Department of Environmental Conservation

Division of Environmental Remediation

Record of Decision

Brookfield Avenue Landfill Site
New York City, Richmond County
Site Number 2-43-006
Operable Unit 1

March 2002

New York State Department of Environmental Conservation

GEORGE E. PATAKI, *Governor* ERIN M. CROTTY, *Commissioner*

DECLARATION STATEMENT - RECORD OF DECISION

Brookfield Avenue Landfill Inactive Hazardous Waste Disposal Site
New York City, Richmond County
Site No. 2-43-006
Operable Unit 01

Statement of Purpose and Basis

The Record of Decision (ROD) presents the selected remedy for the Brookfield Avenue Landfill Class 2 inactive hazardous waste disposal site which was chosen in accordance with the New York State Environmental Conservation Law. The remedial program selected is not inconsistent with the National Oil and Hazardous Substances Pollution Contingency Plan of March 8, 1990 (40CFR300).

This decision is based on the Administrative Record of the New York State Department of Environmental Conservation (NYSDEC) for the Brookfield Avenue Landfill inactive hazardous waste disposal site and upon public input to the Proposed Remedial Action Plan (PRAP) presented by the NYSDEC. A listing of the documents included as a part of the Administrative Record is included in Appendix B of the ROD.

Assessment of the Site

Actual or threatened release of hazardous waste constituents from this site, if not addressed by implementing the response action selected in this ROD, presents a current or potential significant threat to public health and the environment.

Description of Selected Remedy

Based on the results of the Remedial Investigation/Feasibility Study (RI/FS) for the Brookfield Avenue Landfill and the criteria identified for evaluation of alternatives, the NYSDEC has selected Alternative 2B, capping with active gas collection, leachate collection and barrier wall . The components of the remedy are as follows:

- A remedial design program;
- A Part 360 landfill cap;
- Active landfill gas collection and treatment;
- A barrier wall to prevent groundwater inflow into the landfill and prevent methane migration along Arthur Kill Road;
- Surface water runoff collection;
- Leachate collection and treatment;
- Minimization of encroachment into freshwater and tidal wetlands;
- Institutional controls including deed restrictions to supplement engineering controls; and
- Initiation of a long term monitoring program to ensure that the contained hazardous waste does not leave the site.

New York State Department of Health Acceptance

The New York State Department of Health concurs with the remedy selected for this site as being protective of human health.

Declaration

The selected remedy is protective of human health and the environment, complies with State and Federal requirements that are legally applicable or relevant and appropriate to the remedial action to the extent practicable, and is cost effective. This remedy utilizes permanent solutions and alternative treatment or resource recovery technologies, to the maximum extent practicable, and satisfies the preference for remedies that reduce toxicity, mobility, or volume as a principal element.

3/19/2002
Date

Michael J. O'Toole, Jr., Director
Division of Environmental Remediation

TABLE OF CONTENTS

SECTION		PAGE
1:	Summary of the Record of Decision	1
2:	Site Location and Description	2
3:	Site History	2
	3.1 Operational/Disposal History	2
	3.2 Investigation	2
	3.2 Remedial History	2
4:	Site Contamination	3
	4.1 Summary of Remedial Investigation	3
	4.2 Interim Remedial Measures	8
	4.3 Summary of Human Exposure Pathways	9
	4.4 Summary of Environmental Exposure Pathways	10
5:	Enforcement Status	10
6:	Summary of the Remediation Goals	10
7:	Summary of the Evaluation of Alternatives	11
	7.1 Description of Remedial Alternatives	11
	7.2 Evaluation of Remedial Alternatives	14
8:	Summary of the Selected Remedy	16
8.1	Selected Remedy	17
8.2	Additