waters)	Surface Water	ARAR	NYSDEC
N/A	Fish and Wildlife Impact Analysis for Inactive Hazardous Waste Sites	Hazardous Waste Sites	TBC	NYSDEC
TOGS 2.1.3	Primary and Principal Aquifer Determinations	Groundwater	TBC	NYSDEC
Executive Order No. 11990	Protection of Wetlands	Wetlands	ARAR	USEPA

Table 1-3

POTENTIALLY APPLICABLE ACTION SPECIFIC ARARs/TBCs
SONIA ROAD LANDFILL

Citation/ Reference	Title	Applicable Media	Potential ARAR/TBC	Regulatory Agency
Article 3, Suffolk County Sanitary Code	Permits and Licenses, General Provisions	All Media	ARAR	SCDHS
Article 7 Suffolk County Sanitary Code	Water Pollution Control	Wastewater Discharge	ARAR	SCDHS
Article 12, Suffolk County Sanitary Code	Toxic and Hazardous Materials Storage and Handling Controls	Multi-Media	ARAR	SCDHS
6 NYCRR 200	General Provision	Air	ARAR	NYSDEC
6 NYCRR 201	Permits and Registrations	Air	ARAR	NYSDEC
6 NYCRR 211	General Prohibitions	Air	ARAR	NYSDEC
6 NYCRR 212	General Process Emission Sources	Air	ARAR	NYSDEC
6 NYCRR 360	Solid Waste Management Facilities	Solid Waste	ARAR	NYSDEC
6 NYCRR 364	Waste Transporter Permits	Solid/Hazardous Waste	ARAR	NYSDEC
6 NYCRR 370	Hazardous Waste Management System - General	Hazardous Waste	ARAR	NYSDEC
6 NYCRR 372	Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities	Hazardous Waste	ARAR	NYSDEC
6 NYCRR 373	Hazardous Waste Management Facilities	Hazardous Waste	ARAR	NYSDEC
6 NYCRR 375	Inactive Hazardous Waste Disposal Site Remedial Program	Hazardous Waste	ARAR	NYSDEC
6 NYCRR 376	Land Disposal Restrictions	Hazardous Waste	ARAR	NYSDEC
6 NYCRR 608	Use and Protection of Waters	Surface Water	ARAR	NYSDEC
6 NYCRR 617 and 618	State Environmental Quality Review	All Media	ARAR	NYSDEC

Table 1-3 (continued)

POTENTIALLY APPLICABLE ACTION SPECIFIC ARARs/TBCs
SONIA ROAD LANDFILL

Citation/ Reference	Title	Applicable Media	Potential ARAR/TBC	Regulatory Agency
6 NYCRR 621	Uniform Procedures	All Media	ARAR	NYSDEC
6 NYCRR 624	Permit Hearing Procedures	All Media	ARAR	NYSDEC
6 NYCRR 650	Qualifications of Operators of Wastewater Treatment Plants	NA	ARAR	NYSDEC
6 NYCRR 663	Freshwater Wetlands - Permit Requirements	Wetlands	ARAR	NYSDEC
6 NYCRR 700-705	Classifications and Standards of Quality and Purity	Surface Water/ Groundwater	ARAR	NYSDEC
6 NYCRR 750-758	State Pollutant Discharge Elimination System	Surface Water/ Groundwater	ARAR	NYSDEC
Air Guide No. 1	Guideline for the Control of Toxic Ambient Air Contaminants	Air	TBC	NYSDEC
Air Guide No. 29	Technical Guidance for Regulating and Permitting Air Emissions from Air Strippers, Soil Vapor Extraction Systems and Cold-Mix Asphalt Units	Air	TBC	NYSDEC
Air Guide No. 41	Permitting for Landfill Gas Energy Recovery	Air	TBC	NYSDEC
TAGM HWR-4030	Selection of Remedial Actions at Inactive Hazardous Waste Disposal Sites	Hazardous Waste	TBC	NYSDEC
TAGM HWR-4031	Fugitive Dust Suppression and Particulate Monitoring Programs at Inactive Hazardous Waste Sites	Air	TBC	NYSDEC
TAGM HWR-4046	Determination of Soil Cleanup Objectives and Cleanup Levels	Soil	TBC	NYSDEC
N/A	Analytical Services Protocol	All Media	TBC	NYSDEC

Table 1-3 (continued)

**POTENTIALLY APPLICABLE ACTION SPECIFIC ARARs/TBCs
SONIA ROAD LANDFILL**

Citation/ Reference	Title	Applicable Media	Potential ARAR/TBC	Regulatory Agency
TOGS 1.3.1	Waste Assimilative Capacity Analysis & Allocation for Setting Water Quality Based Effluent Limits	Wastewater Discharge	TBC	NYSDEC
TOGS 1.3.1C	Development of Water Quality Based Effluent Limits for Metals Amendment	Wastewater Discharge	TBC	NYSDEC
TOGS 1.3.4	BPJ Methodologies	Wastewater Discharge	TBC	NYSDEC
TOGS 2.1.2	UIR at Groundwater Remediation Sites	Groundwater	TBC	NYSDEC
TOGS 2.1.3	Primary & Principal Aquifer Determinations	Groundwater	TBC	NYSDEC
29 CFR 1910.120	Hazardous Waste Operations and Emergency Response	NA	ARAR	USDOL
40 CFR 122	EPA Administered Permit Programs: The National Pollutant Discharge Elimination System	Wastewater Discharge	ARAR	USEPA

municipal solid waste landfills, is considered as a remedy for the site. This Presumptive Remedy provides a final cover for the site consistent with the requirements of 6 NYCRR Part 360 with variances under Part 360-1.7(c) and the NYSDEC TAGM "Accelerated Remedial Actions at Class 2, Non-RCRA Regulated Landfills." The objective of this feasibility study will also be to meet the goal of this guidance document, while again, considering planned use of the site.

The approach of a feasibility study is to initially develop remedial action objectives for medium-specific or operable unit-specific goals to protect human health and the environment. The goals consider the contaminants and contaminant concentrations (as determined by the remedial investigation), the exposure routes and potential receptors (as determined by the baseline risk assessment), and the acceptable contaminant or risk levels or range of levels.

In the initial phase of the feasibility study, identified remedial technologies which are not technically applicable to contamination found, or are unproven and/or are not commercially available, will be eliminated from further consideration. The technologies remaining after initial screening will be assembled into remedial alternatives for evaluation. Screening of alternatives will consider effectiveness, implementability, relative costs and compatibility with potential future land use.

Screening of technologies includes a preliminary evaluation of effectiveness and implementability in accordance with NYSDEC criteria. Effectiveness evaluation includes consideration of the following:

1. The potential effectiveness of process options in handling the estimated areas or volumes of contaminated media, and meeting the remediation goals identified by the remedial action objectives;

2. The potential impacts to human health and the environment during the construction and implementation phase; and

3. The proven effectiveness and reliability of the process with respect to the contaminants and conditions at the site.

Implementability includes both the technical and administrative feasibility of utilizing the technology or alternative. Administrative feasibility considers institutional factors such as the ability to obtain necessary permits for on-site or off-site actions, and the ability to restrict land use based on specific remediation measures. Technical feasibility considers such aspects as the ability to comply with SCGs, the availability and capacity of treatment, storage and disposal facilities, the availability of equipment and skilled labor to implement the technology, the ability to design, construct and operate the alternative, and acceptability to the regulatory agencies and the public. Preliminary costs are considered at this stage of the feasibility study process for the purpose of relative cost comparison among the alternatives.

The results of the screening process includes potentially viable technologies or combinations of technologies/alternatives for the site which will be carried forward for detailed evaluation.

The guidance requires that a feasibility study provide a detailed analysis of the potential remedial alternatives based upon consideration of the following evaluation criteria for each alternative.

- Threshold Criteria
  - Compliance with applicable regulatory standards, criteria and guidelines
  - Protection of human health and the environment
- Balancing Criteria
  - Short-term impacts and effectiveness
  - Long-term effectiveness and permanence
  - Reduction in toxicity, mobility and/or volume of contamination
  - Implementability
  - Cost

In addition to the above listed Threshold and Balancing Criteria, the guidance also presents the following modifying criteria:

- State acceptance
- Community acceptance

Provided below is a description of each of the feasibility study criteria.

Applicable federal and New York State SCGs are identified for this site to provide both action-specific guidelines for remedial work at the site and contaminant-specific cleanup standards for the alternatives under evaluation. In addition to action-specific and contaminant-specific guidelines, there are also location-specific guidelines that pertain to such issues as restrictions on actions at historic sites. These guidelines and standards are referenced in Section 1.4 of this document and are considered a minimum performance specification for each remedial action alternative under consideration.

Protection of human health and the environment is evaluated on the basis of estimated reductions in both human and environmental exposure to contaminants for each remedial action alternative. The evaluation focuses on whether a specific alternative achieves adequate protection, and how site risks are eliminated, reduced or controlled through treatment, engineering or institutional controls. An integral part of this evaluation is an assessment of long-term residual risks to be expected after remediation has been completed. Evaluation of the human health and environmental protection factor is generally based, in part, on the findings of a site-specific risk assessment. The risk assessment performed for this site incorporates the qualitative estimation of the risk posed by carcinogenic and noncarcinogenic contaminants detected during the remedial investigation. The results of the risk assessment performed for this site are presented in a separate document entitled, "Qualitative Risk Assessment," dated April 1998.

Evaluation of short-term impacts and effectiveness of each alternative examines health and environmental risks likely to exist during the implementation of a particular remedial action. Principal factors for consideration include the expediency with which a particular alternative can be completed, potential impacts on the nearby community and on-site workers, and mitigation measures for short-term risks required by a given alternative during the necessary implementation period.

Examination of long-term impacts and effectiveness for each alternative requires an estimation of the degree of permanence afforded by each alternative. To this end, the anticipated service life of each alternative must be estimated, together with the estimated quantity and characterization of residual contamination remaining on-site at the end of this service life. The magnitude of residual risks must also be considered in terms of the amount and concentrations of contaminants remaining following implementation of a remedial action, considering the persistence, toxicity and mobility of these contaminants, and their propensity to bioaccumulate.

Reduction in toxicity, mobility and volume of contaminants is evaluated on the basis of the estimated quantity of contamination treated or destroyed, together with the estimated quantity of waste materials produced by the treatment process itself. Furthermore, this evaluation considers whether a particular alternative will achieve the irreversible destruction of contaminants, treatment of the contaminants or merely removal of contaminants for disposal elsewhere.

Evaluation of implementability examines the difficulty associated with the installation and/or operation of each alternative on-site and the proven or perceived reliability with which an alternative can achieve system performance goals (primarily the SCGs discussed above). The evaluation must examine the potential need for future remedial action, the level of oversight required by regulatory agencies, the availability of certain technology resources required by each alternative and community acceptance of the alternative.

Cost evaluations presented in this document estimate the capital, and operation and maintenance (O&M) costs, including monitoring, associated with each remedial action alternative. From these estimates, a total present worth for each option is determined.

Regulatory agency and community acceptance evaluates the technical and administrative issues and concerns which the agencies or the community may have regarding each of the alternatives.

1.6 Approach to Feasibility Study

Technical and Administrative Guidance Memorandum (TAGM) HWR-92-4044 (Accelerated Remedial Actions at Class 2, Non-RCRA Regulated Landfills) states that the RI/FS process for Class 2 sites requires the identification and screening of remedial technologies; however, the TAGM indicates the process may be "somewhat simplified and accelerated" due to the typical large size and composition of mixed waste landfills that are composed of primarily municipal solid waste. In this feasibility study technologies are organized, identified, and screened by media as follows: waste/soil, landfill gas and groundwater. TAGM HWR-92-4044 also requires consideration of a leachate collection system. However, at the Sonia Road Landfill, since the landfill is unlined and waste extends vertically into the water table and the horizontal extent of the waste is close to the property line in most portions of the site, leachate collection is not a viable option, and therefore, is not evaluated further in this feasibility study.

In general, as discussed above, the Sonia Road Landfill is not highly contaminated. Under current conditions and use, the site does not pose a significant threat to human health or the environment. Waste and subsurface soil contamination at the site does not appear to be significantly impacting groundwater, and soil vapor and surface soil contamination is very limited. Therefore, while waste/soil remediation technologies are identified and evaluated, the focus of this feasibility study is on evaluation of capping options as a Presumptive Remedy in accordance with TAGM HWR-92-4044. Because of elevated levels of methane detected at the site and potential for off-site migration as a result of implementation of the Presumptive Remedy (capping of the landfill), landfill gas collection and treatment is evaluated in conjunction with capping.

With regard to groundwater, although leachate impacts have been detected in the shallow groundwater immediately downgradient of the landfill and in deeper groundwater downgradient of the site, the impacts appear to be decreasing, likely the result of reduction of leachate concentration due to the age of the landfill and natural attenuation in downgradient migration. Although this leachate impacted groundwater does not pose a threat to human health or the environment, remediation of leachate contaminated groundwater will be evaluated as part of the feasibility study to provide a comprehensive set of alternatives.

With respect to volatile organic chemical contaminated groundwater detected in the vicinity of Sonia Road Landfill, although not attributed to the site, but to upgradient industrial sources, remediation of groundwater impacted by VOCs will also be addressed in this feasibility study to comprehensively address groundwater contamination in the study area.

2.0 IDENTIFICATION AND SCREENING OF REMEDIAL TECHNOLOGIES

2.1 Introduction

In general, response actions which satisfy remedial objectives for a site include institutional, containment, isolation, removal or treatment actions. In addition, United States Environmental Protection Agency (USEPA) guidance under the Comprehensive Emergency Response, Compensation and Liability Act (CERCLA) requires the evaluation and comparison of a No-Action Alternative to the action alternatives. Each response action for each medium of interest must satisfy the remedial action objectives for the site or the specific area of concern. Technologies and process options, which are available commercially and have been demonstrated successfully, are identified in this feasibility study along with certain selected emerging technologies. The screening of process options or technology types is performed by evaluating the ability of each technology to meet specific remedial action objectives, technical implementability, and short-term and long-term effectiveness. A discussion of selected response actions and their applicability to the Sonia Road Landfill is provided below. Primary evaluation/screening of the response action and remedial technologies will be based on technical effectiveness as it related to the site-specific characteristics of the Sonia Road Landfill. However, where appropriate, consideration will also be given to implementability and cost.

2.2 No Action

The No-Action Alternative will be considered, and as described above, will serve as a baseline to compare and evaluate the effectiveness of other actions. Under the no-action scenario, limited remedial response actions may be considered including site access restrictions, such as placement of fencing around the areas of concern, posting of signs warning the public of the presence of contamination, and monitoring. Monitoring would consist of periodic groundwater sampling to evaluate changes over time in conditions at the site and to ascertain the level of any natural attenuation which may occur or any increase in contamination which may necessitate further remedial action. Natural attenuation (under the No Action Alternative), as opposed to active remediation, relies on naturally occurring physical, chemical and biological processes (dilution, dispersion and degradation) to reduce contaminant concentrations.

2.3 Institutional Controls

Institutional controls may include access restrictions and deed restrictions. Access restrictions, such as eliminating access to the landfill by fencing and posting of signs, are considered potentially applicable to the site. Deed restrictions could be imposed by the Town of Islip to limit uses of and activities at the site. Current zoning for industrial use is institution control to limit site use and activities. Additional restrictions could be developed by the Town in the case of the Sonia Road Landfill, and could be implemented through the Town building permit approval process. The implementation of the restrictions and the responsibility for enforcement would be essentially with the Town of Islip. Deed restrictions, in addition to zoning, which prohibit/restrict future use and development of the site would be a potentially applicable alternative for the site.

2.4 Groundwater Remediation Technologies

Treatment, collection and containment technologies, which could be applicable to remediation of groundwater contaminated with volatile organic compounds and leachate constituents are identified and evaluated below.

2.4.1 Extraction and Treatment

Extraction and treatment or “pump and treat” technologies are widely used for groundwater remediation and/or containment.

2.4.1.1 - Extraction Technologies

Extraction is a remedial technology generally used in combination with treatment technologies to control and remove contaminants in groundwater. Two extraction technologies, pumping wells and groundwater interceptor trenches, are described below.

2.4.1.1.1 - Wells

Technology Description: The use of wells to pump contaminated groundwater to the surface for treatment is in wide use as a remedial technology. With this technology, contaminated groundwater can be extracted for on-site or off-site treatment and disposal. Groundwater modeling could assist in this effort to identify optimal pumping rates and well locations.

Initial Screening Results: Extraction wells represent a potentially viable technology for remediation of groundwater at the Sonia Road Landfill. Therefore, this technology will be retained for further evaluation.

2.4.1.1.2 - Interceptor Trenches

Technology Description: As opposed to wells, groundwater interceptor trenches have been used successfully to extract groundwater in situations where the depth to groundwater is shallow, contamination is limited to the upper portion of the aquifer and soils can be excavated without causing structural damage and interfering with underground utilities.

Initial Screening Results: Due to the depth to groundwater contamination at the Sonia Road Landfill (approximately 90 feet), the use of groundwater interceptor trenches will not be considered further.

2.4.1.2 - Treatment Technologies

Once extracted, contaminated groundwater must be treated to meet discharge standards. Treatment technologies include biological, chemical and physical processes. A number of these technologies are described below.

2.4.1.2.1 - Air Stripping

Technology Description: Air stripping involves a process by which volatile organic compounds are partitioned from groundwater by greatly increasing the surface area of the contaminated water exposed to air. Types of aeration methods include packed towers, diffused aeration, tray aeration and spray aeration. Air stripping is a widely used, proven and commercially available technology.

The applicability and effectiveness of air stripping will depend on the potential for inorganic or biological fouling of the equipment. Clogging of the stripping column packing material due to inorganics in the groundwater (especially dissolved ferrous iron, which precipitates out as insoluble ferrous hydroxide species upon aeration) and biofouling are common problems if not taken into consideration during the design phase. In addition, the Henry's Law constant of the VOCs in the water stream will determine the effectiveness of air stripping.

Initial Screening Results: Air stripping represents a potentially viable technology for treatment of extracted groundwater at the Sonia Road Landfill. Therefore, this technology will be retained for further evaluation.

2.4.1.2.2 - Carbon Adsorption (Liquid Phase)

Technology Description: Carbon adsorption involves a process by which groundwater is pumped through a series of canisters containing activated carbon to which dissolved contaminants adsorb. The technology requires periodic replacement or regeneration of saturated carbon. Carbon adsorption (liquid phase) is a widely used, proven and commercially available technology. The applicability and effectiveness of carbon adsorption may be limited by the presence of certain compounds which can foul the system, high contaminant concentration levels and the physical properties of the contaminants, among other factors.

Initial Screening Results: This technology has been very effective in the removal of VOCs from contaminated groundwater, and therefore, will be retained for further evaluation.

2.4.1.2.3 - Oxidation

Technology Description: Ultraviolet (UV) radiation, ozone and/or hydrogen peroxide may be used to destroy contaminants as groundwater flows into a treatment tank. An ozone destruction unit is used to treat off-gas from the treatment tank. UV oxidation is a commercially available technology which is effective in the treatment of volatile and semivolatile organic compounds.

Initial Screening Results: Oxidation is a potentially viable technology for treatment of extracted groundwater at the Sonia Road Landfill. Therefore, this technology will be retained for further evaluation.

2.4.1.2.4 - Biological Treatment

Technology Description: Typically, this technology involves the introduction of groundwater into biological treatment units where enzymes and microorganisms decompose organic contaminants into carbon dioxide, water and nonhazardous by-products. Supplemental nutrients may be added to assist the biological process. Biological treatment occurs at the rate of decomposition, which may be low. Biodegradation may also be accomplished in situ through the same biological processes.

Initial Screening Results: Biological treatment is generally less effective than available alternative technologies on chlorinated organic contaminants which are present in the groundwater at the Sonia Road Landfill. Therefore, this technology will not be considered further for this purpose but will be retained for evaluation as a potential technology for nitrogen removal.

2.4.1.2.5 - Reverse Osmosis

Technology Description: Osmosis is a process which occurs when two solutions of different solute concentrations reach an equilibrium across a semi-permeable membrane. The solvent (water in this case) will naturally flow from the less concentrated solution into the more concentrated solution. To reverse this process, the solution with the high concentrations must be pressurized to a level higher than the osmotic pressure. At sufficiently high pressures, usually 200 to 800 pounds per square inch (psi), the water will flow out of the more concentrated solution, leaving the contaminants trapped on the other side of the semi-permeable membrane. The volume of the concentrated waste is generally 10 to 20% of the feed volume. This concentrated waste will require additional treatment. Reverse osmosis has been demonstrated to be effective for treatment of brackish waters, aqueous inorganic wastes and radionuclides, and recent findings indicate that it is useful in removing some specific organic compounds from solution. The effectiveness of this process is highly dependent on the chemical composition of the waste solution to be treated and the characteristics of the membrane.

Initial Screening Results: Since more effective and proven methods for treatment of volatile organic and inorganic contaminants are readily available and large volumes of reject water would be generated, reverse osmosis will not be considered further.

2.4.1.2.6 - Filtration

Technology Description: Filtration is a process in which suspended and colloidal particles, which are not readily settleable, are removed from water by physical entrapment on a media. Fluid flow through the filter media may be accomplished by gravity or it may be pressure induced. Beds of granular material, such as sand and anthracite, are commonly used filters in groundwater treatment. Other types of filters include vacuum filters, plate and frame filters, and belt filters.

These are often used to dewater sludges produced by processes like sedimentation and chemical precipitation. Packed beds of granular material are usually backwashed to remove the filter cake. The collected solids will require disposal and costs will depend on whether the material is hazardous or nonhazardous.

Initial Screening Results: Filtration is used to remove suspended solids and colloidal particles as part of a water treatment process, and therefore, will be retained for further consideration as part of an overall treatment process for extracted groundwater.

2.4.1.2.7 - Ion Exchange

Technology Description: Ion exchange is a process in which ions are removed from solution by exchange with non-toxic ions supplied by the ion exchange material. Inorganic compounds can be removed by this process. Generally, a train of resin beds in series containing different resins for cation and anion removal are used. The beds must be monitored for breakthrough and must be regenerated using a wide variety of regeneration chemicals which may themselves be hazardous. Ion exchange can be used both as a pretreatment and as a polishing step.

Initial Screening Results: The ion exchange process may be suitable for the removal of inorganic compounds from extracted groundwater as part of an overall water treatment alternative. Therefore, this technology will be retained for further consideration.

2.4.1.2.8 - Chemical Precipitation and Clarification

Technology Description: Precipitation is a physical and chemical technique that can be used to remove metals from an aqueous stream. The metals can be precipitated out of solution by changing the chemical equilibrium of the solution. This is generally achieved by adding a chemical that reacts directly with the contaminant to form an insoluble settleable product. When used prior to other treatment technologies, this process eliminates the probability of reduced efficiency due to dissolved metals precipitation during later phases of treatment. The pH can be adjusted to optimize the precipitation process. Metals can be precipitated as hydroxides, carbonates and sulfides. Typical precipitating agents include calcium oxide, caustic soda, sodium sulfide, ferrous sulfide and hydrogen sulfide gas.

Initial Screening Results: Chemical precipitation may be utilized for the removal of inorganics as part of an overall groundwater treatment process, and therefore, this technology will be retained for further consideration.

2.4.1.3 - Discharge Management

Groundwater extraction and treatment systems will generate a treated wastewater discharge requiring proper management and disposal. Several discharge management options are identified below. In addition, many of the treatment processes produce residuals that required treatment and/or disposal.

2.4.1.3.1 - Discharge to Publicly Owned Treatment Works

Technology Description: Under this option, treated, pretreated and untreated discharge would be routed to the nearest sewer system. The effluent would have to meet the discharge requirements of the Publicly Owned Treatment Works (POTW). With regard to the Sonia Road Landfill site, the POTW is the Southwest Sewer District.

Initial Screening Results: Discharge to the sewer system represents a potentially viable option for disposal of treated groundwater assuming the POTW requirements can be met, and therefore, this technology will be retained for further evaluation. Among other considerations evaluation of the distance and routing to the nearest sewer lines, and available capacity of existing sewer lines and the POTW will be required.

2.4.1.3.2 - Off-site Transportation and Disposal of Treated Discharge

Technology Description: This option involves on-site storage and subsequent transport and off-site disposal of treated groundwater.

Initial Screening Results: Due to the excessive storage and handling requirements associated with the large volumes of water anticipated, this option will not be considered further.

2.4.1.3.3 - Discharge to Surface Water

Technology Description: Discharge to surface water would entail obtaining a SPDES permit which would require treatment to discharge standards along with routine monitoring of the discharge. In addition, construction of pipe would be required to convey the treated discharge to the receiving surface water (e.g., Sampawams Creek).

Initial Screening: This option will be retained for further evaluation which would include, among other things, evaluation of routing for the conveyance system to the receiving water body and the potential for meeting all of the requirements of a SPDES permit.

2.4.1.3.4 - Recharge/Reinjection

Technology Description: Recharge/reinjection options include discharge of treated groundwater to a recharge basin, injection wells or leaching pool(s). Again a SPDES permit would be required. This option if implemented on or near the site would have to be evaluated with respect to potential impact on the groundwater extraction strategy being implemented.

Initial Screening: This option will not be retained for evaluation since there is little or no area for recharge basins or leaching pools on-site or off-site, and recharge via injection wells in the vicinity of the landfill would interfere with groundwater remediation, if required.

2.4.2 In-Situ Treatment

In-situ treatment technologies for remediation of groundwater involve both proven and "emerging" techniques, as described below.

2.4.2.1 - In-Well Air Stripping

Technology Description: In-well air stripping is a process by which air is injected into a well, lifting contaminated groundwater in the well and allowing additional groundwater flow into the well. Once inside the well, the volatile organic compounds in the contaminated groundwater are transferred from the water to air bubbles which rise and are collected at the top of the well by vapor extraction. The partially treated groundwater is not brought to the surface, but rather, it is forced into the saturated or unsaturated zone, and the process is repeated. As groundwater circulates through the treatment system in situ, contaminant concentrations are reduced. In-well air stripping is an emerging technology.

Initial Screening Results: Although there is concern regarding clogging of the screens with iron and iron bacteria, as well as adequate treatment utilizing groundwater recirculation, in-well air stripping represents a potentially viable technology for removal of volatile organic compounds without any aboveground water discharge. Therefore, this technology will be retained for further consideration.

2.4.2.2. - Air Sparging

Technology Description: Air sparging involves injecting air into a saturated matrix in order to create an underground stripper that removes contaminants through volatilization. The technology is designed to operate at sufficient air flow rates in order to effect volatilization as opposed to the lower air flow rates used to increase groundwater oxygen concentrations to stimulate biodegradation. Air sparging must operate in conjunction with a soil vapor extraction (SVE) system that captures volatile contaminants in the unsaturated zone as they are stripped from the saturated zone. Air sparging is a widely used, proven commercially available technology; however, the applicability and effectiveness of the process is limited by the depth of contamination and geology.

Initial Screening Results: The depth to groundwater contamination at the Sonia Road Landfill (approximately 90 feet) would limit the ability to effectively capture the volatile contaminants released during air sparging. Therefore, this technology will not be considered further.

2.4.2.3 - Oxygen Enhancement with Air Sparging/Bioremediation

Technology Description: Oxygen enhancement with air sparging (or "bio-sparging") involves injecting air under pressure below the water table to increase groundwater oxygen concentrations and enhance the rate of biological degradation of organic contaminants by naturally occurring microbes. Bio-sparging increases mixing in the saturated zone, which increases the contact between groundwater and soil. The ease and low cost of installing small-diameter air injection points allows considerable flexibility in the design and construction of a remediation system. Oxygen enhancement with air sparging is a full-scale commercially available technology. However, the applicability and effectiveness of the process may be limited by the potential for migration of vapors through the vadose zone and release into the atmosphere or subsurface structures.

Initial Screening Results: Biosparging represents a potentially viable technology for in-situ treatment of volatile organic compounds at the Sonia Road Landfill, and therefore, this technology will be retained for further consideration.

2.4.2.4 - Dual Phase Extraction

Technology Description: Dual phase extraction technologies involve applying a high vacuum system to simultaneously remove liquid (groundwater) and gas (volatile vapors) from low permeability or heterogeneous formations. The vacuum extraction well includes a screened section in the zone of contaminated soils and groundwater. As the vacuum is applied to the well, soil vapor is extracted and groundwater is entrained by the extracted vapors. Once above grade, the extracted vapors and groundwater are separated and treated. Dual phase extraction is a full-scale commercially available technology.

Initial Screening Results: Due to the depth of VOC-contaminated groundwater at the Sonia Road Landfill, dual vapor extraction is not applicable and, therefore, will not be considered further.

2.4.2.5 - Oxygen Enhancement with Hydrogen Peroxide

Technology Description: Oxygen enhancement with hydrogen peroxide involves the use of a dilute solution of hydrogen peroxide which is circulated throughout a contaminated groundwater zone to increase the oxygen content of groundwater and enhance the rate of aerobic degradation of organic contaminants by naturally occurring microbes. For best results, factors that must be considered include redox conditions, saturation rates, presence of nutrient trace elements, pH, temperature and permeability of the subsurface materials. Oxygen enhancement with hydrogen peroxide is a full-scale commercially available technology.

Initial Screening Results: Oxygen enhancement with hydrogen peroxide represents a potentially viable technology for in-situ treatment of volatile organic compounds, and therefore, this technology will be retained for further consideration.

2.4.2.6 - Passive Treatment or Reactive Walls

Technology Description: The use of passive treatment or reactive walls involves installing a permeable reaction wall across the flow path of a contaminant plume, allowing the plume to passively move through the wall. Typically, the contaminants are degraded by reactions with a mixture of porous media and a metal catalyst. The use of passive treatment walls is an emerging technology which is applicable only in relatively shallow aquifers, because a trench must be constructed down to the level of the bedrock or a low permeability geologic unit in order to install the reactive wall. In addition, passive treatment walls are often only effective for a short time because they lose their reactive capacity, requiring replacement of the reactive medium.

Initial Screening Results: Due to the depth to groundwater contamination and the depth to the clay layer at the Sonia Road Landfill (approximately 90 feet), reactive walls will not be considered further.

2.4.2.7 - Funnel and Gate

Technology Description: Another emerging passive groundwater remediation technology, that is very similar to and incorporates the treatment/reactive wall technology, is the funnel-and-gate system. Like treatment walls, the funnel-and-gate system includes the installation of a permeable wall containing a mixture of porous media and treatment media which degrade the contaminants in groundwater and allow the treatment water to passively move through the wall. However, the primary difference between the two technologies is that the funnel-and-gate system includes the installation of low permeability or impermeable cut-off walls (or "funnels") such as slurry or sheet pile walls in the path of the contaminated groundwater or plume which direct or "funnel" the contaminated groundwater to a treatment/reactive wall (or "gate"). The "gate" passes the contaminated groundwater through the treatment wall, which then remediates the groundwater.

Advantages and disadvantages of the funnel-and-gate technology are similar to those of treatment walls. However, slurry walls, sheet piling and other materials that are used to form the funnel are often easier and/or more economical to install than the treatment walls. Therefore, construction of funnel-and-gate systems may be less costly than treatment wall systems depending upon the application.

Initial Screening Results: Similar to passive treatment walls, the containment walls necessary to construct a funnel and gate treatment system must extend to the depth of the contaminated groundwater and be keyed into a low permeability geologic unit to cut off groundwater flow. Due to the depth to groundwater contamination and the clay layer at the Sonia Road Landfill (approximately 90 feet), the funnel and gate technology will not be considered further.

2.4.3 Containment Barriers

Technology Description: Containment barriers include subsurface structures such as a vertically excavated trench that is filled with a slurry or grout or sheet pile walls. Most commonly a slurry, usually a mixture of bentonite and water, is used. The slurry hydraulically shores the trench to prevent collapse and forms a low permeability barrier to impede groundwater flow. Containment barriers are often used where the waste mass is too large for practical treatment and where soluble and mobile constituents pose an imminent threat to a source of drinking water. Containment barriers are a full-scale commercially available technology.

Initial Screening Results: Similar to the evaluation of funnel and gate technology due to the depth to groundwater contamination and the clay layer at the Sonia Road Landfill (approximately 90 feet), slurry walls will not be considered further.

2.4.4 Natural Attenuation

Technology Description: Natural attenuation is an alternative whereby natural subsurface processes such as dilution, dispersion, volatilization, biodegradation, adsorption and chemical reactions with subsurface materials are allowed to reduce contaminant concentrations to acceptable levels. Consideration of this option requires groundwater modeling and evaluation of contaminant degradation rates to determine feasibility, and special approvals may be needed. In addition, groundwater sampling and analysis must be conducted throughout the process to confirm that attenuation is proceeding at a rate consistent with meeting groundwater cleanup objectives and that any potential receptors will not be impacted. Several disadvantages of natural attenuation include: intermediate degradation products may be more mobile and more toxic than the original contaminant; it should be used only in low-risk situations; it should be used only where there are no potential impacts on receptors; contaminants may migrate before they are degraded; regulatory agency acceptability is poor; and community acceptability is poor.

Initial Screening Results: This alternative will not be retained for further evaluation.

2.4.5 No Action

Technology Description: For groundwater, the no-action alternative would be utilized in situations where source control activities have been undertaken, and although there may be residual groundwater contamination, the extent may be limited and there is no significant threat to human health or the environment caused by these residuals. This alternative may be applicable where the source area would be remediated (i.e., on-site remediation of soil and groundwater contamination), natural attenuation of the contamination would be expected to occur and long-term monitoring would continue. The no-action alternative would not be applicable to sites where there are potential receptors or where natural attenuation is not expected to occur.

Initial Screening Results: The no-action alternative would not be applicable due to the need for groundwater remediation to mitigate the potential for migration of contaminants and impairment of the groundwater resources. However, as discussed in Section 2.2, the no-action alternative must be considered in order to serve as a baseline to compare and evaluate the effectiveness of other action alternatives. Therefore, the no-action alternative will be retained for further consideration.

2.5 Waste/Soil Remediation Technologies

2.5.1 Isolation/Containment

Potentially applicable isolation and containment technologies include surface barriers, such as permeable covers and low permeability caps. These technologies are designed to prevent direct contact with and migration of contaminants from the area of concern and do not provide any treatment for the isolated/contained waste or contaminated soil. Various forms of surface barriers currently exist to significantly reduce the infiltration of precipitation into waste and contaminated soil, and minimize surface runoff and contact with contaminated material.

Low permeability caps have an advantage over permeable covers in that these technologies would limit infiltration by precipitation in addition to mitigating direct contact with contaminated material. However, low permeability caps are more costly, require a sloped surface to promote runoff and may preclude/limit the use of the capped area and require additional maintenance. In addition, low permeability caps will often cause off-site subsurface migration of landfill gases, while permeable covers will allow the on-site escape of gases to the atmosphere. The following is a discussion of various low permeability and permeable caps.

2.5.1.1 - RCRA Cap

Technology Description: This technology consists of constructing a cap over contaminated materials as defined in the Resource Conservation and Recovery Act (RCRA) Subpart N, 40 CFR 264.300. These caps are applicable to landfills specifically used for the disposal of hazardous wastes, whereas the Part 360 cap as described below is more applicable to municipal solid waste landfills that may have received some hazardous waste. The cap would prevent direct contact with waste and contaminated soil, and would minimize infiltration of precipitation through waste and contaminated soil and further contamination of groundwater. It would also eliminate contaminated runoff.

A RCRA cap consists of three sections. The top section consists of a 2-foot vegetated topsoil and a soil layer. A geotextile is placed between the top section and middle section. The middle section contains a 1-foot sand and gravel filter which prevents clogging of the underlying drainage layer. The bottom section is a flexible membrane liner (FML) which overlies and protects a second low permeability 2-foot compacted soil/clay layer. The thickness (5 feet), maintenance requirements and slope (typically a minimum of 4%) of this type of cap would preclude many potential future land use options.

Initial Screening Results: This type of cap will provide significant protection from infiltration of precipitation into the contaminated subsurface and provides additional protection over other types of low permeability caps presented below. However, because of its very high cost and other less costly caps being nearly as effective, this technology will not be retained for further consideration.

2.5.1.2 - Part 360 Cap

Technology Description: This technology consists of constructing a cap over waste materials as defined in 6 NYCRR Part 360. This cap consists of a four-layered system comprised of a vegetated topsoil upper layer, underlain by a drainage/barrier protection layer followed by a low permeability layer (10^{-7} cm/sec) comprised of clay (18 inches) or a flexible membrane liner (FML), followed by a gas venting layer. The thickness of the multimedia cap with a FML is 2 to 3 feet. Similar to the RCRA cap described above, this cover also mitigates direct contact with waste and contaminated soil, infiltration of precipitation and runoff of contaminants. The thickness, required maintenance and slope of the cap (minimum 4%) would also significantly reduce utilization of the capped area.

Initial Screening Results: Since this type of cap provides for adequate containment/isolation of waste and contaminated soil, this technology will be considered further as a presumptive remedy.

2.5.1.3 - Pavement/Structure Cap

Technology Description: An asphalt or concrete structure surface would significantly reduce the amount of infiltration into and contact with waste and contaminated waste and soil, as well as surface runoff of contaminants from the site. In addition, it could be implemented as part of site development, such as construction of buildings and asphalt parking areas. Efforts may need to be undertaken to design appropriate drainage systems to redirect surface runoff that currently infiltrates the area. This type of cover, which would be about 1 1/2 to 2 feet in thickness, would not be as thick as the RCRA cap (5 feet) or the multimedia cap (2 to 3 feet), and the slope could be reduced to 2% to promote runoff. Maintenance would be required in order to ensure that cracks due to weathering, settlement or traffic are repaired.

Initial Screening Results: Since this cover has not been acceptable to NYSDEC as a landfill cap, this technology will not be considered further.

2.5.1.4 - Semi-permeable Cover

Technology Description: This technology, which is an allowable Part 360 variance under the NYSDEC Regulatory Relief Initiative for closure of municipal solid waste landfills, provides for the placement of an 18-inch semi-permeable soil cover (10^{-5} cm/sec hydraulic conductivity). This type of cover would mitigate direct contact with waste and contaminated soil, and runoff of contaminated surface soil. While it would not eliminate infiltration of precipitation through the landfill waste, with surface grading to promote drainage off the landfill site, this type of cover would reduce infiltration of precipitation and generation of leachate.

Initial Screening Results: Limited infiltration through a semi-permeable cover may continue to impact groundwater, which is a Sole-source Aquifer, and would likely not be acceptable to the regulatory agencies. Therefore, this technology will not be considered further.

2.5.1.5 - Permeable Cover

Technology Description: This technology provides for the placement of a 2-foot soil ($>10^{-5}$ cm/sec hydraulic conductivity) and/or gravel cover. This type of cover would mitigate direct contact with waste and contaminated soil, and runoff of contaminated surface soil; however, even with grading of the landfill surface, in particular with regard to the shallow slopes anticipated for the Sonia Road Landfill, it would not substantially reduce infiltration of precipitation.

Initial Screening Results: Infiltration through a permeable cover would likely result in continued impact to groundwater and would likely not be acceptable to the regulatory agencies. Therefore, this technology will not be considered further.

2.5.2 Excavation, Off-Site Treatment and Disposal

Technology Description: Off-site disposal would require excavation of waste and contaminated soil and transportation to an approved/permitted secure landfill or incinerator. Pre-treatment may be required in order to meet land disposal restriction. In addition, large excavations may require construction of structural supports, such as sheeting, and vapor and particulate emission controls may also be required.

Initial Screening Results: Due to the large quantities of waste and soil excavation which would be required at the Sonia Road Landfill, and resulting very high cost, excavation and, off-site disposal does not represent a practical option, and therefore, will not be considered further.

2.5.3 Soil Treatment

There are a number of demonstrated/commercially available technologies for the treatment of contaminated soil. Some treatment technologies can be performed in situ and other technologies require treatment of the soil ex situ. Ex situ soil treatment processes would require excavation of the soil prior to treatment. Therefore, similar problems regarding excavation, as discussed above in Section 2.5.2, would be encountered. Provided below is a discussion of a number of soil treatment technologies including bioremediation, solvent/acid extraction, soil washing, thermal separation/desorption and in situ soil flushing.

2.5.3.1 - Bioremediation

Technology Description: Bioremediation is a process in which microorganisms degrade organic contaminants. The degradation of the contaminants is accomplished by metabolizing the contaminants and either using them as a source of carbon or energy, or possibly not as a source of nutrients at all. Microorganisms can adapt to degrade synthetic compounds depending upon whether or not the compound is toxic, or whether or not it is in high enough concentration to support microbial growth. Many different methodologies have been utilized to identify applicable microorganisms, including isolation of pure strains from current contaminated situations to utilizing genetic engineering to produce a microorganism capable of degrading a specific compound. Bioremediation also comprises the stimulation of indigenous microorganisms.

Bioremediation is effective for the treatment of organic materials, such as volatile organic compounds (VOCs) and semivolatile organic compounds (SVOCs), and is not effective in treatment of inorganics, such as heavy metals. In situ bioremediation generally requires the addition of nutrients, oxygen, moisture and possibly the addition of microbes to the soil through wells or spread on the surface for infiltration into the contaminated material. Ex situ bioremediation requires the addition of water and nutrients, as well as possibly microbes, to excavated soils and rotating the soils to introduce oxygen and provide adequate contact to allow degradation of the chemicals.

One of the most important factors effecting bioremediation is the ability to biodegrade the waste contaminants. In addition, the solubility of the contaminant is also an important factor. A chemical that is tightly adsorbed onto the particle surface or has a very low diffusivity through the aqueous medium can prolong the treatment time.

Initial Screening Results: Bioremediation would not be applicable to the heterogeneous waste material in the Sonia Road Landfill, and therefore, will not be considered further.

2.5.3.2 - Solvent/Acid Extraction

Technology Description: The solvent extraction process, as it applies to soil remediation, utilizes a solvent to extract organic components from a solid matrix into a liquid solution. The process typically utilizes a single vessel in which the solvent is placed into contact with excavated soil. The solvent is then recovered and recycled, and the extracted organic and/or inorganic contaminants are either disposed or recycled. The decontaminated soils can be backfilled on-site or landfilled depending on removal efficiencies of the process and/or land disposal restrictions. Extraction solvents are not currently available for all contaminants and extraction efficiencies may vary for different types of soils and levels of contaminants.

One of the limitations of the solvent/acid extraction technology is that soils containing more than 20% moisture must be dried prior to treatment because excess water dilutes the solvent, reducing contaminant solubilization and transport efficiency. Solvent/acid extraction would require excavation and possibly extensive handling/ drying of waste and soils. Once removed and treated, there would still be the residuals requiring additional treatment, such as stabilization or off-site disposal.

Initial Screening Results: Due to the extensive excavation and handling requirements which would be associated with solvent/acid extraction and likely in effectiveness in treating the heterogeneous waste in the Sonia Road Landfill, this alternative will not be considered further.

2.5.3.3 - Soil Washing

Technology Description: Soil washing technologies physically separate soils so that the contaminants, which are primarily associated with the fine size fraction of the soil, are separated from the uncontaminated larger size fraction. The washing fluid may be composed of water and/or a surfactant capable of removing the contaminants from the soil. Either a solid-solid or liquid-solid separation is conducted where the contaminant can be leached by the fluid, or the contaminant is stripped from the particles with which it is associated. Soil would require excavation prior to treatment, and therefore, would have similar problems with regard to excavation, as discussed above.

The products of the soil washing process are clean soil, wash water containing an oily phase, dissolved contaminants and/or precipitated solids, and a finer fraction containing adsorbed organics and precipitated soils. The result is high levels of contaminants concentrated into a relatively small volume of material, thereby simplifying the ultimate treatment or disposal of the contaminated media. Soil washing technologies can be effective for removing organics and inorganics from the soils depending on contaminant concentrations, soil characteristics and process capability.

Initial Screening Results: In addition to the extensive waste excavation/handling which would be required to implement soil washing, the complex soil/waste mixtures in the landfill would make it difficult to formulate an effective washing fluid. As a result, soil washing will not be considered further.

2.5.3.4 - Thermal Separation/Desorption

Technology Description: Thermal separation processes have proven effectiveness in removing PCBs, volatile organic compounds, semivolatile organic compounds and some heavy metals from soil by volatilization. The contaminants are condensed and the condensate is typically treated or disposed of off-site. The concentrations of organic compounds in the soil are typically reduced to levels at which the soil could be backfilled on-site. Unlike solvent extraction, this process would not typically be affected by soil moisture content, although soil moisture content greater than 40% may reduce the process efficiency.

Initial Screening Results: Due to the extensive amount of soil/waste excavation and handling associated with thermal separation/desorption, this technology will not be considered further.

2.5.3.5 - In Situ Soil Washing (Soil Flushing)

In situ soil washing is a process by which water or water containing a surfactant is applied to the unsaturated soil or injected into the groundwater to raise the water table into the contaminated soil zone. The process includes extraction of the groundwater and treatment/removal of the leached contaminants before the water/groundwater is recirculated.

The technology has been developed to treat nonhalogenated volatile organic compounds and inorganics. It may also be applicable to treat semivolatile organic compounds, fuels and pesticides. The technology is only applicable at sites in which flushed contaminants and soil flushing fluid can be contained and recaptured. Therefore, a low permeability boundary is generally required.

Initial Screening Results: Since the geology of this area regarding the requirement for a low permeability "floor" does not appear suitable for use of this technology and there is no system to collect the wash water unless all the waste and soil is excavated and replaced, this technology will not be considered further.

2.5.4 Solidification and Stabilization

Solidification technologies may significantly reduce the mobility of inorganic hazardous wastes, but typically do not reduce the toxicity or volume of the wastes. These technologies may not be considered as a permanent remedy.

2.5.4.1 - Solidification

Technology Description: Solidification technologies generally utilize a cementitious matrix to encapsulate contaminants, thereby reducing their potential for leaching. These technologies treat contaminated soil or waste with Portland cement, cement kiln, pozzolans, etc., to produce a stable material. The solidified material experiences a volume increase, generally in the range of 10 to

30%. If the solidification process is performed on-site, the stabilized material could be disposed on-site. This technology results in significant volume increases.

Initial Screening Results: Solidification of the waste/soil in the landfill would require extensive material excavation and handling and would result in a significant volume increase. Although there are in-situ solidification techniques, because of the heterogeneous nature of the wastes buried at the Sonia Road Landfill, this technology will not be considered further.

2.5.4.2 - Stabilization/Chemical Fixation

Technology Description: In contrast to solidification, the chemical fixation technologies utilizes a process which involves more than immobilization. The process utilizes standard solidification processing; however, the volume expansion and the associated dilution are minimized. The process can be customized to form materials ranging from pebble-sized granules to solid concrete. Volume expansions are usually in the 10 to 20% range. Volatilization of organics would likely not occur due to the low heat of reaction. Although the contaminants would be "fixed" and, once treated, would not exceed TCLP levels, the total concentrations of the contaminants of concern would likely not change. Therefore, although the contaminants may not leach into the groundwater, the soil would still possibly be a human health and environmental risk. Some type of low permeability cover over the material would likely be required.

Initial Screening Results: Similar to solidification, implementation of this technology would involve extensive material excavation and handling and would result in a volume increase. In addition, the heterogeneous nature of the wastes at the Sonia Road Landfill would preclude in-situ stabilization. Therefore, this technology will not be considered further.

2.5.5 No Action

Technology Description: For soil, the no-action alternative would be utilized in situations where, although there may be residual soil contamination, there is no significant threat to human health or the environment. This alternative may be applicable to sites where there is no significant groundwater contamination and natural attenuation would be expected to occur.

Initial Screening Results: Based on the above, the no-action alternative would not be applicable to the Sonia Road Landfill due to the presence of waste which results in the potential for groundwater contamination. However, as stated previously, the no-action alternative must be considered in order to serve as a baseline to compare and evaluate the effectiveness of other action alternatives. Therefore, the no-action alternative will be retained for further consideration.

2.6 Landfill Gas Remediation Technologies

Presented in this section is a description of full-scale commercially available technologies for the collection and treatment of landfill gas. The technologies identified below represent potential options for treatment of landfill gas, which has been extracted/collected from the landfill via a system of wells and piping connected to a blower station. Volatile organic compounds are the primary constituents of extracted/collected landfill gas for which treatment would be required.

2.6.1 Collection

Potential landfill gas collection technologies are described and screened below.

2.6.1.1 - Perimeter Collection Wells

Technology Description: A perimeter landfill gas collection system generally comprises a series of wells, either horizontal or vertical, installed around the perimeter of the landfill to intercept subsurface gas migration. The wells are connected by a piping network to a vacuum blower station which induces a negative pressure at the well heads. The landfill gas exhausted from the blower station may be discharged to the atmosphere or treatment may be required.

Initial Screening Results: Since the use of wells to implement perimeter landfill gas collection is a well-proven technology, it will be retained for further evaluation. In particular, vertical wells would be appropriate for the Sonia Road Landfill due to the depth to groundwater being approximately 20-25 feet.

2.6.1.2 - Perimeter Trenches

Technology Description: Perimeter trenches represent an alternate means to intercept landfill gas and minimize off-site subsurface migration. These trenches are filled with a material to collect the gas. Generally, trenches are constructed down to the water table or the depth of waste, whichever is shallower. These trenches are generally employed to passively collect and vent landfill gas.

Initial Screening Results: Depth to groundwater at the Sonia Road Landfill is generally 20 feet or greater, and in many parts of the site fill material extends to the landfill perimeter. Therefore, installation of perimeter trenches as a gas migration control option does not represent a viable option and will not be given further consideration.

2.6.1.3 - Passive Vents

Technology Description: Passive vents typically consist of shallow wells installed in the landfill mass in conjunction with construction of a low permeability landfill cap in order to provide a means for release of gas pressure beneath the cap. The landfill gas is passively discharged through the well heads to atmosphere as a result of natural pressure and/or concentration gradients.

Initial Screening Results: Passive vents are a widely used, well proven means of releasing gas from capped landfills and, therefore, will be retained for further evaluation.

2.6.1.4 - Recovery Wells

Technology Description: Recovery wells are frequently installed directly into a landfill to prevent uncontrolled release of landfill gas to the atmosphere, minimize off-site subsurface gas migration and/or prevent gas buildup beneath a capping system. Similar to a perimeter collection system, the recovery wells are connected to a series of pipes and a vacuum blower station which induces a negative pressure at the well heads thereby extracting the gas from the landfill mass. Treatment is sometimes required prior to discharge of the recovered landfill gas to atmosphere in order to prevent potential safety and health hazards, as well as odor nuisances. Recovery wells are installed in landfills for the purpose of gas control and/or generation of electricity.

Initial Screening Results: Use of recovery wells is a well proven technology for preventing uncontrolled landfill gas emissions, minimizing subsurface gas migration and preventing buildup of landfill gas beneath a capping system. Therefore, this technology will be retained for further evaluation.

2.6.2 Treatment

2.6.2.1 - Thermal Oxidation

Thermal oxidation is the process of oxidizing gas by thermal processes to produce carbon dioxide and water. Thermal oxidation can occur with or without energy recovery. Thermal oxidation without energy recovery can take place in either an open or enclosed flare or thermal (fume) incinerator. Thermal oxidation with energy recovery can take place in an internal combustion engine/generator set, gas turbine/generator set or boiler.

2.6.2.1.1 - Thermal Incinerators

Technology Description: Thermal or fume incinerators, also known as thermal oxidizers, are available to achieve 95% to 99+% destruction efficiencies with capacities designed to handle flows of 1,000 to 500,000 cfm. VOC concentrations ranging from 100 to 2,000 ppm may be treated; however, maximum combustible gas concentrations are typically limited to < 25% LEL or dilute gases that are not autogenous, due to safety considerations. Thermal incinerators can be used to control vent streams from methane recovery systems which are below 25% LEL, in which case auxiliary fuel is typically required. Combustion occurs at temperatures ranging from 1,300°F to 1,800°F. Actual operating temperatures are a function of the type and concentration of landfill gas and the desired destruction efficiency. Combustion temperatures operating near 1,800°F as mentioned above can produce elevated levels of by-products such as NOx which may require further treatment or control. Generally, two types of thermal incinerators are used: regenerative and recuperative. Both techniques capture and recycle the heat content of the combustion exhaust gases to heat incoming gas. Regenerative systems use dense, inert materials (i.e., ceramics) to capture heat from exhaust gases, whereas, recuperative systems recapture thermal energy with heat exchangers (i.e., shell and tube).

Initial Screening Results: Since thermal incinerators are not recommended for treatment of gas streams which may exceed 25% LEL, which is expected to be released/extracted from the Sonia Road Landfill, this technology is not suitable for treating landfill gas emissions and will not be given further consideration as a potential remedial technology.

2.6.2.1.2 - Open or Enclosed Flares

Flaring is an open or closed combustion process in which the oxygen required for combustion is provided by either natural drafting or forced air. Open flares can be located at ground or elevated levels and can operate with or without supplemental gas depending upon the quantity (cfm) and quality (Btu value) of the landfill gas. Enclosed flares are usually at ground level and are enclosed with a fire resistant material that extends above the top of the flame (i.e., refractory shell). The temperature above the flame with this type of flare can be easily monitored to achieve proper combustion conditions. In general, enclosed flares allow better combustion control and can achieve 70% to 99.9% destruction efficiencies. A knockout device and/or filter is utilized to reduce the amount of gas condensate in the gas stream and extend the life of the landfill gas flare.

The high temperatures which can be achieved with flares (in the order of magnitude from 1,000°F to 2,000°F) results in a relatively high plume rise and good dispersion of the by-products of combustion. Flare combustion efficiencies depend on the heating value (i.e., Btu value) and density of the landfill gas, flame temperature, residence time, turbulence and available quantities of oxygen.

Initial Screening Results: Based on the high temperatures that can be achieved by flares, and their availability, reliability and good dispersion of the by-products of the combustion process, flares have the technical feasibility to control and treat landfill gas emissions. Therefore, this technology will be considered further.

2.6.2.1.3 - Internal Combustion Engines/Generator Sets

Internal combustion engines have been used in tandem with generator sets to combust landfill gas and produce electricity for a number of years. Additionally, the internal combustion engine/generator set is a desirable remedial action technology because of its short construction time, ease of installation and operational capacity, and its ability to achieve 98% or better destruction efficiencies of the landfill gas stream. However, with the varying heating value of landfill gas, internal combustion engines will operate erratically and burning raw landfill gas will decrease the life of the engine. To increase the performance and life of an internal combustion engine, the quality of the landfill gas must be improved by incorporating a knock-out drum and filter as with the flare. Additionally, a scrubbing system can be used to remove acid and sulfur compounds from the landfill gas prior to combustion in the engine.

Initial Screening Results: Internal combustion engine/generator sets represent a high maintenance technology for landfill gas treatment, which is typically only implemented for electric power generation. Therefore, this technology will not be retained for further evaluation.

2.6.2.1.4 - Gas Turbines/Generator Sets

Technology Description: As with internal combustion engines, gas turbines can also achieve 98+% destruction efficiencies. Gas turbines are heat engines which convert energy into work by compressing a hot gas. A compressor draws in ambient air, compresses it, burns a mixture of landfill gas and ambient air to heat it, and then expands the compressed air in a turbine to produce power.

Gas turbines have substantially lower maintenance requirements than internal combustion engines. Additionally, gas turbines are capable of handling the anticipated fluctuating heating values of landfill gas without sacrificing engine performance and also emit lower air pollutants then internal combustion engines.

As with flares and internal combustion engines, pretreatment of the landfill gas is required prior to combustion in a gas turbine to extend the life and improve the performance of gas turbines. Pretreatment of the landfill gas prior to combustion can include a knock-out drum and filter which will remove condensate and particles from the landfill gas stream, respectively.

Initial Screening Results: Similar to internal combustion engines, gas turbine/generator sets are typically used for generation of electric power. Therefore, this technology will not be retained for further evaluation.

2.6.2.1.5 - Boilers

Technology Description: Boilers are characterized as utility, industrial or domestic/commercial based on the heat input into the furnace. The majority of landfill gas fired boilers are industrial. Landfill gas fired boilers can be utilized to produce heat or hot water for on-site purposes or produce superheated steam used in steam turbines to generate electricity. In a water tube boiler, hot combustion gases are passed over the outside of tubes which contain hot water and steam. Landfill gas can also be piped to an off-site boiler.

Initial Screening Results: Landfill gas fired boilers are very costly, require large amounts of landfill gas (i.e., 6,000 to 8,000 cfm) and, compared with other destruction technologies, may only be economically beneficial at very large landfills. Additionally, pretreatment of the landfill gas is required to extend the life and improve efficiency of the boiler. As a result, this technology will not be considered further.

2.6.2.2 - Catalytic Oxidation

Technology Description: Catalytic oxidation is similar to thermal oxidation except that operating temperatures are generally lower (700°F to 900°F). Lower operating temperatures will reduce start-up fuel requirements, but may also lower thermal efficiencies. With lower operating temperatures, the destruction efficiencies are typically reduced from 95%-99% to 90%-95%. Catalytic oxidation systems in general have lower capacities than thermal oxidation systems, handling flows of 1,000 to 100,000 cfm and VOC concentrations from 100 to 2,000 ppm, which make them suitable for low and/or cyclic VOC concentration operations.

Liquid or solid particles in the gas stream may deposit on the catalyst and form a coating that reduces the catalyst's activity by preventing contact between the landfill gas and the catalyst surface. Additionally, a catalytic oxidation process can produce secondary combustion waste and the contaminated catalyst material may require disposal as a hazardous waste. However, with lower operating temperatures, there are no significant quantities of nitrogen oxides produced as by-products of combustion.

Initial Screening Results: Based upon reduced destruction efficiencies and the potential for deactivating the catalyst surface, this technology will not be considered further.

2.6.2.3 - Adsorption

Adsorption is the process by which volatile organic contaminants are removed by physical adsorption onto the surface of an adsorbent (most commonly carbon). The adsorbed contaminants can be removed from the adsorbent under suitable temperature and pressure conditions and reused. Carbon adsorption systems may be designed to handle capacities of 100 to 60,000 cfm with contaminant concentrations from 200 to 10,000 ppm. Removal efficiencies for carbon adsorption systems range from 50% to 99%. The USEPA presents the following anticipated removal efficiencies:

- 200 - 400 ppmv: 50%
- 1,000 - 2,000 ppmv: 95%
- 5,000 - 10,000 ppmv: 99%

Secondary or residual wastes from carbon adsorption systems include spent carbon and collected contaminants which can require recycling and disposal, respectively.

A typical carbon adsorption system consists of two parallel adsorption trains. While one train is adsorbing, the other is being regenerated. This process can occur either on-site with the use of steam, hot air or hot nitrogen, or off-site where a carbon supplier retrieves the spent carbon and either replaces it with fresh carbon or regenerates it off-site. Regardless of the regeneration process, a concentrated form of the contaminants is created and must be either recycled or treated. However, because the contaminants have been concentrated, the cost of secondary treatment is reduced dramatically. As part of the regeneration process, carbon is heated to remove the contaminants. Because carbon is flammable, the temperature can only be raised to a finite degree. When this temperature is reached and regeneration no longer occurs, the waste carbon will require disposal.

Carbon exhaustion rates are particularly high for those compounds with low molecular weights such as chloromethane and vinyl chloride. Additionally, carbon beds are very sensitive to the moisture content of the gas stream being treated. Therefore, as the relative humidity of the gas stream increases, the performance of the carbon (i.e., ability to adsorb) decreases.

Initial Screening Results: Based on the estimated low removal efficiencies for landfill gas streams containing low concentrations of VOCs and expected high carbon usage, use of carbon adsorption will not be considered further.

2.6.2.4 - Absorption

Technology Description: Absorption is a separation/treatment technology process option which removes volatile organic contaminants from landfill gas by contact with a liquid solvent. In effect, the landfill gas stream is "scrubbed." Devices which utilize the absorption principle include spray towers, venturi scrubbers, packed towers and plate columns. Typically, landfill gas is introduced at the bottom of the tower and allowed to rise through the packing material. Solvent, which is used to "scrub" the landfill gas stream, is introduced from the top of the column and absorbs the contaminants and carries them out the bottom, while the cleaned gas exits the top. The solvent most commonly used is ethylene glycol. Off-site disposal of the contaminated solvent would be required.

Absorption systems are designed to handle flow capacities of 2,000 to 100,000 cfms with contaminant concentrations ranging from 500 to 5,000 ppm. Additionally, absorbers can achieve removal efficiencies ranging from 95% to 98%. Absorbers for landfill gas applications are typically used to pretreat landfill gas by removing nonmethane hydrocarbons, condensate and carbon dioxide. Pretreatment is expected to increase the quality (i.e., Btu value) of the landfill gas for use in a thermal oxidation process.

Initial Screening Results: According to the USEPA, there are very few landfills in the United States which employ the absorption processes. Additionally, the feasibility of an absorption process is usually determined by the gas composition, flow rate, natural gas price and distance to local gas service pipelines (for recovery purposes). The absorption process also requires a high initial capital cost. In general, absorbers are less effective than other control technologies and are more commonly used to recover inorganic compounds in manufacturing processes, and therefore, will not be considered further.

2.6.2.5 - Condensation

Technology Description: The condensation process technology for the separation/treatment of landfill gas is most efficient for organic contaminants with boiling points greater that 100°F and at relatively high concentration usually above 5,000 ppm. The basic principle of the condensation process consists of the chilling or pressurizing of landfill gas to condense it into a liquid which then must be treated to remove and separate the condensed water from the contaminants. As a result of the remaining contaminant stream, the condensation process appears to be best suited for a monosolvent system which lends itself to recovery for reuse or recycling. Otherwise, management of the contaminants, which are usually disposed, can be very expensive if characterized as a hazardous waste. Additionally, the resulting condensed water, which is usually sent to a wastewater treatment facility, must also be properly handled and disposed of.

Initial Screening Results: The removal efficiency of condensation systems is typically in the range of 50% to 90%, therefore, this technology will not be considered further.

2.6.2.6 - Biological Treatment

Technology Description: The application of biofiltration to landfill gas is an emerging separation/treatment technology which has only recently become commercially available. Biofiltration is a process which involves the use of soil or compost beds containing microorganisms to convert the VOCs in landfill gas into carbon dioxide, water and mineral salts. Other medium include high density plastic which minimizes plugging, a silica media with high porosity which favors biomass growth and granulated activated carbon which can accommodate variations in load. The flow capacity for a biofiltration system is unlimited. However, biofiltration systems are limited to low contaminant concentrations ranging from 500 to 2,000 ppm.

Initial Screening Results: As a result of its emerging status with respect to landfill gas applications, and the availability of other proven technologies, biofiltration will not be considered further.

2.6.2.7 - Membrane Separation

As with biofiltration, the application of membrane separation technology for the treatment of landfill gas has only recently become commercially available. The basic principle of membrane separation technology is to separate volatile organic contaminants from landfill gas using a semi-permeable polymeric membrane. This principle operates on selective permeability of one gas over another.

There are three types of membranes used in membrane separation systems. These include spiral-wound, tubular and hollow fiber, with the spiral-wound membrane being the most common. The pore size and permeability of a membrane in a membrane separation system is directly related to the temperature of the landfill gas. Membranes can be damaged when the temperature of the landfill gas is greater than 160°F . Additionally, a knock-out drum (for gas condensate) and filter (for particulates) is recommended upstream of the membrane separation system to prevent scaling or fouling of the membrane. Foreign particles and water can decrease the performance of these systems. The advantages of a membrane separation system over other separation/treatment technology process options include size, cost, flexibility and simplicity of operation. Additionally, a membrane separation system can be easily modified to adjust to varying flow rates by adding or removing membranes in series or parallel.

Initial Screening Results: According to the USEPA, there are only two landfills in the United States which employ the membrane separation technology. With its only recent commercial availability and infrequent use, this technology will not be considered further.

2.6.2.8 - Natural Attenuation

Technology Description: As with natural attenuation as it applies to groundwater contamination, for landfill gas natural attenuation represents a process whereby natural processes such as dilution, volatilization, decomposition, absorption and chemical reactions reduce emissions of contaminants to acceptable levels. Natural attenuation applies to both volatile organic chemicals and methane with regard to the Sonia Road Landfill. The evaluation of this option may be undertaken in consideration of the anticipated effects of additional remedial alternatives (e.g., landfill capping, passive vents, etc.) on release of landfill gas to the atmosphere and associated impacts, including odors, as well as the potential for subsurface migration of landfill gas. Air modeling may be necessary to undertake an evaluation of natural attenuation. In addition, monitoring of landfill gas contaminant concentrations would be necessary to evaluate the natural attenuation process.

Initial Screening Results: This technology will not be acceptable for remediation of VOCs or methane at the Sonia Road Landfill since the final alternative for the landfill will include capping.

2.6.2.9 - No Action

Technology Description: The no action alternative would involve allowing landfill gas to vent to the atmosphere or migrate in the subsurface soil without extraction of the gas or any active controls. This alternative would only be applicable if there is no significant threat to human health and the environment.

Initial Screening Results: The no action alternative is not applicable due to the potential for subsurface migration due to planned construction of the landfill cap. However, the no action alternative will be retained to serve as a baseline against which to compare and evaluate the effectiveness of other alternatives.

A summary of the identification and screening of the technologies discussed above is presented in Tables 2-1, 2-2 and 2-3.

2.7 Summary Evaluation of Remedial Technologies

Based on the screening of remedial technologies, provided below is a summary of the technologies that are retained for further consideration, either as remedial alternatives in and of themselves, or in combination with other technologies to form alternatives.

Groundwater Remediation

- Extraction technologies
  - wells

- Treatment technologies
  - air stripping
  - carbon adsorption
  - UV oxidation
  - biological treatment (for nitrogen removal)
  - filtration
  - ion exchange
  - chemical precipitation and clarification

- Discharge management
  - discharge to POTW
  - discharge to surface water

- In-situ treatment and containment
  - in-well air stripping
  - oxygen enhancement with air sparging/bioremediation
  - oxygen enhancement with hydrogen peroxide

- No action

Waste/Soil Remediation

- Isolation/containment
  - Part 360 cap

- No action

Landfill Gas Remediation

- Collection
  - perimeter collection wells
  - passive vents
  - recovery wells

- Treatment
  - open or enclosed flares

- No action

Table 2-1

INITIAL SCREENING OF GROUNDWATER REMEDIATION TECHNOLOGIES
SONIA ROAD LANDFILL
WEST BRENTWOOD, NEW YORK

General Response Action	Remedial Technology	Description	Summary of Initial Screening Results
Groundwater Extraction	Extraction Wells	Extraction wells are constructed to pump contaminated groundwater to the surface for treatment.	Retained for further consideration.
	Interceptor Trenches	Trenches are constructed to intercept shallow groundwater plumes.	Not applicable due to depth of groundwater contamination (≈90 feet).
Treatment Technologies	Air Stripping	VOCs are partitioned from water phase to gas phase via packed tower or aeration.	Retained for further consideration for VOC removal.
	Carbon Adsorption	Groundwater is pumped through canisters containing activated carbon or alternate adsorbent.	Retained for further consideration for VOC removal.
	UV Oxidation	Contaminants are destroyed by ultraviolet radiation.	Retained for further consideration for VOC removal.
	Biological Treatment	Microorganisms decompose organic contaminants in treatment units.	Not applicable due to availability of more effective technologies for chlorinated organic contaminants; however, it will be retained for consideration for nitrogen removal.

Table 2-1 (continued)

INITIAL SCREENING OF GROUNDWATER REMEDIATION TECHNOLOGIES
SONIA ROAD LANDFILL
WEST BRENTWOOD, NEW YORK

General Response Action	Remedial Technology	Description	Summary of Initial Screening Results
Treatment Technologies (continued)	Reverse Osmosis	Semi-permeable membrane and high pressure is used to obtain a concentrated solution of contaminants.	Not retained for further consideration since more effective and proven methods are available for treatment of VOC-contaminated groundwater and large volumes of reject water that would be generated for removal of other contaminants.
	Filtration	Suspended particles are removed by entrapment on a media (i.e., filter).	Retained for further consideration for metals removal.
	Ion Exchange	Ions are removed via substitution with alternate ions supplied by the ion-exchange material.	Retained for further consideration for metals removal.
	Chemical Precipitation and Clarification	Physical/chemical techniques are used to form insoluble settleable compounds to remove contaminants from solution.	Retained for further consideration for metals removal.

Table 2-1 (continued)

INITIAL SCREENING OF GROUNDWATER REMEDIATION TECHNOLOGIES
SONIA ROAD LANDFILL
WEST BRENTWOOD, NEW YORK

General Response Action	Remedial Technology	Description	Summary of Initial Screening Results
Discharge Management	Discharge to POTW	Route treated discharge to nearest sewer system.	Retained for further consideration.
	Off-site Disposal of Treated Discharge	On-site storage and off-site transport and disposal.	Not retained for further consideration due to excessive storage and handling requirements.
	Discharge to Surface Water	Route discharge to surface water body (e.g., Sampawams Creek).	Retained for further consideration.
	Recharge/Reinjection	Discharge treated groundwater to recharge basin, injection wells or leaching pools.	Not retained for further consideration due to limited space and interference with groundwater remediation, if required.
In-Situ Treatment and Containment	In-Well Air Stripping	Air is injected into a well, displacing contaminated groundwater and stripping VOCs which are treated in the gas phase at the surface.	Retained for further consideration for VOC removal.
	Air Sparging	Air is injected into the saturated matrix to strip volatile contaminants which are recovered by vapor extraction.	Not retained for further consideration due to depth of VOC groundwater contamination (≈90 feet).

Table 2-1 (continued)

INITIAL SCREENING OF GROUNDWATER REMEDIATION TECHNOLOGIES
SONIA ROAD LANDFILL
WEST BRENTWOOD, NEW YORK

General Response Action	Remedial Technology	Description	Summary of Initial Screening Results
In-Situ Treatment and Containment (continued)	Oxygen Enhancement with Air Sparging/ Bioremediation	Air is injected into saturated matrix to enhance biological decomposition of contaminants.	Retained for further consideration for VOC removal.
	Dual Phase Extraction	Vacuum is applied to saturated and unsaturated zones. Vapor and liquid phases are recovered and treated at surface.	Not retained for further consideration due to depth of VOC groundwater contamination.
	Oxygen Enhancement with Hydrogen Peroxide	Dilute hydrogen peroxide is circulated in groundwater plume to enhance rate of aerobic degradation.	Retained for further consideration for VOC removal.
	Passive Treatment or Reactive Walls	Permeable reaction wall is installed across flow path of contaminant plume.	Not retained for further consideration due to depth to groundwater contamination and depth to clay layer (≈90 feet).
	Funnel and Gate	Cut-off walls are installed to direct groundwater flow to a permeable wall with treatment media which degrades the contaminants.	Not retained for further consideration due to depth to groundwater contamination and depth to clay layer (≈90 feet).

Table 2-1 (continued)

INITIAL SCREENING OF GROUNDWATER REMEDIATION TECHNOLOGIES
SONIA ROAD LANDFILL
WEST BRENTWOOD, NEW YORK

General Response Action	Remedial Technology	Description	Summary of Initial Screening Results
In-Situ Treatment and Containment (continued)	Containment Barrier	Subsurface low permeability structure is installed to impede groundwater flow.	Not retained for further consideration due to depth to groundwater contamination and depth to clay layer (≈90 feet).
	Natural Attenuation	Natural subsurface processes in conjunction with monitoring reduce contaminant concentrations.	Not retained for further consideration due to poor regulatory and community acceptability.
	No Action	No remedial measures are implemented.	Retained for further consideration for comparison purposes in accordance with regulatory guidance.

Table 2-2

INITIAL SCREENING OF WASTE/SOIL REMEDIATION TECHNOLOGIES
SONIA ROAD LANDFILL
WEST BRENTWOOD, NEW YORK

General Response Action	Remedial Technology	Description	Summary of Initial Screening Results
Isolation/Containment	RCRA Cap	2-foot vegetated topsoil and soil layer above a geotextile over a 1-foot sand and gravel drainage layer which is underlain by a flexible membrane liner and 2-foot compacted soil/clay layer.	Not retained for further consideration since less costly effective caps are available.
	Part 360 Cap	A four-layered system: vegetated topsoil upper layer, underlain by a drainage/barrier layer followed by a low permeability clay layer or geosynthetic membrane followed by a gas venting layer.	Retained for further consideration as a Presumptive Remedy.
	Pavement/Structure Cap	A cap comprised of an asphalt or concrete surface or building structure.	Not retained for further consideration because this type cover has not been accepted by NYSDEC as a landfill cap.
	Semi-permeable Cover	An 18-inch (10^{-5} cm/s) soil to mitigate direct contact with and runoff of contaminated surface soil, and reduce infiltration of precipitation.	Not retained for further consideration because this type of cover has not been accepted by NYSDEC as a landfill cap over a Sole-source Aquifer.

Table 2-2 (continued)

INITIAL SCREENING OF WASTE/SOIL REMEDIATION TECHNOLOGIES
SONIA ROAD LANDFILL
WEST BRENTWOOD, NEW YORK

General Response Action	Remedial Technology	Description	Summary of Initial Screening Results
Isolation/Containment (continued)	Permeable Cover	A 2-foot (>10^{-5} cm/s) soil and/or gravel cover to mitigate direct contact with and runoff of contaminated surface soil.	Not retained for further consideration since infiltration through a permeable cover would permit continued impact to groundwater.
Excavation, Off-site Treatment and Disposal	Off-site Disposal	Waste and contaminated soil are excavated and transported to an approved landfill or treatment facility.	Not retained for further consideration due to large quantities of waste and soil excavation which would be required.
Soil Treatment	Bioremediation	Microorganisms are used to degrade organic contaminants	Not retained for further consideration because of the heterogeneous waste material in the landfill.
	Solvent/ Acid Extraction	A solvent is utilized to extract organic compounds from a solid matrix into a liquid solution.	Not retained for further consideration due to the extensive excavation and handling requirements.
	Soil Washing	Soil is physically separated and fine fraction is washed to transfer contaminants into solution.	Not retained for further consideration since complex soil/waste mixtures would preclude formulation of an effective washing fluid.

Table 2-2 (continued)

INITIAL SCREENING OF WASTE/SOIL REMEDIATION TECHNOLOGIES
SONIA ROAD LANDFILL
WEST BRENTWOOD, NEW YORK

General Response Action	Remedial Technology	Description	Summary of Initial Screening Results
Soil Treatment (continued)	Thermal Separation/ Desorption	Contaminants are thermally desorbed and condensed and the condensate is treated or disposed off-site.	Not retained for further consideration due to the extensive excavation and handling requirements.
	In-Situ Soil Washing	Water is applied to the unsaturated soil or injected into the groundwater to raise the water table into the contaminated zone and leached contaminants are removed.	Not retained for further consideration because of the heterogeneous nature of waste material in the landfill.
Solidification and Stabilization	Solidification	A cementitious matrix is used to encapsulate contaminants and reduce leaching potential.	Not retained for further consideration due to extensive excavation and handling required, and resulting volume increase.
	Stabilization/ Chemical Fixation	Chemical additives and processes are used to immobilize contaminants with minimum volume expansion.	Not retained for further consideration due to extensive excavation and handling required, and volume increase.
No Action	---	No remedial measures are implemented.	Retained for further consideration for comparison purposes in accordance with regulatory guidance.

Table 2-3

INITIAL SCREENING OF LANDFILL GAS REMEDIATION TECHNOLOGIES
SONIA ROAD LANDFILL
WEST BRENTWOOD, NEW YORK

General Response Action	Remedial Technology	Description	Summary of Initial Screening Results
Collection	Perimeter Collection Wells	Horizontal or vertical wells are installed around landfill perimeter and connected to vacuum blower.	Retained for further consideration.
	Perimeter Trenches	Trenches are excavated to depth of waste or groundwater around landfill perimeter.	Not retained for further consideration due to depth to groundwater and lack of space.
	Passive Vents	Wells are installed in capping system to relieve gas buildup.	Retained for further consideration.
	Recovery Wells	Recovery wells are installed and screened in landfill mass and connected to vacuum blower.	Retained for further consideration.
Landfill Gas Treatment	Thermal Incineration	Gas is oxidized at temperatures ranging from 1,300°F to 1,800°F.	Not retained for further consideration because such systems are not recommended for gas streams which may exceed 25% LEL.
	Open or Enclosed Flares	A combustion process in which oxygen is provided by natural drafting or forced air.	Retained for further consideration.

Table 2-3 (continued)

INITIAL SCREENING OF LANDFILL GAS REMEDIATION TECHNOLOGIES
SONIA ROAD LANDFILL
WEST BRENTWOOD, NEW YORK

General Response Action	Remedial Technology	Description	Summary of Initial Screening Results
Landfill Gas Treatment (continued)	Internal Combustion Engine/Generator Site	Internal combustion engine, in tandem with generator sets, is used to combust landfill gas and produce electricity.	Not retained for further consideration due to high maintenance and since electric power generation is not under consideration.
	Gas Turbines/ Generator Sets	Heat engines are utilized to convert energy into work by compressing a hot gas.	Not retained for further consideration since electric power generation is not under consideration.
	Boilers	Gas-fired boilers are used to produce heat or hot water, and to produce electricity.	Not retained for further consideration due to very high cost, and extensive amount of landfill gas required.
	Catalytic Oxidation	Similar to thermal oxidation but operates at lower temperatures.	Not retained for further consideration because of reduced destruction efficiencies and potential for deactivating the catalyst surface.
	Adsorption	Contaminants are removed by physical adsorption onto the surface of an adsorbent (e.g., carbon).	Not retained for further consideration due to low removal efficiencies for landfill gas streams with low VOC concentration.

Table 2-3 (continued)

INITIAL SCREENING OF LANDFILL GAS REMEDIATION TECHNOLOGIES
SONIA ROAD LANDFILL
WEST BRENTWOOD, NEW YORK

General Response Action	Remedial Technology	Description	Summary of Initial Screening Results
Landfill Gas Treatment (continued)	Absorption	A separation/treatment option which removes contaminants by contact with a liquid solvent.	Not retained for further consideration due to high capital cost and not as effective as other technologies.
	Condensation	Landfill gas is chilled or pressurized to condense it into a liquid, which is subsequently treated.	Not retained for further consideration due to low removal efficiency
	Biological Treatment	Soil or compost beds containing microorganisms are used to convert the VOCs into CO_2, water and mineral salts.	Not retained for further consideration due to emerging status and availability of alternate proven technologies.
	Membrane Separation	Contaminants are separated from landfill gas using semi-permeable polymeric membrane.	Not retained for further consideration because of inadequate operating record; only recently available and infrequently used.
Natural Attenuation	---	Natural processes such as dilution, volatilization, decomposition, absorption and chemical reactions reduce emissions to acceptable levels.	Not retained for further consideration due to incompatibility with capping..

Table 2-3 (continued)

**INITIAL SCREENING OF LANDFILL GAS REMEDIATION TECHNOLOGIES
SONIA ROAD LANDFILL
WEST BRENTWOOD, NEW YORK**

General Response Action	Remedial Technology	Description	Summary of Initial Screening Results
No Action	---	Involves allowing landfill gas to vent to the atmosphere or migrate in the subsurface soil without extraction of the gas.	Retained for further consideration for comparison purposes in accordance with regulatory guidance.

3.0 DEVELOPMENT AND PRELIMINARY EVALUATION OF ALTERNATIVES

Based on the screening of remedial technologies in Section 2.0, the next phase of the feasibility study process is to develop remedial alternatives for preliminary evaluation for effectiveness, implementability and cost. These alternatives can comprise either a single technology if only one medium at a site is of concern and if only one treatment process is required, or a combination of technologies if multiple media are of concern or if multiple treatment processes are required, such as at the Sonia Road Landfill.

As described previously, the media of concern identified for the Sonia Road Landfill site are waste, subsurface soil and landfill gas. Although groundwater impacted by municipal solid waste leachate has not been identified as a medium of concern, because it does not pose a threat to human health or the environment and the landfill will be capped as a Presumptive Remedy, leachate-impacted groundwater will be included in the evaluation of alternatives to address all contaminated media at the site. Similarly, although groundwater impacted by volatile organic compounds is not related to the Sonia Road Landfill, because this contamination is the result of upgradient industrial sources, to provide a comprehensive range of remediation options, VOC-impacted groundwater will also be included in the evaluation alternatives.

Based on the media identified for evaluation above, five alternatives, as illustrated in Table 3-1, have been developed for the Sonia Road Landfill, which range from remediation of all media to no action, including the Presumptive Remedy selected for the site. A description of these alternatives, and the remedial technologies that form the alternative and the media they address, is provided below.

Alternative	Media	Technology
1	• Waste and Subsurface Soil	Off-site Waste Removal and Placement On-site Part 360 Cap
	• Landfill Gas	Perimeter Collection Wells and Recovery Wells (and flare if required)

Table 3-1

SONIA ROAD LANDFILL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
SUMMARY OF REMEDIAL ALTERNATIVES

Alternative	Part 360 Cap	Perimeter Gas Collection and Recovery Wells (and Flare, if required)	Groundwater Extraction Wells	Groundwater Treatment for Leachate Parameters	Groundwater Treatment for VOCs	
1	✓	✓	✓	✓	✓	
2	✓	✓	✓	✓		
3	✓	✓				
4	✓ (w/passive vents)					
5	⇦ No Action ⇨					

Note: All alternatives include long-term monitoring.

Alternative	Media	Technology
	• Groundwater (leachate constituents/shallow groundwater and VOCs/deep groundwater)	Extraction Wells, Treatment (aeration, filtration and ion exchange) and Discharge to Sampawams Creek (1A) or Southwest Sewer District (1B)
2	• Waste and Subsurface Soil	Off-site Waste Removal and Placement On-site Part 360 Cap
	• Landfill Gas	Perimeter Collection Wells and Recovery Wells (and flare if required)
	• Groundwater (leachate constituents/shallow groundwater)	Extraction Wells, Treatment (aeration, filtration and ion exchange) and Discharge to Sampawams Creek (2A) or Southwest Sewer District (2B)
	• Groundwater (VOCs/deep groundwater)	No Active Remediation
3	• Waste and Subsurface Soil	Off-site Waste Removal and Placement On-site Part 360 Cap
	• Landfill Gas	Perimeter Collection Wells and Recovery Wells (and flare if required)
	• Groundwater (leachate constituents/shallow groundwater and VOCs/deep groundwater)	No Active Remediation
4	• Waste and Subsurface Soil	Off-site Waste Removal and Placement On-site Part 360 Cap
	• Landfill Gas	Passive Vents
	• Groundwater (leachate constituents/shallow groundwater and VOCs/deep groundwater)	No Active Remediation
5	• No Action	

All of the alternatives above include long-term monitoring. A more detailed description of these alternatives is provided below.

3.1 Description of Remedial Alternatives

3.1.1 Alternative 1 - Shallow and Deep Groundwater Treatment, Landfill Gas Control and Capping

This alternative addresses remediation of all media, including waste, subsurface soil, landfill gas, leachate-impacted groundwater and volatile organic compound-impacted groundwater. Waste beyond the northern property line of the landfill will be excavated and placed within the boundary of the site. A low permeability cap will provide remediation of the waste and contaminated subsurface soil at the site. This cap will comprise from bottom to top, a geotextile layer, a 12-inch gas venting layer, 60-mil High Density Polyethylene (HDPE) geomembrane, geocomposite drainage layer, 24-inch barrier protection layer and a 6-inch vegetative growth medium or 6-inch stone/recycled concrete layer. An illustration of this cap is provided in Figure 3-1. This cap will prevent precipitation from migrating through the landfill and mitigate the generation of leachate and contamination of groundwater.

Drainage of storm water off the landfill cap will be accomplished by grading the landfill cover material below the cap to a minimum 2% slope. Although the standard minimum grade is 4% as specified in the Part 360 requirements, the grade of 2% will be essentially as effective in promoting runoff off the cap, will better allow use of the site for planned industrial activities, and will reduce cost. A surface grade of 2% will require a Part 360 variance.

Remediation of landfill gas will be accomplished by placement of 4-inch PVC perimeter gas collection wells around the landfill site and recovery wells within the interior of the site. The perimeter collection wells will be screened from 5 feet below ground surface to the water table and will be spaced 250 feet apart, and the recovery wells will be spaced 250 feet apart and extend 5 feet into the waste mass. If necessary to meet emissions requirements or reduce odors, the extracted gas will be treated using a flare. This gas control system will prevent landfill gas from migrating off-site.

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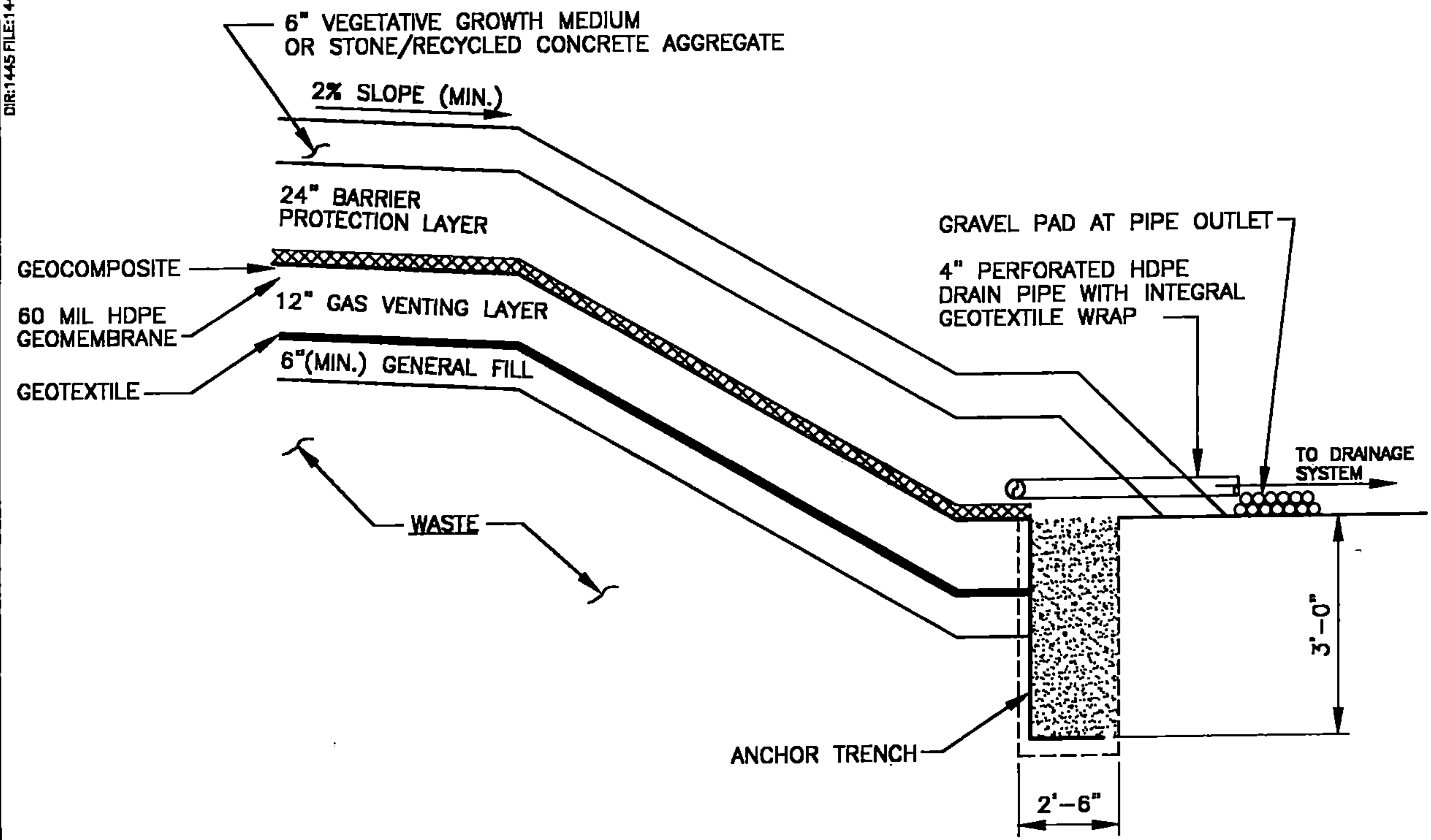

SONIA ROAD LANDFILL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY

CAP CROSS-SECTION

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FIGURE 3-1

Remediation of leachate- and VOC-impacted groundwater will be accomplished by placement of two 10-inch PVC groundwater extraction wells along the downgradient/southern and eastern boundary of the landfill. These wells will be screened from the water table (approximately 20 feet below ground surface) to the top of the Gardiners Clay (approximately 100 feet below ground surface). As determined from groundwater modeling, it is estimated that to control shallow leachate- and deep VOC-impacted groundwater, an extraction rate of approximately 400 gallons per minute (gpm) will be required. Groundwater extraction and treatment was selected for remediation of groundwater, since in-situ treatment for inorganic contaminants has not been proven as a viable and commercially available technology.

The extracted groundwater will be treated for those contaminants which exceed groundwater standards, which are VOCs, ammonia, iron, manganese, phenols and sodium. Based on experience, the treatment processes selected to address these contaminants as part of this alternative are the following in sequence from influent to effluent: aeration (tank and air stripper) to remove VOCs, ammonia and phenols; green sand filtration with permanganate to remove iron and manganese; and ion exchange to remove sodium.

The treated effluent will be discharged to Sampawams Creek or the Southwest Sewer District (SWSD) via the 12-inch wastewater force main from Pilgrim State Hospital to the SWSD. This main is located just west of the Sonia Road Landfill along Corbin Avenue. Although there are potentially other discharge options available, they are not suitable for the Sonia Road Landfill: recharge—there is no space available on-site or in the study area to construct recharge basins for discharge of treated groundwater; and reinjection—although injection wells could be placed along the upgradient boundary of the landfill, they would likely interfere with the remediation of the VOC plume. Monitoring of groundwater and landfill gas for a 30-year period is included as part of this alternative to determine the effectiveness of the remediation systems.

3.1.2 Alternative 2 - Shallow Groundwater Treatment, Landfill Gas Control and Capping

This alternative addresses remediation of the media described in Alternative 1, except for VOC-contaminated groundwater. Waste beyond the landfill boundary will be excavated and placed within the site, and the same low permeability cap, landfill gas collection system and groundwater treatment and discharge system(s) will be utilized. In addition, the same long-term monitoring program will be conducted to determine the effectiveness of the remediation systems. Since this alternative will address only leachate-impacted groundwater, which is shallow at the landfill site extending from the water table to approximately 40 feet below the water table, the extraction wells will extend to about 60 feet below grade and be screened from about 20 to 60 feet. Based on groundwater modeling, the pumping rate to control the leachate-impacted groundwater is estimated to be 300 gpm and the extraction wells will be 8 inches in diameter. VOC-contaminated groundwater will not be extracted and treated.

3.1.3 Alternative 3 - Landfill Gas Control and Capping

This alternative addresses remediation of the waste, subsurface soil and landfill gas but does not address remediation of groundwater. The waste beyond the landfill boundary will be excavated and placed within the site, and the same low permeability cap and landfill gas collection system as described in Alternative 1 will be utilized. In addition, the same long-term monitoring program will be conducted.

3.1.4 Alternative 4 - Capping

This alternative addresses only remediation of the waste and subsurface soil by excavation of waste beyond the landfill boundary and placement within the site, and use of a low permeability cap with passive vents. The same long-term monitoring program as defined for Alternatives 1 through 3 will be conducted to determine the effectiveness of the remediation system.

3.1.5 Alternative 5 - No Action

This alternative provides no active remediation and relies solely on natural attenuation for remediation of waste, subsurface soil, landfill gas and groundwater. Waste beyond the landfill property line will not be removed. However, the "no action" alternative will provide for maintenance of the existing fence around the landfill and long-term monitoring to monitor any degradation, dispersion or dilution of contaminants in the groundwater.

Provided below is the preliminary evaluation of these alternatives for effectiveness, implementability and relative costs. A description of these criteria is provided in Section 1.3 (Feasibility Study Description).

3.2 Evaluation of Remedial Alternatives

3.2.1 Alternative 1

Effectiveness

Alternative 1 will meet all of the remedial action objectives as established for the Sonia Road Landfill and described in Section 1.4 of this document. This alternative will be fully protective of human health and the environment. Waste beyond the landfill property line will be removed, and the low permeability cap will prevent direct contact with waste and contaminated soil; prevent surface runoff and off-site transport of surficial contaminants; mitigate generation of leachate and impacts to groundwater; prevent off-site migration of landfill gas and release of unacceptable levels of contaminants to the air; and control and treat all contaminated groundwater in the vicinity of the landfill and protect the sole source aquifer. All of the technologies selected for this alternative have been proven effective and are reliable.

Implementability

Construction and operation of all the technologies associated with Alternative 1 are readily implementable, except perhaps for the treated groundwater discharge systems as discussed below. The necessary labor, equipment, materials and supplies are commercially available, and there is limited space along the western boundary of the landfill to construct the groundwater treatment facility. It is anticipated that this alternative will be acceptable to the public. However, discharge of treated groundwater to Sampawams Creek may not be easily achievable. The flow rate, after startup of the treatment facility, would be steady state and negate the opportunity for detention and release at a reduced flow rate. This condition would be compounded if it becomes necessary to discharge surface runoff from the landfill cap to the creek. The additional flow of 400 gpm may cause flooding, in particular during heavy precipitation events. Because of this concern, discharge to the creek may not be viable and approvable by the regulatory agencies. With regard to discharge to the SWSD, since the wastewater transmission line along Corbin Avenue is a force main, a pump station would be required to pump the treated groundwater into the force main. In addition, the Suffolk County Department of Public Works has expressed reservation about accepting a flow of 400 gpm into the 12-inch main because of future capacity requirements of the Pilgrim State facility, assuming that the groundwater remediation system may need to operate for an extended period of time.

Cost

The cost of Alternative 1 is high, in particular for construction of the landfill cap, and operation and maintenance of the groundwater treatment system. The approximate cost for this alternative, based on a present worth analysis, assuming operation of the groundwater treatment and landfill gas extraction system for 15 years, and maintenance of the cap and monitoring for 30 years, is approximately $18.6 million. The details of this cost estimate, together with the cost estimates for the other alternatives, are provided in Table 3-2. These cost estimates do not include construction observation and construction quality assurance/construction quality control (CQA/CQC) testing.

Table 3-2

SONIA ROAD LANDFILL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
REMEDIAL ALTERNATIVE PRELIMINARY COST ESTIMATES

PRESENT WORTH COSTS	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Capital Costs					
Mobilization/Demobilization	$ 200,000	$ 200,000	$ 150,000	$ 150,000	–
Site Preparation*	1,000,000	1,000,000	900,000	900,000	–
Construction of Cap	9,000,000	9,000,000	9,000,000	9,000,000	–
Construction of Gas Control System (5,600'/wells/20' deep) and Piping Equipment and Monitoring Wells	1,000,000	1,000,000	1,000,000	–	–
Construction of Groundwater Extraction System (200 gpm each/10"Ø/100' deep) and Piping	200,000	–	–	–	–
Construction of Groundwater Treatment System (400 gpm/aeration tank, permanganate filter and ion exchange)	2,300,000	–	–	–	–
Construction of Groundwater Extraction System (150 gpm each/8"Ø/60' deep) and Piping	–	150,000	–	–	–
Construction of Groundwater Treatment System (300 gpm/aeration tank, permanganate filter and ion exchange)	–	2,000,000	–	–	–
Construction of Effluent Discharge Line	600,000	600,000	–	–	–
Total Capital Cost	**$14,300,000**	**$13,950,000**	**$11,050,000**	**$10,050,000**	**$0**

*Includes clearing and grubbing, unclassified excavation and relandfilling (including off-site waste), contour grading material and contour grading.
**Does not include contingency and engineering.

Table 3-2 (continued)

SONIA ROAD LANDFILL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
REMEDIAL ALTERNATIVE PRELIMINARY COST ESTIMATES

PRESENT WORTH COSTS[3]		**Alternative 1**	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 5**
	Annual Costs					
O&M Costs						
Groundwater Treatment (chemical, exchange regeneration)[1]	$15,000	$150,000	$150,000	–	–	–
Groundwater Treatment Residuals Disposal [1]	10,000	100,000	100,000	–	–	–
Power and Utilities Groundwater Treatment[1]	130,000	1,300,000	1,300,000	–	–	–
Gas Collection[1]	40,000	400,000	400,000	400,000	–	–
Labor Groundwater Treatment[1]	90,000	900,000	900,000	–	–	–
Gas Collection[1]	40,000	400,000	400,000	400,000	–	–
Cap[2]	20,000	300,000	300,000	300,000	300,000	–
Maintenance (materials and supplies) Groundwater Treatment[1]	10,000	100,000	100,000	–	–	–
Gas Collection[1]	5,000	50,000	50,000	50,000	–	–
Cap[2]	10,000	150,000	150,000	150,000	150,000	–
Monitoring[2]	30,000	450,000	450,000	450,000	450,000	450,000
Total O&M Cost		**$4,300,000**	**$4,300,000**	**$1,750,000**	**$900,000**	**$450,000**
TOTAL COST		**$18,600,000**	**$18,250,000**	**$12,800,000**	**$10,950,000**	**$450,000**

[1] Assumes 15 years of operation
[2] Assumes 30 years of operation
[3] Assumes 5% annual interest

3.2.2 Alternative 2

Effectiveness

Alternative 2 will meet all of the remedial action objectives relative to impacts caused by the Sonia Road Landfill. This alternative will not fully protect the sole source aquifer since it will not remediate groundwater contaminated by volatile organic compounds. However, as discussed previously, significant VOC contamination of groundwater is not a result of a release from the landfill, but rather from upgradient industrial sources. Relative to the site, waste beyond the landfill boundary will be removed, and the low permeability cap will prevent direct contact with waste and contaminated soil, prevent surface runoff and off-site migration of surficial contaminants, and mitigate generation of leachate and impacts to groundwater; the gas control system will prevent off-site migration of landfill gas and release of unacceptable levels of contaminants to the air; and the shallow groundwater remediation system will control and treat the leachate-impacted groundwater.

Deep VOC-contaminated groundwater will naturally attenuate, which is not as effective as active remediation. However, since, based on available information, it is unlikely that there are potential downgradient receptors using deep private wells, there are no shallow public water supply wells downgradient of the landfill, the VOC plume is expected to lessen in concentration as it migrates downgradient of the area of the landfill and there are no anticipated impacts on surface water, it does not appear that remediation of the VOC-impacted groundwater is necessary to protect human health and the environment, recognizing that it still impacts a natural resource. All of the technologies associated with Alternative 2 have been proven effective and are reliable.

Implementability

Construction and operation of all of the technologies associated with Alternative 2 are readily implementable, except for the treated groundwater discharge systems as discussed above for Alternative 1. The necessary labor, equipment, materials and supplies are commercially available and construction is not complex. It is anticipated that this alternative will be acceptable to the public. Although the discharge flow will be somewhat less for this alternative (300 gpm), it may still present difficulties regarding discharge to Sampawams Creek and the force main along Corbin Avenue. As a result, it is anticipated that this alternative may not be viable and approvable by the regulatory and operating agencies.

Cost

The cost of Alternative 2 will be somewhat less than Alternative 1, but still very high as a result of construction of the cap and operation, and maintenance of the groundwater treatment system. While the groundwater remediation system will not require deep extraction wells and will have less pumping capacity (300 gpm vs. 400 gpm), the same treatment processes and discharge system will be necessary. The approximate present worth cost for this alternative is approximately $18.3 million.

3.2.3 Alternative 3

Effectiveness

Alternative 3 will meet the remedial action objectives, excluding protection of the Sole-source Aquifer, and control and treatment of contaminated groundwater to prevent further migration. As previously discussed, significant VOC contamination of groundwater is not associated with the Sonia Road Landfill. Although this alternative will not remediate leachate-impacted groundwater directly, construction of a low permeability cap over the landfill will significantly reduce generation of leachate and significantly reduce leachate impacts on groundwater. However, since there is waste below the groundwater, release of leachate-related contaminants may not be entirely eliminated.

In addition to reducing leachate generation, removal of waste beyond the landfill boundary and the cap will prevent direct contact with waste and contaminated soil, and prevent surface runoff and off-site migration of surficial contaminants. The gas control system will prevent off-site migration of landfill gas and a flare will mitigate the release of unacceptable levels of contaminants to the air, if required.

As discussed above for Alternative 2, based on available information, it is unlikely that there are potential downgradient receptors using private wells. The closest downgradient properties which could possibly utilize private wells are located approximately 1.5 miles from the landfill. The closest downgradient public water supply wells are about 2 miles from the site, over 400 feet deep and screened below the Gardiners Clay. The closest downgradient surface water is Great South Bay located approximately 4 miles from the site. For the above reasons, it is extremely unlikely that human or environmental health will be adversely impacted by contaminated groundwater in the vicinity of the landfill. All of the technologies associated with Alternative 3 have been proven effective and are reliable.

Implementability

Construction and operation of all of the technologies associated with Alternative 3 are readily implementable. The necessary labor, equipment, materials and supplies are commercial available, and construction is not complex.

With regard to acceptability, as a result of the risk assessment, which indicates little or no unacceptable risk due to existing groundwater contamination (or other media associated with the landfill considering construction of the cap), expected improvement in groundwater with implementation of the cap and consistency with municipal solid waste landfill closure requirements, this alternative is likely to be acceptable to the regulatory agencies and the public. As a result, all necessary approvals and permits should be obtainable.

Cost

The cost of Alternative 3 will be significantly less than Alternatives 1 and 2, since groundwater remediation is not an element of this alternative. The major cost associated with this alternative is the landfill cap. The approximate present worth cost for Alternative 3 is approximately $12.4 million.

3.2.4 Alternative 4

Effectiveness

Alternative 4 will meet only four of the eight remedial action objectives for the Sonia Road Landfill and will likely not be protective of human health. While removal of the waste beyond the landfill boundary and the cap will prevent direct contact with waste and contaminated soil, prevent surface runoff and off-site migration of surficial contaminants and mitigate the generation of leachate, it will not control potential off-site migration of explosive gas, which would pose a threat to human health. The landfill is currently generating methane gas, particularly in the eastern portion which is closest to residential and industrial buildings, and it is expected to continue to do so for another 5 to 10 years, therefore, remediation of the gas is necessary Active groundwater remediation is not a component of Alternative 4. However, because of the Presumptive Remedy to cap the landfill and absence of potential human and environmental receptors as described above for Alternative 3, active groundwater remediation is not necessary.. The technology associated with Alternative 4 has been proven to be effective and is reliable, but will not mitigate potential off-site migration of landfill gas.

Implementability

Construction of a low permeability cap is readily implementable. The necessary labor, equipment, materials and supplies are commercially available, and construction is not complex. However, since there is the potential for off-site migration of explosive gas, in particular after construction of the cap, which is not in conformance with New York State (Part 360) regulations and a potential threat to human health, this alternative will not be acceptable to the regulatory agencies or to the public.

Cost

The cost of Alternative 4 will be significantly less than Alternatives 1 and 2 since groundwater remediation is not a component of this alternative, and somewhat less than Alternative 3 since landfill gas control is also not a component. Similar to Alternative 3, the major cost element for Alternative 4 is the landfill cap. The approximate cost for this alternative is approximately $11 million.

3.2.5 Alternative 5

Effectiveness

Alternative 5 will not meet any of the remedial action objectives since no remedial action will be undertaken. This alternative relies solely on natural attenuation to mitigate generation of leachate, migration of landfill gas and migration of contaminated groundwater. Natural attenuation of landfill gas will not control the potential for off-site explosive gas migration and natural attenuation of waste and contaminated soil will not mitigate continued contamination of the groundwater resource and sole source aquifer. In addition, existence of waste material beyond the landfill boundary will not mitigate the potential for contact with the waste and off-site migration of contaminants. Therefore, this alternative is not effective.

Implementability

Since no action does not mitigate the potential for off-site migration of explosive gas and continued contamination of groundwater, it is not in conformance with New York State regulations, as well as federal requirements regarding protection of a sole source aquifer, and since no action is unlikely to be acceptable to the public, this alternative is not implementable. However, as required by the federal and New York State guidelines for preparation of feasibility studies, the no action alternative will be retained for purposes of comparison to other retained alternatives in the detailed evaluation of alternatives (see Section 4.0).

Cost

The cost of Alternative 5 will be significantly less than Alternatives 1 through 4, in particular Alternatives 1 and 2. The approximate cost for Alternative 5, which involves only long-term monitoring, is approximately $450,000.

3.3 Summary Evaluation of Alternatives

Provided in Table 3-3 is a summary of the preliminary evaluation of the remedial alternatives developed for the Sonia Road Landfill.

With regard to selection of alternatives to be evaluated further in greater detail in order to select a remedial plan for the site, Alternative 4 will not be retained since it does not provide for adequate protection of human health. While Alternatives 1 and 2 provide the most environmental benefit because they provide for remediation of groundwater, which is a natural resource and part of a sole source aquifer, these alternatives do not provide for added protection of human health as compared to Alternative 3. As described above, although groundwater is contaminated in the vicinity of the landfill, no potential human or environmental receptors have

Table 3-3

SONIA ROAD LANDFILL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
SUMMARY OF PRELIMINARY EVALUATION OF REMEDIAL ALTERNATIVES

Remedial Alternative		Effectiveness	Ease of Implementation	Cost	Retained
Alternative 1	Low Permeability Cap, Landfill Gas Control, On-site Groundwater Treatment for VOCs and Leachate Constituents, Discharge to Sampawams Creek or SWSD, and Long-term Monitoring	High	Moderate to Low (possible difficulty with discharge to Sampawams Creek and SWSD)	$18,600,000	No (very high cost and little added value regarding protection of human health and environment)
Alternative 2	Low Permeability Cap, Landfill Gas Control, On-site Groundwater Treatment for Leachate Constituents, Discharge to Sampawams Creek or SWSD, and Long-term Monitoring	High (relative to landfill contamination)	Moderate to Low (possible difficulty with discharge to Sampawams Creek and SWSD)	$18,250,000	No (very high cost and little added value regarding protection of human health and environment)
Alternative 3	Low Permeability Cap, Landfill Gas Control and Long-term Monitoring	High to Moderate (relative to landfill contamination)	High to Moderate (may not be strongly supported by the public)	$12,800,000	Yes (moderate cost with sufficient protection of human health and environment)
Alternative 4	Low Permeability Cap and Long-term Monitoring	Low	Low (unlikely regulatory agency and public acceptance)	$10,950,000	No (no gas control and unlikely agency and public acceptance)
Alternative 5	No Action and Long-term Monitoring	Very Low	Very low (will not be acceptable to regulatory agencies and the public)	$450,000	Yes (required by feasibility study guidance)

been identified that would be impacted by this contamination, and as a result, Alternative 3 will be retained for detailed evaluation. Therefore, the significant cost of Alternatives 1 and 2 provide little additional benefit regarding protection of human health and the environment, and will not be retained for detailed analysis.

In addition, the VOC contamination of groundwater is, for the most part, caused by upgradient industrial sources and should not be a cost related to remediation of the landfill, and the selected Presumptive Remedy for the Sonia Road Landfill will significantly reduce leachate-derived impacts on groundwater in the future. Although Alternative 5 is also not acceptable, since it does not provide for adequate protection of human health and the sole source aquifer, in compliance with federal and New York State guidance for preparation of feasibility studies, this alternative will also be retained for detailed analysis.

3.4 Evaluation of Selection of Presumptive Remedy Relative to Guidance

In addition to evaluation of the alternatives relative to feasibility study criteria as described above in Sections 3.1 through 3.6, evaluation of the selection of the Presumptive Remedy must also be performed to ensure that it is consistent with NYSDEC requirements as contained in the Division Technical and Administrative Guidance Memorandum (TAGM) Accelerated Remedial Actions at Class 2, Non-RCRA Regulated Landfills. This TAGM is provided in Appendix A. Provided below is a comparison of the Presumptive Remedy for the Sonia Road Landfill, which is a Part 360 cap, to the technical considerations contained in the TAGM.

Technical Consideration	Presumptive Remedy
• Meet or Exceed the Part 360 Capping Requirements	Part 360 cap with variances will be constructed.
• Remediation of "Hot Spots" (e.g., hazardous waste, highly contaminated soil, drums, etc.) Prior to Capping	Not required since "hot spots" were not detected as a result of the remedial investigation.

Technical Consideration	Presumptive Remedy
• Consolidation of Waste and Contaminated Soil or Sediment Prior to Capping	Waste determined to be beyond northern property boundary will be excavated and consolidated on-site. Because of waste depth (typically greater than 10 feet) at the horizontal limit of waste, there is little or no opportunity for additional consolidation. There is no site-related contaminated off-site soil and sediment, and the entire landfill will be capped.
• Definition of Landfill Area	Extensive test trench program was conducted to define limits of waste.
• Phased Capping	No excavation of waste or contaminated soil, or generation of drilling/trench spoils is planned during construction, except as part of contour grading prior to construction of the cap.
• Landfill Gas Controls	A gas venting layer and recovery wells (one per acre as required by Part 360) will be part of the cap. In addition, perimeter gas collection wells will be part of the gas control system.
• Leachate Collection System	Not applicable to the Sonia Road Landfill since waste is below the water table in most areas of the landfill, up to 40 feet into groundwater. Also, leachate migrates vertically into groundwater. As a result, there is no opportunity to collect leachate; however, a groundwater control and treatment system to address leachate-impacted groundwater was considered.
• Treatment of Leachate	Not applicable to the Sonia Road Landfill since there is no opportunity for leachate collection; however, treatment of leachate-impacted groundwater was considered.

4.0 DETAILED ANALYSIS OF ALTERNATIVES

Based on the preliminary evaluation of the remedial alternatives developed for the Sonia Road Landfill described in Section 3.0 above, two alternatives remain for the site, these being Alternative 3, which comprises removal of off-site waste, a low permeability/Part 360 cap, landfill gas controls, natural attenuation of groundwater contamination and long-term monitoring; and Alternative 5, which is no action (natural attenuation of all contaminated media) and long-term monitoring.

Provided below is a detailed evaluation of Alternatives 3 and 5. Based on this detailed evaluation, a remedial plan will be recommended for the site for regulatory agency and public comment. In accordance with federal and New York State Department of Environmental Conservation Guidance for Selection of Remedial Actions at Superfund Sites, as described in Section 1.4, the following feasibility study evaluation criteria will be addressed in the detailed evaluation of alternatives.

- Threshold Criteria
  - Protection of human health and the environment
  - Compliance with applicable regulatory standards, criteria and guidelines/ARARs
- Balancing Criteria
  - Short-term impacts and effectiveness
  - Long-term effectiveness and permanence
  - Reduction in toxicity, mobility and/or volume of contamination
  - Implementability
  - Cost

In addition to the above threshold and balancing criteria, the guidance also provides the following modifying criteria:

- Modifying Criteria
  - State acceptance
  - Community acceptance

A detailed description of each of these criteria is provided in Section 1.4 of this document.

Provided below is a comparative analysis of remedial Alternatives 3 and 5 to each of the detailed evaluation criteria presented above.

4.1 Overall Protection of Human Health and the Environment

Alternative 3 will be protective of human health and the environment through removal of waste beyond the Sonia Road Landfill boundary and capping of the landfill, which will prevent potential direct contact with waste and contaminated soil and off-site migration of contaminants in surficial soil. In addition, construction of a landfill gas control system will prevent off-site migration of explosive gas. Capping of the landfill will also significantly reduce generation of leachate and contamination of groundwater. Existing leachate-impacted groundwater does not pose a threat to human or environmental receptors and will be remediated through natural attenuation. With regard to VOC-contaminated groundwater, it is assumed that NYSDEC will investigate and remediate the source or sources of this contamination as part of the State's Superfund Program.

Alternative 5 will not be protective of human health and the environment since natural attenuation of contaminants in waste and soil will not be effective in the 30-year planning period and groundwater will continue to be contaminated for many years. Those receptors that gain access to the site, as well as to waste off-site, could potentially come into contact with waste and contaminated soil. In addition, natural attenuation of landfill gas will not prevent the potential for off-site migration of explosive gas.

4.2 Compliance with Applicable Regulatory Standards, Criteria and Guidelines/ARARs

Alternative 3 will be compliant with all regulatory standards, criteria and guidelines (SCGs) and Applicable or Relevant and Appropriate Requirements (ARARs) established for the

Sonia Road Landfill as described in Section 1.4. The source of contamination (municipal solid waste) will be remediated (removed from off-site and capped, together with a perimeter gas control system) in conformance with the New York State Part 360 regulations and groundwater standards and guidelines, and protection of the sole source aquifer will likely be attained (as it pertains to contaminants related to the landfill) through capping. In addition, air quality standards will be attained by gas control emissions treatment (flare), if required. Implementation of this alternative will be in compliance with all federal, state and local permit requirements.

Alternative 5 will not be compliant with any of the SCGs and ARARs established by the site, in particular since it is not in conformance with the Part 360 regulations and requirements for protection of groundwater and sole source aquifer.

4.3 Short-term Impacts and Effectiveness

Alternative 3 can be fully implemented within about 18 months of selection of this alternative and issuance of the Record of Decision, and will be immediately effective in mitigating the potential for direct contact with waste and contaminated soil, off-site migration of contaminated soil, generation of landfill leachate and off-site migration of landfill gas. With proper implementation of a construction health and safety plan and construction quality assurance plan, there will be no adverse impacts on human health and the environment during construction of the cap and gas control system. Also, no significant disruption of the community, including the industries immediately north of the landfill, is expected during construction, and operation and maintenance of the remediation system. During construction, to the maximum extent possible, construction-related facilities will be located along the western boundary of the landfill away from the residential area to the south and east of the site. Any waste or contaminated soil and groundwater that will be generated during construction will be properly and safely handled and disposed on-site under the cap, or off-site if necessary.

Alternative 5 will have no short-term construction impacts and can be fully implemented immediately; however, it will not be effective in the short (or long) term in preventing potential contact with waste or contaminated soil, and release of contaminants to the environment.

4.4 Long-term Effectiveness and Permanence

Alternative 3 will provide long-term effectiveness and permanence in protecting human health and the environment by isolating and controlling exposure to and release of contaminants from waste and contaminated soil. Removal of off-site waste, and the low permeability cap and landfill gas control system is considered an effective long-term and permanent remedial action. By mitigating the release of contaminants to groundwater, it is expected that impacts to groundwater will be significantly reduced and therefore will also be effective and permanent. The risk posed by the contaminants that remain in the waste and contaminated soil are minimal since the contaminants will be isolated from direct exposure and leaching to groundwater.

Alternative 5 will not provide for long-term effectiveness and permanence since remediation of waste, contaminated soil and landfill gas will not occur, and contaminants will continue to be released to the environment in significant, unacceptable levels. As a result of this continued release of contamination, natural attenuation of leachate-impacted groundwater will not be effective.

4.5 Reduction of Toxicity, Mobility or Volume Through Treatment

Alternative 3 will not reduce the toxicity or volume of contaminants in the landfill; however, it will significantly reduce the mobility of contaminants, not through treatment, but through isolation/containment as described above in Section 4.4. Expected reduction of contaminant levels of existing leachate-impacted groundwater through installation of the cap will reduce the toxicity and volume of contaminants in groundwater in part through degradation/bioremediation, as well as through dilution and dispersion.

Alternative 5 will not be effective in reducing the toxicity, volume or mobility of the contaminants at the site, and as a result, natural attenuation will also not be effective. Contaminants will continue to be released to and migrate in the environment in significant, unacceptable levels.

4.6 Implementability

Alternative 3 remedial technologies are commercially available and have been proven effective and reliable for mitigating the migration of contaminants from landfills, including both leachate and landfill gas, as well as the treatment of gas, if required. In addition, the components comprising this alternative can be easily constructed, maintained and operated. Labor, equipment, materials and supplies required to implement this alternative are readily available.

Alternative 5 can be easily implemented but, as discussed above, will not be effective in protecting human health and the environment.

4.7 Cost

The estimated capital cost, and long-term (30-year) O&M present worth cost associated with Alternatives 3 and 5, as provided in Table 3-2, is $12,800,000 and $450,000, respectively. A detailed construction cost estimate is provided in the Presumptive Remedy Engineering Design Report, dated March 1998. As noted in Section 3.0, these costs do not include construction observation and construction quality assurance/construction quality control (CQA/CQC) testing.

4.8 Regulatory Acceptance

Alternative 3, since it will provide effective and permanent remediation of the Sonia Road Landfill both on-site and off-site without adverse short-term impacts, and will provide protection of human health and the environment and meet the applicable SCGs/ARARs at a relatively moderate cost, it is expected that this alternative will be acceptable to all federal, state and local regulatory agencies. However, the final determination of regulatory acceptance will be made following comments received from the regulating agencies on the recommended remedial action/alternative.

Alternative 5, since it will not provide effective and permanent remediation, and will not provide protection of human health and the environment and meet SCGs/ARARs, will not be acceptable to the regulatory agencies.

4.9 Community Acceptance

Similar to the reasons provided above in Section 4.8 for acceptance of Alternative 3 by the regulatory agencies, it is expected that this alternative will also be accepted by the public. However, also similar to the discussion regarding regulatory acceptance, final determination of community acceptance will be made following comments received by the community in the remedial action/alternative recommended for the site.

Alternative 5, for the same reasons provided in Section 4.8, will not be acceptable to the community.

A summary of the comparison of Alternatives 3 and 5 is provided in Table 4-1.

4.10 Recommended Alternative

Based on the preliminary evaluation of remedial alternatives described in Section 3.0 and the detailed evaluation of alternatives in this section, Alternative 3 is recommended for remediation of the Sonia Road Landfill. This alternative fully meets all of the remedial action objectives identified for the site and all of the feasibility study criteria, in particular, protection of human health and the environment, and attainment of applicable SCGs and ARARs at a moderate cost. The remedial technologies that comprise this alternative are proven, commercially and readily available, and can be implemented in a relatively short time without adverse impacts, and are immediately effective. The recommended remediation plan comprises the following:

Table 4-1

SONIA ROAD LANDFILL
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
REMEDIAL ALTERNATIVE COMPARATIVE ANALYSIS SUMMARY

Evaluation Criteria	Alternative 3 (Cap, Gas Extraction and Long-Term Monitoring)	Alternative 5 (No Action with Long-Term Monitoring)
Overall Protection of Human Health and the Environment	●	○
Compliance with ARARs	●	○
Long-term Effectiveness and Permanence	●	○
Reduction of Toxicity, Mobility or Volume through Treatment	●	○
Short-term Impacts and Effectiveness	●	◒
Implementability	●	●
Cost	$12,800,000	$450,000
Regulatory Agency Acceptance	●	○
Community Acceptance	●	○

● Fully Meets Criteria ◒ May or Partially Meet Criteria ○ Does Not Meet Criteria

- Excavation of waste beyond the northern landfill property line and placement of the waste on-site;
- Installation of a low permeability Part 360 cap over the landfill;
- Installation of a gas migration control system, comprising recovery wells in the interior of the landfill and collection wells around the perimeter of the landfill, and a flare to control/treat emissions, if required; and
- Performance of a long-term groundwater monitoring program to monitor the effectiveness of the remediation system.

In addition to the above-recommended remedial action for the Sonia Road Landfill, it is also recommended that NYSDEC determine and remediate the source or sources of volatile organic compound contamination of groundwater detected in the vicinity of the landfill.

APPENDIX A

NYSDEC DIVISION TECHNICAL AND ADMINISTRATIVE GUIDANCE MEMORANDUM (TAGM HWR-90-4030) SELECTION OF REMEDIAL ACTIONS AT INACTIVE HAZARDOUS WASTE SITES

(12-75)

D. Smith

New York State Department of Environmental Conservation

HWR-90-4030
REVISED MAY 15, 1990

MEMORANDUM

TO: Regional Hazardous Waste Remediation Engineers, Bureau Directors & Section Chiefs
FROM: Michael J. O'Toole, Jr., Director, Division of Hazardous Waste Remediation
SUBJECT: REVISED TAGM - SELECTION OF REMEDIAL ACTIONS AT INACTIVE HAZARDOUS WASTE SITES
DATE: MAY 15 1990

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 of 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 and 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.

Bureau of
Program Management

If there is any uncertainty as to whether documents should be withheld or released in a particular case, the program attorney or regional attorney should be consulted prior to sending out a response.

cc: E. Sullivan
G. Greeley
D. Markell
M. Gerstman
A. DeBarbieri
C. Goddard
E. McCandless
Regional Directors
Regional Engineers
RHW Engineers

HWR-90-4030
REVISED MAY 15 1990

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

TECHNICAL AND ADMINISTRATIVE GUIDANCE MEMORANDUM (TAGM)

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. **IMPLEMENTATION 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.

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

or

(ii) 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

(iii) a RCRA Part B permit;

or

(iv) a RCRA Research and Development permit.

or

(v) 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:

(i) significant loss of the surface cover such as clay cap with a potential for exposure of waste material underneath the cap;

(ii) contamination of the groundwater by the leachate from the waste material;

(iii) contamination of the adjoining surface water by the leachate from the waste material or by the contaminated groundwater;

(iv) structural failure of the control or isolation technology.

Table 4.1 should be used in evaluating the effectiveness of each alternative in protecting human health and the environment. If an alternative is scored less than 10 out of a maximum score of 25, project manager may consider rejecting that remedial alternative from further consideration.

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 obtain approvals 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.**

Implementability of each remedial alternative should be evaluated using Table 4.2. If an alternative does not score a minimum of eight out of a possible maximum 15, then the Project Manager has the option of screening out this alternative from further consideration.

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

o 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 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 selection of a remedy. The seven evaluation criteria 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 shown in Table 5-1 and discussed in the following sections. The weight for each criteria is also noted in Table 5-1.

5.2.3 Analysis of Individual Alternatives

5.2.3.1 Compliance with Applicable New York State Standards, Criteria and Guidelines (SCGs) (Relative Weight = 10)

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.

If an alternative complies with all SCGs, it should be assigned a full score of 10. If an alternative complies with none of the above-mentioned four specific aspects of the SCGs, it should receive a score of 0. Each component of the four specific aspects of the SCGs shall receive a maximum score of 2.5. **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.** Table 5.2 may be used to evaluate remedial alternatives.

5.2.3.2 Overall Protection of Human Health and the Environment (Relative Weight = 20)

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.

Table 5.3 outlines pertaining questions to be answered in order to assist the evaluator in assigning relative weighing scores to remedial alternatives.

5.2.3.3 Short-term Impacts and Effectiveness (Relative Weight: 10): 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:

(i) 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.

(ii) 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.

(iii) 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.

(iv) 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.

Score for this criterion should be assigned based on the analysis of factors (i), (ii), (iii) presented in Table 5.4. 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 (Relative Weight = 15)

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 and operating 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 of 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.

Table 5.5 should be used during the analysis to assign scores for this criterion.

5.2.3.5 Reduction of Toxicity, Mobility and Volume (Relative Weight = 15)

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

Table 5.6 lists typical questions to be addressed during the analysis of toxicity, mobility, or volume reduction.

Table 5.6 should be used as the basis for evaluation of remedial alternatives and in assigning score for this criteria.

5.2.3.6 Implementability (Relative Weight = 15): Of the total weight of 15, the technical feasibility shall receive a maximum score of 10 while administrative feasibility and availability of services and materials shall be assigned a combined maximum score of 5.

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 for 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.

Table 5-5 should assist the evaluator in determining degree of technical feasibility among remedial alternatives. The maximum score for the technical feasibility is 10.

o 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)

o 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.

A combined scoring not to exceed five should be assigned to administrative feasibility and availability of services and materials.

Table 5.7 lists typical questions to be addressed during the analysis of administrative feasibility and availability of services and materials.

5.2.3.7 <u>Cost (Relative Weight = 15)</u>

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

(1) <u>Capital Costs</u>. 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:

- o Construction costs - Costs of materials, labor (including fringe benefits and worker's compensation), and equipment required to install a remedial action

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

Indirect capital costs may include:

- o Engineering expenses - Costs of administration, design, construction supervision, drafting, and treatability testing
- o Legal fees and license or permit costs - Administrative and technical costs necessary to obtain licenses and permits for installation and operation
- o Start up and shakedown costs - Costs incurred during remedial action start up
- o 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:

- o Operating labor costs - Wages, salaries, training, overhead, and fringe benefits associated with the labor needed for post-construction operations
- o Maintenance materials and labor costs - Costs for labor, parts and other resources required for routine maintenance of facilities and equipment
- o Auxiliary materials and energy - Costs of such items as chemicals and electricity for treatment plant operations, water and sewer services, and fuel

- o Disposal of residues - Costs to treat or dispose of residuals such as sludges from treatment processes or spent activated carbon

- o Purchased services - Sampling costs, laboratory fees, and professional fees for which the need can be predicted

- o Administrative costs - Costs associated with the administration of remedial action O&M not included under other categories

- o 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

- o Replacement costs - Cost for maintaining equipment or structures that wear out over time

- o 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, these "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.

An alternative with the lowest present worth shall be assigned the highest score of 15. Other alternatives shall be assigned the cost score inversely proportional to their present worth.

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 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, differences in total scores, etc. 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 rational 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.

Table 4.1

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening			Score
1. Protection of community during remedial actions.	◦ Are there significant short-term risks to the community that must be addressed? **(If answer is no, go to Factor 2.)**	**Yes** **No**	____ ____	0 4
	◦ Can the short-term risk be easily controlled?	**Yes** **No**	____ ____	1 0
	◦ Does the mitigative effort to control short-term risk impact the community life-style?	**Yes** **No**	____ ____	0 2
Subtotal (maximum = 4)				
2. Environmental Impacts	◦ Are there significant short-term risks to the environment that must be addressed? **(If answer is no, go to Factor 3.)**	**Yes** **No**	____ ____	0 4
	◦ Are the available mitigative measures reliable to minimize potential impacts?	**Yes** **No**	____ ____	3 0
Subtotal (maximum = 4)				
3. Time to implement the remedy.	◦ What is the required time to implement the remedy?	**≤ 2yr.** **> 2yr.**	____ ____	1 0
	◦ Required duration of the mitigative effort to control short-term risk.	**≤ 2yr.** **> 2yr.**	____ ____	1 0
Subtotal (maximum = 2)				
4. On-site or off-site treatment or land disposal	◦ On-site treatment* ◦ Off-site treatment* ◦ On-site or off-site land disposal			3 1 0
Subtotal (maximum = 3)				
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes				
5. Permanence of the remedial alternative.	◦ Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 7.)**	**Yes** **No**	____ ____	3 0
Subtotal (maximum = 3)				

Table 4.1 (cont'd)

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening		Score
6. Lifetime of remedial actions.	° Expected lifetime or duration of of effectiveness of the remedy.	25-30yr.____	3
		20-25yr.____	2
		15-20yr.____	1
		< 15yr.____	0
Subtotal (maximum = 3)			
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	None ____	3
		≤ 25% ____	2
		25-50% ____	1
		≥ 50% ____	0
	ii) Is there treated residual left at the site? (If answer is no, go to Factor 8.)	Yes ____	0
		No ____	2
	iii) Is the treated residual toxic?	Yes ____	0
		No ____	1
	iv) Is the treated residual mobile?	Yes ____	0
		No ____	1
Subtotal (maximum = 5)			
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	< 5yr. ____	1
		> 5yr. ____	0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? (If answer is no, go to "iv")	Yes ____	0
		No ____	1
	iii) Degree of confidence that controls can adequately handle potential problems.	Moderate to very confident ____	1
		Somewhat to not confident ____	0
	iv) Relative degree of long-term monitoring required (compare with other remedial alternatives)	Minimum ____	2
		Moderate ____	1
		Extensive ____	0
Subtotal (maximum = 4)			
TOTAL (maximum = 25)			

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.2

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening	Score
1. <u>Technical Feasibility</u>		
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	___ 3
	ii) Somewhat difficult to construct. No uncertainties in construction.	___ 2
	iii) Very difficult to construct and/or significant uncertainties in construction.	___
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___ 3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	___ 2
c. Schedule of delays due to technical problems.	i) Unlikely	___ 2
	ii) Somewhat likely	___ 1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___ 2
	ii) Some future remedial actions may be necessary.	___ 1
Subtotal (maximum = 10)		
2. <u>Administrative Feasibility</u>		
a. Coordination with other agencies.	i) Minimal coordination is required.	___ 2
	ii) Required coordination is normal.	___ 1
	iii) Extensive coordination is required.	___ 0
Subtotal (maximum = 2)		
3. <u>Availability of Services and Materials</u>		
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	**Yes** ___ 1 **No** ___ 0
	ii) Will more than one vendor be available to provide a competitive bid?	**Yes** ___ **No** ___ 0

Table 4.2 (cont'd)

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening		Score
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	**Yes** ___	1
		No ___	0

Subtotal (maximum = 3)

TOTAL (**maximum** = 15)

IF THE TOTAL IS LESS THAN 8, **PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.**

Table 5.1
CRITERIA FOR DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS, CRITERIA AND GUIDELINES (SCGs)(10)

- Compliance With Contaminant-Specific SCGs
- Compliance With Action-Specific SCGs
- Compliance With Location-Specific SCGs

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT (20)

- Environmental Impacts
- Transport of Hazardous Materials
- Health Impacts

SHORT-TERM EFFECTIVENESS (10)

- Protection of Community During Remedial Actions
- Protection of Workers During Remedial Actions
- Environmental Impacts
- Time Until Remedial Action Objectives Are Achieved

LONG-TERM EFFECTIVENESS & PERMANENCE (15)

- Magnitude of Residual Risk
- Adequacy of Controls
- Reliability of Controls

REDUCTION OF TOXICITY, MOBILITY AND VOLUME (15)

- Treatment Process Used and Materials Treated
- Amount of Hazardous Materials Destroyed or Treated
- Degree of Expected Reductions in Toxicity, Mobility and Volume
- Degree to Which Treatment is Irreversible
- Type and Quantity of Hazardous Residuals Remaining After Treatment

IMPLEMENTABILITY (15)

- Ability to Construct and Operate the Technology
- Reliability of the Technology Based on its Acceptable Demonstrations
- Ease of Undertaking Additional Remedial Actions, if Necessary
- Ability to Monitor Effectiveness of Remedy
- Availability of Necessary Equipment and Specialists
- Timing of New Technology Under Consideration

COST (15)

- Immediate Capital Costs
- Operating and Maintenance Costs
- Future Capital Costs
- Cost to Future Land Use
- Present Worth Cost

Table 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)

(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
1. Compliance with chemical-specific SCGs	Meets chemical specific SCGs such as groundwater standards	Yes ___ No ___	4 0
2. Compliance with action-specific SCGs	Meets SCGs such as technology standards for incineration or landfill	Yes ___ No ___	3 0
3. Compliance with location-specific SCGs	Meets location-specific SCGs such as Freshwater Wetlands Act	Yes ___ No ___	3 0

TOTAL (Maximum = 10)

Table 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
1. Use of the site after remediation.	Unrestricted use of the land and water. **(If answer is yes, go to the end of the Table.)**	**Yes** ____ **No** ____	20 0
TOTAL (Maximum = 20)			
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	**Yes** ____ **No** ____	3 0
	ii) Is the exposure to contaminants via groundwater/surface water acceptable?	**Yes** ____ **No** ____	4 0
	iii) Is the exposure to contaminants via sediments/soils acceptable?	**Yes** ____ **No** ____	3 0
Subtotal (maximum = 10)			
3. Magnitude of residual public health risks after the remediation.	i) Health risk	**≤ 1 in 1,000,000** ____	5
	ii) Health risk	**≤ 1 in 100,000** ____	2
Subtotal (maximum = 5)			
4. Magnitude of residual environmental risks after the remediation.	i) Less than acceptable	____	5
	ii) Slightly greater than acceptable	____	3
	iii) Significant risk still exists	____	0
Subtotal (maximum = 5)			
TOTAL (maximum = 20)			

Table 5.4

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis			Score
1. Protection of community during remedial actions.	○ Are there significant short-term risks to the community that must be addressed? **(If answer is no, go to Factor 2.)**	**Yes**	___	0
		No	___	4
	○ Can the risk be easily controlled?	**Yes**	___	1
		No	___	0
	○ Does the mitigative effort to control risk impact the community life-style?	**Yes**	___	0
		No	___	2
Subtotal (maximum = 4)				
2. Environmental Impacts	○ Are there significant short-term risks to the environment that must be addressed? **(If answer is no, go to Factor 3.)**	**Yes**	___	0
		No	___	4
	○ Are the available mitigative measures reliable to minimize potential impacts?	**Yes**	___	3
		No	___	0
Subtotal (maximum = 4)				
3. Time to implement the remedy.	○ What is the required time to implement the remedy?	**≤ 2yr.**	___	1
		> 2yr.	___	0
	○ Required duration of the mitigative effort to control short-term risk.	**≤ 2yr.**	___	1
		> 2yr.	___	0
Subtotal (maximum = 2)				
TOTAL (maximum = 10)				

Table 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
1. On-site or off-site treatment or land disposal	° On-site treatment*		3
	° Off-site treatment*		1
	° On-site or off-site land disposal		0
Subtotal (maximum = 3)			
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes			
2. Permanence of the remedial alternative.	° Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 4.)**	**Yes** ____	3
		No ____	0
Subtotal (maximum = 3)			
3. Lifetime of remedial actions.	° Expected lifetime or duration of of effectiveness of the remedy.	25-30yr.____	3
		20-25yr.____	2
		15-20yr.____	1
		< 15yr.____	0
Subtotal (maximum = 3)			
4. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	**None** ____	3
		≤ 25% ____	2
		25-50% ____	1
		≥ 50% ____	0
	ii) Is there treated residual left at the site? **(If answer is no, go to Factor 5.)**	**Yes** ____	0
		No ____	2
	iii) Is the treated residual toxic?	**Yes** ____	0
		No ____	1
	iv) Is the treated residual mobile?	**Yes** ____	0
		No ____	1
Subtotal (maximum = 5)			

Table 5.5 (cont'd)

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
5. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	< 5yr. ____	1
		> 5yr. ____	0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? **(If answer is no, go to "iv")**	**Yes** ____	0
		No ____	1
	iii) Degree of confidence that controls can adequately handle potential problems.	**Moderate to very confident** ____	1
		Somewhat to not confident ____	0
	iv) Relative degree of long-term monitoring required **(compare with other remedial alternatives)**	**Minimum** ____	2
		Moderate ____	1
		Extensive ____	0

Subtotal (maximum = 4)

TOTAL (maximum = 15)

Table 5.6
REDUCTION OF TOXICITY, MOBILITY OR VOLUME
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
1. Volume of hazardous waste reduced (reduction in volume or toxicity). **If Factor 1 is not applicable, go to Factor 2.**	i) Quantity of hazardous waste destroyed or treated. **Immobilization technologies do not score under Factor 1.**	**99-100%** ____	8
		90-99% ____	7
		80-90% ____	6
		60-80% ____	4
		40-60% ____	2
		20-40% ____	1
		< 20% ____	0
	ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? **If answer is no, go to Factor 2**	**Yes** ____	0
		No ____	2
Subtotal (maximum = 10) **If subtotal = 10, go to Factor 3**	iii) After remediation, how is the untreated, residual hazardous waste material disposed?	**Off-site land disposal** ____	0
		On-site land disposal ____	1
		Off-site destruction or treatment ____	2
2. Reduction in mobility of hazardous waste. **If Factor 2 is not applicable, go to Factor 3**	i) Quality of Available Wastes Immobilized After Destruction/ Treatment	**90-100%** ____	2
		60-90% ____	1
		< 60% ____	0
	ii) Method of Immobilization		
	- Reduced mobility by containment	____	0
	- Reduced mobility by alternative treatment technologies	____	3
Subtotal (maximum = 5)			
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste	Completely irreversible	____	5
	Irreversible for most of the hazardous waste constituents.	____	3
	Irreversible for only some of the hazardous waste constituents	____	2
	Reversible for most of the hazardous waste constituents.	____	C
Subtotal (maximum = 5)			
TOTAL (maximum = 15)			____

Table 5.7

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
1. Technical Feasibility			
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	___	3
	ii) Somewhat difficult to construct. No uncertainties in construction.	___	2
	iii) Very difficult to construct and/or significant uncertainties in construction.	___	1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___	3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	___	2
c. Schedule of delays due to technical problems.	i) Unlikely	___	2
	ii) Somewhat likely	___	1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___	2
	ii) Some future remedial actions may be necessary.	___	1
Subtotal (maximum = 10)			
2. Administrative Feasibility			
a. Coordination with other agencies.	i) Minimal coordination is required.	___	2
	ii) Required coordination is normal.	___	1
	iii) Extensive coordination is required.	___	0
Subtotal (maximum = 2)			
3. Availability of Services and Materials			
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	**Yes** ___ **No** ___	1 0
	ii) Will more than one vendor be available to provide a competitive bid?	**Yes** ___ **No** ___	1 0

Table 5.7 (cont'd)

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis			Score
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	**Yes**	____	1
		No	____	0

Subtotal (maximum = 3)

TOTAL (maximum = 15)

RESPONSIVENESS SUMMARY
TECHNICAL AND ADMINISTRATIVE GUIDANCE MEMORANDUM (TAGM) FOR THE SELECTION OF REMEDIAL ACTIONS AT INACTIVE HAZARDOUS WASTE SITES

1. IMPLEMENTATION OF REMEDIAL ACTIONS:

Comment No. 1.1: In the proposed policy's hierarchy of remedial actions, solidification/fixation technologies are only considered for inorganic wastes. These technologies are also applicable to organic wastes.

Response No. 1.1: Recently solidification/fixation technologies have been used for organic wastes. Adequate long term data are not available to determine the effectiveness of solidification/fixation of hazardous wastes, containing high concentrations of organic constituents; however, use of solidification/fixation technologies for waste containing "low" level of organic constituents should be evaluated on site specific basis.

Comment No. 1.2: Destruction will result in the treated materials having "no residue containing unacceptable levels of hazardous wastes." How would this apply to an incinerator ash containing RCRA-regulated waste? What level would be considered unacceptable?

Response No. 1.2: Acceptable cleanup criteria for organic and inorganic hazardous constituents will be developed by the department, in cooperation with the New York State Department of Health (DOH). If concentrations of hazardous constituents of the incinerator ash residue are less than the acceptable cleanup criteria levels, then the remedy will be considered to be permanent reduction in the toxicity of hazardous wastes.

Comment No. 1.3: Section 27-1313, 5) d of the Environmental Conservation Law, notes, "The goal of any such remedial program shall be a complete cleanup of the site through the elimination of the significant threat to the environment posed by the disposal of hazardous wastes at the site and of the imminent danger of irreversible or irreparable damage to the environment caused by such disposal." Therefore, elimination of the significant threat to the environment is the legislatively mandated cleanup goal. However, the draft policy identifies a cleanup goal which "would result in a permanent and significant decrease in the toxicity, mobility or volume of hazardous wastes." While we appreciate and support the DEC's reliance on Superfund Amendment and Reauthorization Act (SARA) and the emphasis on permanent cleanups, we believe that the state goal of eliminating significant threats at the site should be included, as it is a critical and overriding goal of the remedial selection, that needs to be spelled out in the goals statement.

The definition of "reduction of toxicity, mobility, or volume" only includes a decrease of the threat or risk associated with the hazardous substance. State law states that "elimination of the significant threat to the environment" is the remedial goal.

For the requirement, "Be protective of human health and the environment", we recommend adding "with a cleanup goal of achieving pre-existing conditions."

Response No. 1.3: To state that the remediation goal is to eliminate all threats to the environment is inappropriate. The statutory mandate set forth in ECL 27-1313 (5)(d) is the elimination of the significant threat to the environment, not elimination of all threats or achieving pre-existing conditions. The statements contained in the draft policy are consistent with this mandate. In addition, the statutory mandate refers only to those programs implemented by the Department, whereas, the TAGM will apply to the selection of remedy at all sites.

Comment No. 1.4: We strongly support the review of all remediated sites, whether or not hazardous wastes have been left at the site, and the requirement for public comment on any department action. However, waiting five years before reviewing a "remediated" site with leftover contaminants, is inappropriately long. We recommend a review after one year with a public comment period to allow citizens to have input into the specifics of the review process. For instance, it may be appropriate to have water, soil and wildlife testing done at the site, to fully assess the impact of the leftover contamination.

Response No. 1.4: If a remedial action leaves any hazardous wastes at the site, periodic monitoring and operation and maintenance will be required at the site to evaluate the effectiveness of the implemented remedy. The monitoring will include sampling and analysis of appropriate environmental samples. Such sampling and analysis will begin upon construction completion at a specified frequency. Depending upon the nature of the site, sampling may be required quarterly or even monthly.

In addition to this monitoring requirement, such remedial action which leaves any hazardous waste at the site shall be reviewed once each five years to assure that human health and the environment are being protected.

Comment No. 1.5: We strongly support the Department's decision to not include control and isolation technologies in the definition of "permanent remedies". We request the inclusion of one additional preference criteria for the evaluation of treatment technologies. Specifically, we recommend the addition of "(v) the documented preference of citizens or groups in the community where the site is located." We believe this is an important and necessary preference, in addition, to the ones listed in the draft document.

Response No. 1.5: During the feasibility study all alternative treatment technologies, including the technologies known at the time to be preferred by community groups, will be evaluated.

Comment No. 1.6: The guidance document, in Section 2, states that "permanent remedies are to be used wherever practicable". This is different from EPA's criteria of maximum extent practicable. The difference is that EPA's "maximum extent" is, to the best of my knowledge, tied to a cost multiplier. Whereas the term practicable, literally means, possible to perform.

Response No. 1.6: The guidance document states that "permanent remedies are to be used wherever practicable", which means if an alternative is practicable to implement, in light of its evaluation for the seven criteria, it should be considered for implementation.

2. DEVELOPMENT AND PRELIMINARY SCREENING OF REMEDIAL ALTERNATIVES

Comment No. 2.1: The proposed document excludes cost in the screening of remedial alternatives. It is EPA's policy to use cost as a screening factor when there is an order of magnitude differential. This policy differential is mitigated in the detailed analysis section through use of a cost sensitivity analysis - an idea which EPA would be wise to incorporate on a formal basis.

Response No. 2.1: It is our opinion that cost should not be used as a criterion to guide the initial development and screening of remedial alternatives during preliminary screening in order to avoid rejection of permanent remedies. During the preliminary screening, only two (2) criteria, effectiveness and implementability will be considered in evaluating remedial alternatives. It is appropriate to consider cost as a factor only during the detailed analysis of screened alternatives.

Comment No. 2.2: We support the Department's decision to not use cost as a screening criteria in the initial screening process.

Response No. 2.2: Please refer to response No. 2.1.

Comment No. 2.3: When the Department staff are conducting the initial screening of technologies, what sources will be utilized, besides EPA's SITE program and the SUNY Buffalo Center for Hazardous Waste Management?

Response No. 2.3: The feasibility study in general is performed by an engineering consultant for USEPA, NYSDEC or a PRP. The consultant will use all available sources to compile remedial technologies. In addition, NYSDEC intends to procure a consultant to prepare written reports as Technical Resource Documents outlining the state-of-the-art of all alternative treatment technologies which are applicable to the remediation of inactive hazardous waste sites. These technical resource documents will be available to consultants, PRPs, NYSDEC staff and the public.

Comment No. 2.4: Removing a remedial alternative from the screening process if it is expected to fail within 15 years, is an environmentally unsound and arbitrary decision. The goal of the remediation should be to permanently address the contamination.

Response No. 2.4: Concur with the comment. Appropriate changes are made. Please refer to Section 4.1.

3. DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

Comment No. 3.1: The required assignment of weights to seven evaluation criteria will eliminate the flexibility which is so essential to the effective implementation of the superfund program. For this very reason, the proposed National Contingency Plan (NCP) does not consider the use of weights for its evaluation criteria.

Response No. 3.1: It is our opinion that the assigned weights to seven evaluation criteria will provide uniformity and consistency in evaluation and selection of remedial actions.

Comment No. 3.2: Since Applicable or Relevant and Appropriate Requirements (ARARs) and protectiveness are threshold criteria, i.e. statutory mandates which must be met at every site (in the absence of an ARAR waiver), the utility of weights for these criteria is questionable.

Response No. 3.2: Since there may be instances where part of the ARARS may not be met, for an alternative, it is prudent to have weighting factors so that a remedial alternative which meets the ARARs will be given greater weight than the one which does not meet all or some of the ARARs.

Although, it is a statutory mandate that all remedies meet environmental and health protectiveness, some remedial actions provide greater protectiveness than others and, hence, the utility of a weighing factor is justified.

Comment No. 3.3: Division of implementability into its technical and administrative components is a moot point if an alternative is not implementable for any reason. In addition, assigning points to an unimplementable alternative will not create an implementable remedy.

Response No. 3.3: Alternatives will be evaluated based on implementability and effectiveness during the preliminary screening. An alternative not being technically feasible for implementation will not be considered in the detailed analysis.

However, alternatives which pass the preliminary screening will have several degrees of implementability. Some technologies will be more reliable than others; some remedial alternatives will need less administrative requirements than others; availability of services and materials may be easier for some remedial technologies than others. The implementability criterion will consider such factors in the detailed analysis of alternatives.

Comment No. 3.4: How will the contaminant-specific cleanup criteria and ARARs be determined?

Response No. 3.4: Contaminant-Specific cleanup criteria and ARARs will be determined for every site, in cooperation with the Department of Health on a site-specific basis.

Comment No. 3.5: We oppose having cost as one of the seven evaluation criteria in detailed analysis of alternatives. The law requires the selection of a cost-effective remedial method, not a less-expensive method. We recommend the establishment of a third tier using cost as a final selector after the remedial methods have been screened according to the six proposed criteria. Thus, the Department would select a number of remedial methods based on their effectiveness, performance, and environmental and health goals, and then, it would determine which of the resulting methods is the most cost-effective. By allowing cost to be included in the second decision-making tier, it negatively offsets the human health, environment and ARARs criteria. This is inappropriate and, we believe, a divergence from the intent of the Environmental Conservation Law.

Although we support DEC's written clarification of the remedy selection process, we believe that considerations of cost-effectiveness should play a narrow role in the cleanup selection process, and should not interfere with the attainment of permanent and health-protective cleanups.

Response No. 3.5: Under the proposed procedure for evaluating remedies, cost does not negatively offset human health, environment and ARARs criteria. Effectiveness of each remedial alternative in protecting human health and the environment is evaluated during the preliminary screening. It is to be noted that cost is not considered during the preliminary screening. Only those remedies which meet this requirement pass through to the second stage of detailed analysis. In order to effectively complete a detailed comparison of remedial alternatives, the cost of each alternative must be analyzed. Since cost is only one of the seven factors being considered and since a determination will have already been required that the remedies being analyzed are protective of human health and the environment, this analysis ensures that the selection of the remedy meets all statutory requirements under both state and federal laws.

Comment No. 3.6: We strongly endorse the approach required by the federal Superfund Amendments and Reauthorization Act, which allows consideration of cost-effectiveness only after EPA has determined the appropriate level of environmental protection to be achieved. The State Superfund Management Board's current report recommends that the State adopt parallel requirements to those in SARA.

Response No. 3.6: The NYSDEC's approach is more stringent than the USEPA's approach currently being used or outlined in the proposed NCP. USEPA considers cost as a criterion in the preliminary screening process. The NYSDEC's guidance document includes only effectiveness in protecting human health and the environment and implementability in the preliminary screening. Cost is considered only in the detailed analysis for remedial alternatives which pass the preliminary screening. DEC's approach in selection of remedial action is consistent with the requirements of SARA.

Comment No. 3.7: Section 5.2.3 states that "an individual who performs the analysis should use his/her best professional judgement in assigning score" for the short-term effectiveness criteria. We request that the Department staff seriously consider the public comments on this and all the criteria when assigning a score.

Response No. 3.7: Short-term effectiveness of a remedial alternative will be evaluated and assigned a score based on the analysis of factors presented in Table 5-2.

Comment No. 3.8: Section 5.2.3.2 only gives long-term effectiveness and permanence a relative weight of 10. We recommend 20 as this is a top priority criteria in terms of the overall remedial goal. It is more important than the short-term effectiveness and will have a greater negative impact if it fails.

Response No. 3.8: Please refer to Table 5.1 for revised weighing factors. The long-term effectiveness is assigned a score of 15 and short-term effectiveness is assigned a score of 10.

Comment No. 3.9: The potential for risk in relation to treatment residuals and/or untreated wastes is a very important aspect of the long-term effectiveness. The magnitude of remaining risk should be compared to the risk in the pre-existing conditions of the site (based on the available data). The potential for risk should not just be measured in cancer risk levels as this is very inadequate and does not include many other negative health impacts, such as respiratory disease, organ damage, nervous system damage and immune system damage. There should be a separate risk assessment process established by the Department of Health for this and other risk analysis activities in the remedial selection and these risk assessment processes should always allow for community input and community representation in the decision-making process.

Response No. 3.9: During the RI/FS, necessary risk assessment would be performed. As indicated on Table 5.7, remedial alternatives will be evaluated based on any post-remediation exposure via air, groundwater/surface water media and magnitude of residual public health and environmental risks after remediation.

Comment No. 3.10: Section 5.2.3.3. Again, we must point out the divergence from state law in the following statement. "This preference is satisfied when treatment is used to reduce the principal threats at a site..." Eliminating the significant threats to the environment versus "reducing principal threats at a site" is very different. The quantification of reduction is based on subjective variables. A goal of eliminating significant threats is what the law requires.

Response No. 3.10: This language has been modified to be consistent with the statutory requirements.

Comment No. 3.11: Again, we strongly oppose the inclusion of cost and its relative weight score of 15 at this stage of the decision-making process. We strongly oppose the following statement and believe it highlights the divergence of the Department from implementing the legally mandated "cost-effective" criteria which is quite different from cost induced trade-offs. "The distribution of costs over time will be a critical factor in making trade-offs between capital-intensive technologies (including alternative treatment technologies) and less capital-intensive technologies (such as pump and treatment systems)."

Response No. 3.11: Under this policy, cost does not limit the Department from implementing the capital-intensive technologies. As outlined in Section 5.2.3.5, cost consists of capital cost, operation and maintenance cost, future capital cost and cost of future land use. The evaluation of remedial alternatives will also include the costs of future remedial actions when there is a reasonable expectation that a major component of the remedial alternative may fail and require replacement to prevent unwarranted exposure to contaminants. Also, any remedial action that leaves hazardous wastes at a site may affect future land use and perhaps groundwater and surface water use. Access or use of such sites most probably will be restricted to some degree, resulting in loss of business activities, residential development and taxes to the local, state and federal governments. During the FS, potential future land use and the economic loss attributable to such restriction should be determined and included as a cost of the remedial alternatives which do not remediate the site to unrestricted use. Otherwise, the evaluation of the alternatives which fail to remediate the site for unrestricted use will not accurately reflect their real costs. In addition, the continuing presence of an inactive hazardous waste site not remediated to unrestricted use, even though remediated, may have a negative effect on surrounding property values. This loss in value will also be considered as a cost of the remedial program developed for a site.

Comment No. 3.12: On the accuracy of cost estimates, we are surprised by the wide range of discrepancy (+50 to -30). Is this a standard range of expected accuracy?

Response No. 3.12: Yes. According to guidance for conducting Remedial Investigations and Feasibility Studies under CERCLA, prepared by USEPA, typically these "study estimate" costs made during the FS are expected to provide an accuracy of +50 percent to -30 percent. This range of accuracy has been used for a number of years for CERCLA sites. Detailed designs have not been completed at the FS stage 6. More refined cost estimates cannot be made until the design phase is complete.

Comment No. 3.13: Section 5.2.3.6 notes that the "actual determination of which requirements are applicable or relevant and appropriate is made by the DEC in consultation with the DOH." What is the process for public input at this stage? We recommend that each component of ARARs that does not comply should receive a -10.

Response No. 3.13: All ARARs including cleanup criteria will be determined by DEC in consultation with DOH during the first phase RI/FS. As mentioned earlier, this first phase RI/FS report will be available for public review and comment. A remedial alternative will receive scores for components of ARARs that are met.

Comment No. 3.14: Section 5.2.3.7 on overall protection of human health and the environment only has a relative weight score of 15. We recommend at least a score of 25, as this is an important criteria which truly implements the remedial goal to eliminate the significant threat to the environment.

An alternative with the least protection or with remaining contamination which poses a threat or increased risk should receive a 0. If the alternative method leaves contamination which is a significant risk, it should receive a -50.

Response No. 3.14: We agree that this is an important criteria which implements the remedial goal to eliminate the significant threat to public health and environment. Protection of human health and the environment is assigned a score of 20. It is to be emphasized that an alternative which does not protect the public health or environment will not pass the preliminary screening and will not be considered in the detailed analysis. Since some remedial actions provide greater protectiveness than others, the weighing score is used.

Comment No. 3.15: We recommend the deletion of the following sentence which provides a significant loophole. "It may not be necessary or appropriate to address every factor for each alternative being evaluated and, furthermore, it may be useful to address other factors to ensure a better understanding of how an alternative is evaluated against the criteria."

Response No. 3.15: This sentence under section 5.2.4 is deleted.

Comment No. 3.16: Do we have the State ARARs that address the question of "how clean is clean" for any contaminated soil cleanups for inactive hazardous waste sites?

For cancer risk assessment, what cancer risk level will be selected? 1:10,000 or 1:1,000,000?

Response No. 3.16: As stated elsewhere, all ARARs, including soil/sediment cleanup criteria will be determined for each site, in consultation with DOH. DOH will utilize appropriate risk level in addition to several other factors such as migration pathways, exposures routes, etc. in determining soil cleanup criteria.

Comment No. 3.17: I would like to see the detailed analysis of alternatives section be expanded to be more specific in evaluating ecological damage associated with the alternatives. I would include the damage that will be done through the resuspension of sediments, the possible release of currently bound materials, and the modification of land forms. Perhaps a risk assessment of the various alternatives associated with remediation would also be in order. I see this as especially important for river sediments.

Response No. 3.17: Alternatives to remediate river sediments will be evaluated for the seven criteria which include short-term effectiveness, long-term effectiveness and permanence and protection of public health and environment. In an environmentally sensitive site, pertinent short-term and long-term environment risks and benefits of the alternatives will be evaluated during the feasibility study.

Comment No. 3.18: The overall ranking scheme seems to be weighted toward the protection of human health as opposed to the protection of the environment. The environment should be given additional relative weight instead of being lumped in with human health.

Response No. 3.18: Table 5.1 summarizes seven criteria and their scores. Although, there is not a single criterion specifically for the protection of environment, short-term effectiveness, compliance with ARARs and protection of human health and the environment address the environmental risk and impact. In an environmentally sensitive site, pertinent environmental criteria/standards could be the driving factors in the evaluation of remedial alternatives.

Comment No. 3.19: Section 5.2.3.6 says that an alternative which complies with none of the ARARs should receive a score of 0. I assume this means that a waiver to the ARARs is appropriate. If a waiver is not appropriate, the alternative should be thrown out unless the non-attainment of the ARAR is part of every alternative.

Response No. 3.19: If an alternative does not meet the ARARs and a waiver to the ARARs is not appropriate or justifiable, this alternative will not be further considered.

4. COMMUNITY ASSESSMENT

Comment No. 4.1: Although the proposed policy addresses community acceptance at a later point in the decision-making process, it may be prudent to elevate it to an evaluation criterion to deal with those sites where community reactions would preclude implementation of a recommended alternative.

Response No. 4.1: The public will have the first opportunity to understand and evaluate the remedial alternatives when the draft Feasibility Study (FS) report is distributed. It is not feasible to evaluate community reactions to remedial alternatives in the draft FS report. It is appropriate to consider community reactions after the draft FS is presented to and discussed with the public. All public comments on the draft FS report will be considered prior to the selection of remedial action. The public comments will be sought in accordance with New York State Inactive Hazardous Waste Site Citizen Participation Plan and other statutory and regulatory requirements.

Comment No. 4.2: Section 5.2.2 states that "community acceptance" is encompassed in the seven evaluation criteria. How do the seven criteria encompass "community acceptance"? Also, there is an important distinction between community "acceptance" and community preference or the community's recommendation. One assumes a passive community with the underlying assumption being that the Department has to convince the community of its decision. Whereas community preference assumes a meaningful public participation process where the Department incorporates in its decision-making process, the recommendations of the community residents who will be impacted by the remedial method chosen. Community recommendations is an accurate and respectful term.

There is obviously not a lot of time for meaningful community input when the "final remedy selection decision is being made", thus the Department staff should conduct a proactive outreach effort at this critical stage of the decision-making process.

Response No. 4.2: The distinction between "community acceptance" and "community preference" is recognized and appropriate changes are made in the document. The department will solicit public comments and input in accordance with the document titled, "New York State Inactive Hazardous Waste Site Citizen Participation Plan, dated August 30, 1988 and other statutory and regulatory requirements.

Public comments will be solicited on the first phase of the RI/FS report. The first phase of the RI/FS report usually includes the first set of environmental quality data describing conditions at the site and preliminary discussion of alternative remedial technologies. During this public comment opportunity, interested citizens can notify the Department of remedial technologies of interest to them. If the community preferred technologies are technically feasible for the site-specific conditions, they will be evaluated in the final phase of the RI/FS.

APPENDIX B

NYSDEC DIVISION TECHNICAL AND ADMINISTRATIVE GUIDANCE MEMORANDUM (TAGM HWR-92-4044) ACCELERATED REMEDIAL ACTIONS AT CLASS 2, NON-RCRA REGULATED LANDFILLS

HWR-92-4044
March 9, 1992

New York State Department of Environmental Conservation

MEMORANDUM

TO: Reg. Haz. Waste Remediation Engineers, Bur. Dir., & Section Chiefs
FROM: Michael J. O'Toole, Jr., Director, Div. of Haz. Waste Remediation
SUBJECT: DIVISION TECHNICAL AND ADMINISTRATIVE GUIDANCE MEMORANDUM: ACCELERATED REMEDIAL ACTIONS AT CLASS 2, NON-RCRA REGULATED LANDFILLS
DATE:

MAR - 9 1992

Michael J. O'Toole

On January 14, 1992, Deputy Commissioner Sullivan signed the Strategic Plan: Accelerated Remedial Actions which provides guidance concerning Class 2, non-RCRA regulated landfills.

Since this Strategic Plan is an important element in the Division's program, it is also being issued as a Technical and Administrative Guidance Memorandum.

Attachment
cc: E. Sullivan
D. Markell
J. Eckl
R. Davies
R. Dana
C. Goddard
A. Carlson
E. McCandless
P. Counterman
A. Fossa
J. Kelleher
J. Colquhoun
D. Persson
M. Birmingham
D. Johnson
D. Ritter
Regional Directors
Regional Engineers
Regional Solid and Hazardous Waste Engineers
Regional Citizen Participation Specialists

January 14, 1992

STRATEGIC PLAN: ACCELERATED REMEDIAL ACTIONS

Issue: Accelerated Remedial Actions at Class 2, Non-RCRA Regulated Landfills

Priority: High

Responsible Person: Michael J. O'Toole, Jr.

OBJECTIVES:

The Department has adopted a policy favoring permanent remedies whenever feasibile at inactive hazardous waste sites. However, it is often obvious that major mixed waste landfills will not be amenable to complete permanent remedies and that a cap will be called for. In such cases, it may be appropriate to proceed rapidly to the design phase.

To mitigate the major source of contamination posed by Class 2 landfills as early as possible. The Remedial Investigation/Feasibility Study (RI/FS) process for Class 2 sites requires the identification of feasible remedial technologies which are screened and then organized into various remedial alternatives. For source control options at Class 2, non-RCRA regulated landfills, this process may be somewhat simplified and accelerated due to the typical large size and the composition of these landfills. Most Class 2 landfills are composed of substantial quantities of municipal solid waste (MSW) mixed with smaller quantities of hazardous waste (this is not true of pre-RCRA industrial landfills which are not addressed in this guidance). While a complete RI/FS is warranted at these sites to determine the full extent of contamination and any risks posed to human health and/or the environment, certain remedial measures should be evaluated very early in the RI/FS process for possible accelerated implementation based on historic data, early treatability tests, risk assessment or technologically based results with a bias for initiating appropriate remedial actions as early as possible in the remedial process.

STRATEGY:

Identify several remedial measures for Class 2, non-RCRA regulated landfills which would be evaluated, on a site-specific basis, for accelerated implementation. This document describes technical considerations which must be included in this evaluation. It is not intended to describe all remedial design considerations for these remedial actions, but rather to aid in making the decision to proceed with design. If accelerated remedial actions are identified prior to consent order negotiations, these remedial actions should be negotiated into the consent order with the appropriate timeframes for a focused FS or a Departmental analysis of alternatives, opportunity for public input including a public comment period, as appropriate, and Record of Decision.

GUIDANCE:

At some landfills, at least the first phase of RI work may need to be completed to evaluate the following technologies. In many instances, it may be possible to evaluate these technologies at the very onset of the RI. If any accelerated remedial actions are implemented within the context of this document, those actions must be assessed in a focused Feasibility Study or Departmental analysis of alternatives.

I. Source Control Technology #1:

A. Placement of a final cover (capping) in accordance with 6NYCRR Part 360 will be a minimum requirement for all Class 2, non-RCRA regulated landfills unless the variance requirements under Part 360-1.7(c) are met. Since one component of the Part 360 cap is a gas venting system, these emissions must be addressed in the design of that cap.

B. Technical considerations to be evaluated under capping option:

1. RCRA capping requirements will be sufficiently addressed by a properly designed cap which, at a minimum, would meet the Part 360 capping requirements for a typical, non-RCRA regulated landfill. RCRA capping requirements are applicable or relevant to landfills which accept RCRA hazardous waste. Typical Class 2, non-RCRA regulated landfills accepted predominantly municipal/commercial waste along with a lesser amount of RCRA hazardous waste. Therefore, for most Class 2, non-RCRA regulated landfills, a properly designed cap which meets or exceeds the Part 360 capping requirements is appropriate but must consider the appropriateness of RCRA capping requirements. The design engineer must also consider frost penetration and its effect on the low permeability barrier, subsidence of the waste material, and run-off controls to minimize water erosion problems. NOTE: EPA handbook, "Remedial Action at Waste Disposal Sites", Sections 3.1, 3.3, 3.4 and 3.5 should be used as guidance for proper cap design.

2. Any areas or potential areas within the landfill mass (hot spots) which are amenable to on-site treatment or removal and treatment must be addressed prior to capping. Hot spots may be identified by past disposal practices (discrete areas for drum disposal), geophysical testing, soil gas surveys, soil borings/testing, test pits, etc. If hot spots are identified they should be evaluated to determine the feasibility of remediating them.

3. Any on-site or off-site areas (contaminated soils or sediments) which have the potential for consolidation into the main landfill must be addressed prior to

capping. These areas would be identified by geophysical testing, test pits, soil borings, and soil/sediment testing.

4. The entire landfill area must be adequately defined to allow the determination of final grades and elevations. This may be determined by past disposal practices, geophysical testing, test pits, and soil borings.

5. The capping should be phased to allow deposition onto an uncapped area of drilling/trench spoils from monitoring well installation, groundwater recovery well installation, or leachate/groundwater collection trench excavations providing the phasing doesn't prolong the overall capping schedule. This will be influenced by the size of the landfill and the timing and duration of remedial design.

II. Source Control Technology #2:

A. A leachate collection system will be required at most Class 2, non-RCRA regulated landfills. The design and construction of this system must be integrated with the design and construction of the cap.

B. Technical considerations to be evaluated under leachate collection option:

1. The depth of waste and areal extent of waste must be adequately defined to allow determination of final elevations and location of leachate collection system.

2. Any potential for on-site consolidation of wastes which may affect the final location of the leachate collection system must be considered.

3. The pathways for leachate must be adequately defined to aid in total capture.

4. The need for a vertical barrier to minimize the collection of uncontaminated groundwater must be assessed.

5. All reasonable steps should be taken to prevent or control the impacts of leachate on human health.

III. Treatment Technology #1:

A. Treatment of collected leachate to meet discharge standards will be required at all Class 2, non-RCRA regulated landfills which require a leachate collection system. The reason it is considered separately from the leachate collection system in this guidance is due to the sequencing of events. While the design and construction of leachate collection systems must be integrated with the design and construction of the cap, the selection, design, and construction of a leachate treatment system may need to be done subsequent to cap construction. If a leachate treatment system is needed to coincide with the construction of the leachate collection system, the design and construction of a leachate treatment system should be concurrent with the cap design.

B. Technical considerations to be evaluated under leachate treatment option:

1. The leachate may have to be handled as a hazardous waste or it may be handled as any other non-hazardous, landfill leachate. If chemical analysis of the leachate reveals that there are no hazardous constituents in it which could have leached from or been derived from the known hazardous waste in the landfill and the leachate does not fail any RCRA characteristic tests (ignitable, corrosive, reactive, TCLP) or the leachate can be pretreated on site to those levels, then the leachate may be able to be handled as any other non-hazardous, landfill leachate.

2. The collected leachate should be economically treated in an environmentally sound manner in the short term until the final leachate/groundwater remedy is selected. One possibility would be to use a POTW for treatment if the POTW is willing to accept the leachate and can treat the contaminants contained in the leachate.

3. Leachate treatment options may need to be thoroughly evaluated in a feasibility study. This is perhaps the most important consideration in evaluating whether to proceed with the design of a leachate treatment option prior to completion of the RI/FS. Selection of a treatment technology which has been successful at other sites at the exclusion of other options could result in inefficiency or higher costs due to site-specific conditions and would not properly consider all available treatment technologies.

4. If treatment of contaminated groundwater is a strong possibility, it may make more sense to design one treatment system (after the Record of Decision) for both leachate and groundwater unless a modular leachate treatment system can be constructed such that it is easily expanded to treat groundwater or the leachate/groundwater contaminants and their concentrations are sufficiently different to warrant different treatment technologies.

5. The quantity of leachate requiring treatment must be considered along with available discharge points.

6. Provisions to reinject stabilized sludge from the leachate treatment system back into the landfill should be considered within the applicable regulatory and legal constraints.

IMPLEMENTATION PROCESS:

Source control measures described in this guidance when implemented must follow a clear, documented decision process as described below:

1. Recommendation of any or all of the above accelerated remedial actions will be made based on a careful evaluation of all technical considerations (at a minimum, the technical considerations in this guidance must be addressed).

2. A focused FS or Departmental analysis of alternatives must be performed to evaluate the feasibility of accelerating the construction of a cap/leachate system.

3. Any viable remedial actions which are identified in the focused FS or Departmental analysis of alternatives must be presented for public comment through the normal PRAP/ROD process in accordance with DHWR TAGM 4022 to the fullest extent possible.

The design of the early remedial measures should proceed as soon as possible after the responsiveness summary is mailed. Public participation during design and construction must, at a minimum, meet the requirements of the New York State Inactive Hazardous Waste Site Citizen Participation Plan.

An accelerated remedial action which is documented by a ROD must be tracked as a separate operable unit for that site, not as an IRM. However, the ROD will not be tracked as an RI/FS completion since there would only be a design and construction phase associated with that operable unit.

This Strategic Plan is hereby approved for use by the Division of Hazardous Waste Remediation.

Edward O. Sullivan

D. Smith

(12-75)

New York State Department of Environmental Conservation

HWR-90-4030
REVISED MAY 1 5 '90

MEMORANDUM

TO: Regional Hazardous Waste Remediation Engineers, Bureau Directors & Section Chiefs

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

SUBJECT: **REVISED TAGM - SELECTION OF REMEDIAL ACTIONS AT INACTIVE HAZARDOUS WASTE SITES**

DATE: MAY 15 1990

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 of 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 and 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.

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Bureau of
Program Management

If there is any uncertainty as to whether documents should be withheld or released in a particular case, the program attorney or regional attorney should be consulted prior to sending out a response.

cc: E. Sullivan
G. Greeley
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NEW YORK STATE DEPARTMENT OF
ENVIRONMENTAL CONSERVATION
DIVISION OF HAZARDOUS WASTE REMEDIATION
ALBANY, NEW YORK 12233-7010

TECHNICAL AND ADMINISTRATIVE GUIDANCE MEMORANDUM (TAGM)

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. **IMPLEMENTATION 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.

(a) 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);"**

(b) 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 granulated 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;

(c) 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 hence the **availability of the inorganic hazardous wastes to environmental transport and uptake.**

(d) 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 barrier to control migration of leachate, contaminated groundwater and surface runoff, solidification/fixation of organic hazardous wastes, and pumping and treatment of contaminated leachate/groundwater.

(e) 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:

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

or

(ii) 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

(iii) a RCRA Part B permit;

or

(iv) a RCRA Research and Development permit.

or

(v) 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. <u>**PRELIMINARY SCREENING OF REMEDIAL ALTERNATIVES**</u>: 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 <u>not</u> 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:

(i) significant loss of the surface cover such as clay cap with a potential for exposure of waste material underneath the cap;

(ii) contamination of the groundwater by the leachate from the waste material;

(iii) contamination of the adjoining surface water by the leachate from the waste material or by the contaminated groundwater;

(iv) structural failure of the control or isolation technology.

Table 4.1 should be used in evaluating the effectiveness of each alternative in protecting human health and the environment. If an alternative is scored less than 10 out of a maximum score of 25, project manager may consider rejecting that remedial alternative from further consideration.

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 obtain approvals 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.**

Implementability of each remedial alternative should be evaluated using Table 4.2. If an alternative does not score a minimum of eight out of a possible maximum 15, then the Project Manager has the option of screening out this alternative from further consideration.

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:

- o Be protective of human health and the environment
- o Attain SCGs (explain why compliance with SCGs was not needed to protect public health and the environment)
- o 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)
- o 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:

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

o 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 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 selection of a remedy. The seven evaluation criteria 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 shown in Table 5-1 and discussed in the following sections. The weight for each criteria is also noted in Table 5-1.

5.2.3 Analysis of Individual Alternatives

5.2.3.1 Compliance with Applicable New York State Standards, Criteria and Guidelines (SCGs) (Relative Weight = 10)

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.

If an alternative complies with all SCGs, it should be assigned a full score of 10. If an alternative complies with none of the above-mentioned four specific aspects of the SCGs, it should receive a score of 0. Each component of the four specific aspects of the SCGs shall receive a maximum score of 2.5. **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.** Table 5.2 may be used to evaluate remedial alternatives.

5.2.3.2 Overall Protection of Human Health and the Environment (Relative Weight = 20)

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.

Table 5.3 outlines pertaining questions to be answered in order to assist the evaluator in assigning relative weighing scores to remedial alternatives.

5.2.3.3 Short-term Impacts and Effectiveness (Relative Weight: 10): 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:

(i) 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.

(ii) 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.

(iii) 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.

(iv) 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.

Score for this criterion should be assigned based on the analysis of factors (i), (ii), (iii) presented in Table 5.4. 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 (Relative Weight = 15)

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 and operating system necessary for the remedy to remain effective. The following components of the criterion should be addressed for each alternative:

- o Permanence of the remedial alternative.
- o 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 of their toxicity, mobility, and propensity to bio-accumulate.
- o 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.
- o 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.

Table 5.5 should be used during the analysis to assign scores for this criterion.

5.2.3.5 Reduction of Toxicity, Mobility and Volume (Relative Weight = 15)

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:

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

Table 5.6 lists typical questions to be addressed during the analysis of toxicity, mobility, or volume reduction.

Table 5.6 should be used as the basis for evaluation of remedial alternatives and in assigning score for this criteria.

5.2.3.6 Implementability (Relative Weight = 15): Of the total weight of 15, the technical feasibility shall receive a maximum score of 10 while administrative feasibility and availability of services and materials shall be assigned a combined maximum score of 5.

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:

o 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 for 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.

Table 5-5 should assist the evaluator in determining degree of technical feasibility among remedial alternatives. The maximum score for the technical feasibility is 10.

o 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)

o 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.

A combined scoring not to exceed five should be assigned to administrative feasibility and availability of services and materials.

Table 5.7 lists typical questions to be addressed during the analysis of administrative feasibility and availability of services and materials.

5.2.3.7 <u>Cost (Relative Weight = 15)</u>

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:

o 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 action O&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, these "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:

- o The effective life of a remedial action
- o The O&M costs
- o The duration of cleanup
- o The volume of contaminated material, given the uncertainty about site conditions
- o Other design parameters (e.g. the size of the treatment system)
- o 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.

An alternative with the lowest present worth shall be assigned the highest score of 15. Other alternatives shall be assigned the cost score inversely proportional to their present worth.

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 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, differences in total scores, etc. 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 rational 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.

Table 4.1

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening		Score
1. Protection of community during remedial actions.	o Are there significant short-term risks to the community that must be addressed? **(If answer is no, go to Factor 2.)**	**Yes** ___ **No** ___	0 4
	o Can the short-term risk be easily controlled?	**Yes** ___ **No** ___	1 0
	o Does the mitigative effort to control short-term risk impact the community life-style?	**Yes** ___ **No** ___	0 2
Subtotal (maximum = 4)			
2. Environmental Impacts	o Are there significant short-term risks to the environment that must be addressed? (**If answer is no, go to Factor 3.)**	**Yes** ___ **No** ___	0 4
	o Are the available mitigative measures reliable to minimize potential impacts?	**Yes** ___ **No** ___	3 0
Subtotal (maximum = 4)			
3. Time to implement the remedy.	o What is the required time to implement the remedy?	**≤ 2yr.** ___ **> 2yr.** ___	1 0
	o Required duration of the mitigative effort to control short-term risk.	**≤ 2yr.** ___ **> 2yr.** ___	1 0
Subtotal (maximum = 2)			
4. On-site or off-site treatment or land disposal	o On-site treatment* o Off-site treatment* o On-site or off-site land disposal		3 1 0
Subtotal (maximum = 3)			
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes			
5. Permanence of the remedial alternative.	o Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 7.)**	**Yes** ___ **No** ___	3 0
Subtotal (maximum = 3)			

Table 4.1 (cont'd)

SHORT-TERM/LONG-TERM EFFECTIVENESS
(Maximum Score = 25)

Analysis Factor	Basis for Evaluation During Preliminary Screening		Score
6. Lifetime of remedial actions.	° Expected lifetime or duration of of effectiveness of the remedy.	25-30yr. ____	3
		20-25yr. ____	2
		15-20yr. ____	1
		< 15yr. ____	0
Subtotal (maximum = 3)			
7. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	**None** ____	3
		≤ 25% ____	2
		25-50% ____	1
		≥ 50% ____	0
	ii) Is there treated residual left at the site? **(If answer is no, go to Factor 8.)**	**Yes** ____	0
		No ____	2
	iii) Is the treated residual toxic?	**Yes** ____	0
		No ____	1
	iv) Is the treated residual mobile?	**Yes** ____	0
		No ____	1
Subtotal (maximum = 5)			
8. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	**< 5yr.** ____	1
		> 5yr. ____	0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? **(If answer is no, go to "iv")**	**Yes** ____	0
		No ____	1
	iii) Degree of confidence that controls can adequately handle potential problems.	**Moderate to very confident** ____	1
		Somewhat to not confident ____	0
	iv) Relative degree of long-term monitoring required **(compare with other remedial alternatives)**	**Minimum** ____	2
		Moderate ____	1
		Extensive ____	0
Subtotal (maximum = 4)			
TOTAL (maximum = 25)			

IF THE TOTAL IS LESS THAN 10, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 4.2

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening		Score
1. Technical Feasibility			
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	___	3
	ii) Somewhat difficult to construct. No uncertainties in construction.	___	2
	iii) Very difficult to construct and/or significant uncertainties in construction.	___	
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___	3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	___	2
c. Schedule of delays due to technical problems.	i) Unlikely	___	2
	ii) Somewhat likely	___	1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___	2
	ii) Some future remedial actions may be necessary.	___	1
Subtotal (maximum = 10)			
2. Administrative Feasibility			
a. Coordination with other agencies.	i) Minimal coordination is required.	___	2
	ii) Required coordination is normal.	___	1
	iii) Extensive coordination is required.	___	0
Subtotal (maximum = 2)			
3. Availability of Services and Materials			
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	Yes ___ No ___	1 0
	ii) Will more than one vendor be available to provide a competitive bid?	Yes ___ No ___	 0

Table 4.2 (cont'd)

IMPLEMENTABILITY
(Maximum Score = 15)

Analysis Factor	Basis for Evaluation During Preliminary Screening		Score
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	**Yes** ____	1
		No ____	0

Subtotal (maximum = 3)

TOTAL (maximum = 15)

IF THE TOTAL IS LESS THAN 8, PROJECT MANAGER MAY REJECT THE REMEDIAL ALTERNATIVE FROM FURTHER CONSIDERATION.

Table 5.1
CRITERIA FOR DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS, CRITERIA AND GUIDELINES (SCGs)(10)

- Compliance With Contaminant-Specific SCGs
- Compliance With Action-Specific SCGs
- Compliance With Location-Specific SCGs

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT (20)

- Environmental Impacts
- Transport of Hazardous Materials
- Health Impacts

SHORT-TERM EFFECTIVENESS (10)

- Protection of Community During Remedial Actions
- Protection of Workers During Remedial Actions
- Environmental Impacts
- Time Until Remedial Action Objectives Are Achieved

LONG-TERM EFFECTIVENESS & PERMANENCE (15)

- Magnitude of Residual Risk
- Adequacy of Controls
- Reliability of Controls

REDUCTION OF TOXICITY, MOBILITY AND VOLUME (15)

- Treatment Process Used and Materials Treated
- Amount of Hazardous Materials Destroyed or Treated
- Degree of Expected Reductions in Toxicity, Mobility and Volume
- Degree to Which Treatment is Irreversible
- Type and Quantity of Hazardous Residuals Remaining After Treatment

IMPLEMENTABILITY (15)

- Ability to Construct and Operate the Technology
- Reliability of the Technology Based on its Acceptable Demonstrations
- Ease of Undertaking Additional Remedial Actions, if Necessary
- Ability to Monitor Effectiveness of Remedy
- Availability of Necessary Equipment and Specialists
- Timing of New Technology Under Consideration

COST (15)

- Immediate Capital Costs
- Operating and Maintenance Costs
- Future Capital Costs
- Cost to Future Land Use
- Present Worth Cost

Table 5.2

COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE NEW YORK STATE STANDARDS CRITERIA AND GUIDELINES (SCGs)
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
1. Compliance with chemical-specific SCGs	Meets chemical specific SCGs such as groundwater standards	**Yes** ___ **No** ___	4 0
2. Compliance with action-specific SCGs	Meets SCGs such as technology standards for incineration or landfill	**Yes** ___ **No** ___	3 0
3. Compliance with location-specific SCGs	Meets location-specific SCGs such as Freshwater Wetlands Act	**Yes** ___ **No** ___	3 0

TOTAL (Maximum = 10)

Table 5.3

PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT
(Relative Weight = 20)

Analysis Factor	Basis for Evaluation During Detailed Analysis			Score
1. Use of the site after remediation.	Unrestricted use of the land and water. **(If answer is yes, go to the end of the Table.)**	**Yes**	___	20
		No	___	0
TOTAL (Maximum = 20)				
2. Human health and the environment exposure after the remediation.	i) Is the exposure to contaminants via air route acceptable?	**Yes**	___	3
		No	___	0
	ii) Is the exposure to contaminants via groundwater/surface water acceptable?	**Yes**	___	4
		No	___	0
	iii) Is the exposure to contaminants via sediments/soils acceptable?	**Yes**	___	3
		No	___	0
Subtotal (maximum = 10)				
3. Magnitude of residual public health risks after the remediation.	i) Health risk	**≤ 1 in 1,000,000**	___	5
	ii) Health risk	**≤ 1 in 100,000**	___	2
Subtotal (maximum = 5)				
4. Magnitude of residual environmental risks after the remediation.	i) Less than acceptable		___	5
	ii) Slightly greater than acceptable		___	3
	iii) Significant risk still exists		___	0
Subtotal (maximum = 5)				
TOTAL (maximum = 20)				

Table 5.4

SHORT-TERM EFFECTIVENESS
(Relative Weight = 10)

Analysis Factor	Basis for Evaluation During Detailed Analysis			Score
1. Protection of community during remedial actions.	○ Are there significant short-term risks to the community that must be addressed? **(If answer is no, go to Factor 2.)**	**Yes**	___	0
		No	___	4
	○ Can the risk be easily controlled?	**Yes**	___	1
		No	___	0
	○ Does the mitigative effort to control risk impact the community life-style?	**Yes**	___	0
		No	___	2
Subtotal (maximum = 4)				
2. Environmental Impacts	○ Are there significant short-term risks to the environment that must be addressed? **(If answer is no, go to Factor 3.)**	**Yes**	___	0
		No	___	4
	○ Are the available mitigative measures reliable to minimize potential impacts?	**Yes**	___	3
		No	___	0
Subtotal (maximum = 4)				
3. Time to implement the remedy.	○ What is the required time to implement the remedy?	**≤ 2yr.**	___	1
		> 2yr.	___	0
	○ Required duration of the mitigative effort to control short-term risk.	**≤ 2yr.**	___	1
		> 2yr.	___	0
Subtotal (maximum = 2)				
TOTAL (maximum = 10)				

Table 5.5

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = .15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
1. On-site or off-site treatment or land disposal	° On-site treatment*		3
	° Off-site treatment*		1
	° On-site or off-site land disposal		0
Subtotal (maximum = 3)			
*treatment is defined as destruction or separation/ treatment or solidification/ chemical fixation of inorganic wastes			
2. Permanence of the remedial alternative.	° Will the remedy be classified as permanent in accordance with Section 2.1(a), (b), or (c). **(If answer is yes, go to Factor 4.)**	**Yes** ____	3
		No ____	0
Subtotal (maximum = 3)			
3. Lifetime of remedial actions.	° Expected lifetime or duration of of effectiveness of the remedy.	25-30yr.____	3
		20-25yr.____	2
		15-20yr.____	1
		< 15yr.____	0
Subtotal (maximum = 3)			
4. Quantity and nature of waste or residual left at the site after remediation.	i) Quantity of untreated hazardous waste left at the site.	**None** ____	3
		≤ 25% ____	2
		25-50% ____	1
		≥ 50% ____	0
	ii) Is there treated residual left at the site? **(If answer is no, go to Factor 5.)**	**Yes** ____	0
		No ____	2
	iii) Is the treated residual toxic?	**Yes** ____	0
		No ____	1
	iv) Is the treated residual mobile?	**Yes** ____	0
		No ____	1
Subtotal (maximum = 5)			

Table 5.5 (cont'd)

LONG-TERM EFFECTIVENESS AND PERMANENCE
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
5. Adequacy and reliability of controls.	i) Operation and maintenance required for a period of:	**< 5yr.** ___	1
		> 5yr. ___	0
	ii) Are environmental controls required as a part of the remedy to handle potential problems? **(If answer is no, go to "iv")**	**Yes** ___	0
		No ___	1
	iii) Degree of confidence that controls can adequately handle potential problems.	**Moderate to very confident** ___	1
		Somewhat to not confident ___	0
	iv) Relative degree of long-term monitoring required **(compare with other remedial alternatives)**	**Minimum** ___	2
		Moderate ___	1
		Extensive ___	0
Subtotal (maximum = 4)			
TOTAL (maximum = 15)			

Table 5.6

REDUCTION OF TOXICITY, MOBILITY OR VOLUME

(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Sco.
1. Volume of hazardous waste reduced (reduction in volume or toxicity). **If Factor 1 is not applicable, go to Factor 2.**	i) Quantity of hazardous waste destroyed or treated. **Immobilization technologies do not score under Factor 1.**	**99-100%** ____	8
		90-99% ____	7
		80-90% ____	6
		60-80% ____	4
		40-60% ____	2
		20-40% ____	1
		< 20% ____	0
	ii) Are there untreated or concentrated hazardous waste produced as a result of (i)? **If answer is no, go to Factor 2**	**Yes** ____	0
		No ____	2
Subtotal (maximum = 10) **If subtotal = 10, go to Factor 3**	iii) After remediation, how is the untreated, residual hazardous waste material disposed?	**Off-site land disposal** ____	0
		On-site land disposal ____	1
		Off-site destruction or treatment ____	2
2. Reduction in mobility of hazardous waste. **If Factor 2 is not applicable, go to Factor 3**	i) <u>Quality of Available Wastes Immobilized After Destruction/ Treatment</u>	**90-100%** ____	2
		60-90% ____	1
		< 60% ____	0
	ii) <u>Method of Immobilization</u>		
	- Reduced mobility by containment	____	0
	- Reduced mobility by alternative treatment technologies	____	3
Subtotal (maximum = 5)			
3. Irreversibility of the destruction or treatment or immobilization of hazardous waste	Completely irreversible	____	5
	Irreversible for most of the hazardous waste constituents.	____	3
	Irreversible for only some of the hazardous waste constituents	____	2
	Reversible for most of the hazardous waste constituents.	____	0
Subtotal (maximum = 5)			
TOTAL (maximum = 15)			

Table 5.7

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
1. Technical Feasibility			
a. Ability to construct technology.	i) Not difficult to construct. No uncertainties in construction.	___	3
	ii) Somewhat difficult to construct. No uncertainties in construction.	___	2
	iii) Very difficult to construct and/or significant uncertainties in construction.	___	1
b. Reliability of technology.	i) Very reliable in meeting the specified process efficiencies or performance goals.	___	3
	ii) Somewhat reliable in meeting the specified process efficiencies or performance goals.	___	2
c. Schedule of delays due to technical problems.	i) Unlikely	___	2
	ii) Somewhat likely	___	1
d. Need of undertaking additional remedial action, if necessary.	i) No future remedial actions may be anticipated.	___	2
	ii) Some future remedial actions may be necessary.	___	1
Subtotal (maximum = 10)			
2. Administrative Feasibility			
a. Coordination with other agencies.	i) Minimal coordination is required.	___	2
	ii) Required coordination is normal.	___	1
	iii) Extensive coordination is required.	___	0
Subtotal (maximum = 2)			
3. Availability of Services and Materials			
a. Availability of prospective technologies.	i) Are technologies under consideration generally commercially available for the site-specific application?	**Yes** ___ **No** ___	1 0
	ii) Will more than one vendor be available to provide a competitive bid?	**Yes** ___ **No** ___	1 0

Table 5.7 (cont'd)

IMPLEMENTABILITY
(Relative Weight = 15)

Analysis Factor	Basis for Evaluation During Detailed Analysis		Score
b. Availability of necessary equipment and specialists.	i) Additional equipment and specialists may be available without significant delay.	**Yes** ____	1
		No ____	0

Subtotal (maximum = 3)

TOTAL (maximum = 15)

RESPONSIVENESS SUMMARY
TECHNICAL AND ADMINISTRATIVE GUIDANCE MEMORANDUM (TAGM)
FOR THE SELECTION OF REMEDIAL ACTIONS AT
INACTIVE HAZARDOUS WASTE SITES

1. IMPLEMENTATION OF REMEDIAL ACTIONS:

Comment No. 1.1: In the proposed policy's hierarchy of remedial actions, solidification/fixation technologies are only considered for inorganic wastes. These technologies are also applicable to organic wastes.

Response No. 1.1: Recently solidification/fixation technologies have been used for organic wastes. Adequate long term data are not available to determine the effectiveness of solidification/fixation of hazardous wastes, containing high concentrations of organic constituents; however, use of solidification/fixation technologies for waste containing "low" level of organic constituents should be evaluated on site specific basis.

Comment No. 1.2: Destruction will result in the treated materials having "no residue containing unacceptable levels of hazardous wastes." How would this apply to an incinerator ash containing RCRA-regulated waste? What level would be considered unacceptable?

Response No. 1.2: Acceptable cleanup criteria for organic and inorganic hazardous constituents will be developed by the department, in cooperation with the New York State Department of Health (DOH). If concentrations of hazardous constituents of the incinerator ash residue are less than the acceptable cleanup criteria levels, then the remedy will be considered to be permanent reduction in the toxicity of hazardous wastes.

Comment No. 1.3: Section 27-1313, 5) d of the Environmental Conservation Law, notes, "The goal of any such remedial program shall be a complete cleanup of the site through the elimination of the significant threat to the environment posed by the disposal of hazardous wastes at the site and of the imminent danger of irreversible or irreparable damage to the environment caused by such disposal." Therefore, elimination of the significant threat to the environment is the legislatively mandated cleanup goal. However, the draft policy identifies a cleanup goal which "would result in a permanent and significant decrease in the toxicity, mobility or volume of hazardous wastes." While we appreciate and support the DEC's reliance on Superfund Amendment and Reauthorization Act (SARA) and the emphasis on permanent cleanups, we believe that the state goal of eliminating significant threats at the site should be included, as it is a critical and overriding goal of the remedial selection, that needs to be spelled out in the goals statement.

The definition of "reduction of toxicity, mobility, or volume" only includes a decrease of the threat or risk associated with the hazardous substance. State law states that "elimination of the significant threat to the environment" is the remedial goal.

For the requirement, "Be protective of human health and the environment", we recommend adding "with a cleanup goal of achieving pre-existing conditions."

Response No. 1.3: To state that the remediation goal is to eliminate all threats to the environment is inappropriate. The statutory mandate set forth in ECL 27-1313 (5)(d) is the elimination of the significant threat to the environment, not elimination of all threats or achieving pre-existing conditions. The statements contained in the draft policy are consistent with this mandate. In addition, the statutory mandate refers only to those programs implemented by the Department, whereas, the TAGM will apply to the selection of remedy at all sites.

Comment No. 1.4: We strongly support the review of all remediated sites, whether or not hazardous wastes have been left at the site, and the requirement for public comment on any department action. However, waiting five years before reviewing a "remediated" site with leftover contaminants, is inappropriately long. We recommend a review after one year with a public comment period to allow citizens to have input into the specifics of the review process. For instance, it may be appropriate to have water, soil and wildlife testing done at the site, to fully assess the impact of the leftover contamination.

Response No. 1.4: If a remedial action leaves any hazardous wastes at the site, periodic monitoring and operation and maintenance will be required at the site to evaluate the effectiveness of the implemented remedy. The monitoring will include sampling and analysis of appropriate environmental samples. Such sampling and analysis will begin upon construction completion at a specified frequency. Depending upon the nature of the site, sampling may be required quarterly or even monthly.

In addition to this monitoring requirement, such remedial action which leaves any hazardous waste at the site shall be reviewed once each five years to assure that human health and the environment are being protected.

Comment No. 1.5: We strongly support the Department's decision to not include control and isolation technologies in the definition of "permanent remedies". We request the inclusion of one additional preference criteria for the evaluation of treatment technologies. Specifically, we recommend the addition of "(v) the documented preference of citizens or groups in the community where the site is located." We believe this is an important and necessary preference, in addition, to the ones listed in the draft document.

Response No. 1.5: During the feasibility study all alternative treatment technologies, including the technologies known at the time to be preferred by community groups, will be evaluated.

Comment No. 1.6: The guidance document, in Section 2, states that "permanent remedies are to be used wherever practicable". This is different from EPA's criteria of maximum extent practicable. The difference is that EPA's "maximum extent" is, to the best of my knowledge, tied to a cost multiplier. Whereas the term practicable, literally means, possible to perform.

Response No. 1.6: The guidance document states that "permanent remedies are to be used wherever practicable", which means if an alternative is practicable to implement, in light of its evaluation for the seven criteria, it should be considered for implementation.

2. **DEVELOPMENT AND PRELIMINARY SCREENING OF REMEDIAL ALTERNATIVES**

Comment No. 2.1: The proposed document excludes cost in the screening of remedial alternatives. It is EPA's policy to use cost as a screening factor when there is an order of magnitude differential. This policy differential is mitigated in the detailed analysis section through use of a cost sensitivity analysis - an idea which EPA would be wise to incorporate on a formal basis.

Response No. 2.1: It is our opinion that cost should not be used as a criterion to guide the initial development and screening of remedial alternatives during preliminary screening in order to avoid rejection of permanent remedies. During the preliminary screening, only two (2) criteria, effectiveness and implementability will be considered in evaluating remedial alternatives. It is appropriate to consider cost as a factor only during the detailed analysis of screened alternatives.

Comment No. 2.2: We support the Department's decision to not use cost as a screening criteria in the initial screening process.

Response No. 2.2: Please refer to response No. 2.1.

Comment No. 2.3: When the Department staff are conducting the initial screening of technologies, what sources will be utilized, besides EPA's SITE program and the SUNY Buffalo Center for Hazardous Waste Management?

Response No. 2.3: The feasibility study in general is performed by an engineering consultant for USEPA, NYSDEC or a PRP. The consultant will use all available sources to compile remedial technologies. In addition, NYSDEC intends to procure a consultant to prepare written reports as Technical Resource Documents outlining the state-of-the-art of all alternative treatment technologies which are applicable to the remediation of inactive hazardous waste sites. These technical resource documents will be available to consultants, PRPs, NYSDEC staff and the public.

Comment No. 2.4: Removing a remedial alternative from the screening process if it is expected to fail within 15 years, is an environmentally unsound and arbitrary decision. The goal of the remediation should be to permanently address the contamination.

Response No. 2.4: Concur with the comment. Appropriate changes are made. Please refer to Section 4.1.

3. DETAILED ANALYSIS OF REMEDIAL ALTERNATIVES

Comment No. 3.1: The required assignment of weights to seven evaluation criteria will eliminate the flexibility which is so essential to the effective implementation of the superfund program. For this very reason, the proposed National Contingency Plan (NCP) does not consider the use of weights for its evaluation criteria.

Response No. 3.1: It is our opinion that the assigned weights to seven evaluation criteria will provide uniformity and consistency in evaluation and selection of remedial actions.

Comment No. 3.2: Since Applicable or Relevant and Appropriate Requirements (ARARs) and protectiveness are threshold criteria, i.e. statutory mandates which must be met at every site (in the absence of an ARAR waiver), the utility of weights for these criteria is questionable.

Response No. 3.2: Since there may be instances where part of the ARARS may not be met, for an alternative, it is prudent to have weighting factors so that a remedial alternative which meets the ARARs will be given greater weight than the one which does not meet all or some of the ARARs.

Although, it is a statutory mandate that all remedies meet environmental and health protectiveness, some remedial actions provide greater protectiveness than others and, hence, the utility of a weighing factor is justified.

Comment No. 3.3: Division of implementability into its technical and administrative components is a moot point if an alternative is not implementable for any reason. In addition, assigning points to an unimplementable alternative will not create an implementable remedy.

Response No. 3.3: Alternatives will be evaluated based on implementability and effectiveness during the preliminary screening. An alternative not being technically feasible for implementation will not be considered in the detailed analysis.

However, alternatives which pass the preliminary screening will have several degrees of implementability. Some technologies will be more reliable than others; some remedial alternatives will need less administrative requirements than others; availability of services and materials may be easier for some remedial technologies than others. The implementability criterion will consider such factors in the detailed analysis of alternatives.

Comment No. 3.4: How will the contaminant-specific cleanup criteria and ARARs be determined?

Response No. 3.4: Contaminant-Specific cleanup criteria and ARARs will be determined for every site, in cooperation with the Department of Health on a site-specific basis.

Comment No. 3.5: We oppose having cost as one of the seven evaluation criteria in detailed analysis of alternatives. The law requires the selection of a cost-effective remedial method, not a less-expensive method. We recommend the establishment of a third tier using cost as a final selector after the remedial methods have been screened according to the six proposed criteria. Thus, the Department would select a number of remedial methods based on their effectiveness, performance, and environmental and health goals, and then, it would determine which of the resulting methods is the most cost-effective. By allowing cost to be included in the second decision-making tier, it negatively offsets the human health, environment and ARARs criteria. This is inappropriate and, we believe, a divergence from the intent of the Environmental Conservation Law.

Although we support DEC's written clarification of the remedy selection process, we believe that considerations of cost-effectiveness should play a narrow role in the cleanup selection process, and should not interfere with the attainment of permanent and health-protective cleanups.

Response No. 3.5: Under the proposed procedure for evaluating remedies, cost does not negatively offset human health, environment and ARARs criteria. Effectiveness of each remedial alternative in protecting human health and the environment is evaluated during the preliminary screening. It is to be noted that cost is not considered during the preliminary screening. Only those remedies which meet this requirement pass through to the second stage of detailed analysis. In order to effectively complete a detailed comparison of remedial alternatives, the cost of each alternative must be analyzed. Since cost is only one of the seven factors being considered and since a determination will have already been required that the remedies being analyzed are protective of human health and the environment, this analysis ensures that the selection of the remedy meets all statutory requirements under both state and federal laws.

Comment No. 3.6: We strongly endorse the approach required by the federal Superfund Amendments and Reauthorization Act, which allows consideration of cost-effectiveness only after EPA has determined the appropriate level of environmental protection to be achieved. The State Superfund Management Board's current report recommends that the State adopt parallel requirements to those in SARA.

Response No. 3.6: The NYSDEC's approach is more stringent than the USEPA's approach currently being used or outlined in the proposed NCP. USEPA considers cost as a criterion in the preliminary screening process. The NYSDEC's guidance document includes only effectiveness in protecting human health and the environment and implementability in the preliminary screening. Cost is considered only in the detailed analysis for remedial alternatives which pass the preliminary screening. DEC's approach in selection of remedial action is consistent with the requirements of SARA.

Comment No. 3.7: Section 5.2.3 states that "an individual who performs the analysis should use his/her best professional judgement in assigning score" for the short-term effectiveness criteria. We request that the Department staff seriously consider the public comments on this and all the criteria when assigning a score.

Response No. 3.7: Short-term effectiveness of a remedial alternative will be evaluated and assigned a score based on the analysis of factors presented in Table 5-2.

Comment No. 3.8: Section 5.2.3.2 only gives long-term effectiveness and permanence a relative weight of 10. We recommend 20 as this is a top priority criteria in terms of the overall remedial goal. It is more important than the short-term effectiveness and will have a greater negative impact if it fails.

Response No. 3.8: Please refer to Table 5.1 for revised weighing factors. The long-term effectiveness is assigned a score of 15 and short-term effectiveness is assigned a score of 10.

Comment No. 3.9: The potential for risk in relation to treatment residuals and/or untreated wastes is a very important aspect of the long-term effectiveness. The magnitude of remaining risk should be compared to the risk in the pre-existing conditions of the site (based on the available data). The potential for risk should not just be measured in cancer risk levels as this is very inadequate and does not include many other negative health impacts, such as respiratory disease, organ damage, nervous system damage and immune system damage. There should be a separate risk assessment process established by the Department of Health for this and other risk analysis activities in the remedial selection and these risk assessment processes should always allow for community input and community representation in the decision-making process.

Response No. 3.9: During the RI/FS, necessary risk assessment would be performed. As indicated on Table 5.7, remedial alternatives will be evaluated based on any post-remediation exposure via air, groundwater/surface water media and magnitude of residual public health and environmental risks after remediation.

Comment No. 3.10: Section 5.2.3.3. Again, we must point out the divergence from state law in the following statement. "This preference is satisfied when treatment is used to reduce the principal threats at a site..." Eliminating the significant threats to the environment versus "reducing principal threats at a site" is very different. The quantification of reduction is based on subjective variables. A goal of eliminating significant threats is what the law requires.

Response No. 3.10: This language has been modified to be consistent with the statutory requirements.

Comment No. 3.11: Again, we strongly oppose the inclusion of cost and its relative weight score of 15 at this stage of the decision-making process. We strongly oppose the following statement and believe it highlights the divergence of the Department from implementing the legally mandated "cost-effective" criteria which is quite different from cost induced trade-offs. "The distribution of costs over time will be a critical factor in making trade-offs between capital-intensive technologies (including alternative treatment technologies) and less capital-intensive technologies (such as pump and treatment systems)."

Response No. 3.11: Under this policy, cost does not limit the Department from implementing the capital-intensive technologies. As outlined in Section 5.2.3.5, cost consists of capital cost, operation and maintenance cost, future capital cost and cost of future land use. The evaluation of remedial alternatives will also include the costs of future remedial actions when there is a reasonable expectation that a major component of the remedial alternative may fail and require replacement to prevent unwarranted exposure to contaminants. Also, any remedial action that leaves hazardous wastes at a site may affect future land use and perhaps groundwater and surface water use. Access or use of such sites most probably will be restricted to some degree, resulting in loss of business activities, residential development and taxes to the local, state and federal governments. During the FS, potential future land use and the economic loss attributable to such restriction should be determined and included as a cost of the remedial alternatives which do not remediate the site to unrestricted use. Otherwise, the evaluation of the alternatives which fail to remediate the site for unrestricted use will not accurately reflect their real costs. In addition, the continuing presence of an inactive hazardous waste site not remediated to unrestricted use, even though remediated, may have a negative effect on surrounding property values. This loss in value will also be considered as a cost of the remedial program developed for a site.

Comment No. 3.12: On the accuracy of cost estimates, we are surprised by the wide range of discrepancy (+50 to -30). Is this a standard range of expected accuracy?

Response No. 3.12: Yes. According to guidance for conducting Remedial Investigations and Feasibility Studies under CERCLA, prepared by USEPA, typically these "study estimate" costs made during the FS are expected to provide an accuracy of +50 percent to -30 percent. This range of accuracy has been used for a number of years for CERCLA sites. Detailed designs have not been completed at the FS stage 6. More refined cost estimates cannot be made until the design phase is complete.

Comment No. 3.13: Section 5.2.3.6 notes that the "actual determination of which requirements are applicable or relevant and appropriate is made by the DEC in consultation with the DOH." What is the process for public input at this stage? We recommend that each component of ARARs that does not comply should receive a -10.

Response No. 3.13: All ARARs including cleanup criteria will be determined by DEC in consultation with DOH during the first phase RI/FS. As mentioned earlier, this first phase RI/FS report will be available for public review and comment. A remedial alternative will receive scores for components of ARARs that are met.

Comment No. 3.14: Section 5.2.3.7 on overall protection of human health and the environment only has a relative weight score of 15. We recommend at least a score of 25, as this is an important criteria which truly implements the remedial goal to eliminate the significant threat to the environment.

An alternative with the least protection or with remaining contamination which poses a threat or increased risk should receive a 0. If the alternative method leaves contamination which is a significant risk, it should receive a -50.

Response No. 3.14: We agree that this is an important criteria which implements the remedial goal to eliminate the significant threat to public health and environment. Protection of human health and the environment is assigned a score of 20. It is to be emphasized that an alternative which does not protect the public health or environment will not pass the preliminary screening and will not be considered in the detailed analysis. Since some remedial actions provide greater protectiveness than others, the weighing score is used.

Comment No. 3.15: We recommend the deletion of the following sentence which provides a significant loophole. "It may not be necessary or appropriate to address every factor for each alternative being evaluated and, furthermore, it may be useful to address other factors to ensure a better understanding of how an alternative is evaluated against the criteria."

Response No. 3.15: This sentence under section 5.2.4 is deleted.

Comment No. 3.16: Do we have the State ARARs that address the question of "how clean is clean" for any contaminated soil cleanups for inactive hazardous waste sites?

For cancer risk assessment, what cancer risk level will be selected? 1:10,000 or 1:1,000,000?

Response No. 3.16: As stated elsewhere, all ARARs, including soil/sediment cleanup criteria will be determined for each site, in consultation with DOH. DOH will utilize appropriate risk level in addition to several other factors such as migration pathways, exposures routes, etc. in determining soil cleanup criteria.

Comment No. 3.17: I would like to see the detailed analysis of alternatives section be expanded to be more specific in evaluating ecological damage associated with the alternatives. I would include the damage that will be done through the resuspension of sediments, the possible release of currently bound materials, and the modification of land forms. Perhaps a risk assessment of the various alternatives associated with remediation would also be in order. I see this as especially important for river sediments.

Response No. 3.17: Alternatives to remediate river sediments will be evaluated for the seven criteria which include short-term effectiveness, long-term effectiveness and permanence and protection of public health and environment. In an environmentally sensitive site, pertinent short-term and long-term environment risks and benefits of the alternatives will be evaluated during the feasibility study.

Comment No. 3.18: The overall ranking scheme seems to be weighted toward the protection of human health as opposed to the protection of the environment. The environment should be given additional relative weight instead of being lumped in with human health.

Response No. 3.18: Table 5.1 summarizes seven criteria and their scores. Although, there is not a single criterion specifically for the protection of environment, short-term effectiveness, compliance with ARARs and protection of human health and the environment address the environmental risk and impact. In an environmentally sensitive site, pertinent environmental criteria/standards could be the driving factors in the evaluation of remedial alternatives.

Comment No. 3.19: Section 5.2.3.6 says that an alternative which complies with none of the ARARs should receive a score of 0. I assume this means that a waiver to the ARARs is appropriate. If a waiver is not appropriate, the alternative should be thrown out unless the non-attainment of the ARAR is part of every alternative.

Response No. 3.19: If an alternative does not meet the ARARs and a waiver to the ARARs is not appropriate or justifiable, this alternative will not be further considered.

4. COMMUNITY ASSESSMENT

Comment No. 4.1: Although the proposed policy addresses community acceptance at a later point in the decision-making process, it may be prudent to elevate it to an evaluation criterion to deal with those sites where community reactions would preclude implementation of a recommended alternative.

Response No. 4.1: The public will have the first opportunity to understand and evaluate the remedial alternatives when the draft Feasibility Study (FS) report is distributed. It is not feasible to evaluate community reactions to remedial alternatives in the draft FS report. It is appropriate to consider community reactions after the draft FS is presented to and discussed with the public. All public comments on the draft FS report will be considered prior to the selection of remedial action. The public comments will be sought in accordance with New York State Inactive Hazardous Waste Site Citizen Participation Plan and other statutory and regulatory requirements.

Comment No. 4.2: Section 5.2.2 states that "community acceptance" is encompassed in the seven evaluation criteria. How do the seven criteria encompass "community acceptance"? Also, there is an important distinction between community "acceptance" and community preference or the community's recommendation. One assumes a passive community with the underlying assumption being that the Department has to convince the community of its decision. Whereas community preference assumes a meaningful public participation process where the Department incorporates in its decision-making process, the recommendations of the community residents who will be impacted by the remedial method chosen. Community recommendations is an accurate and respectful term.

There is obviously not a lot of time for meaningful community input when the "final remedy selection decision is being made", thus the Department staff should conduct a proactive outreach effort at this critical stage of the decision-making process.

Response No. 4.2: The distinction between "community acceptance" and "community preference" is recognized and appropriate changes are made in the document. The department will solicit public comments and input in accordance with the document titled, "New York State Inactive Hazardous Waste Site Citizen Participation Plan, dated August 30, 1988 and other statutory and regulatory requirements.

Public comments will be solicited on the first phase of the RI/FS report. The first phase of the RI/FS report usually includes the first set of environmental quality data describing conditions at the site and preliminary discussion of alternative remedial technologies. During this public comment opportunity, interested citizens can notify the Department of remedial technologies of interest to them. If the community preferred technologies are technically feasible for the site-specific conditions, they will be evaluated in the final phase of the RI/FS.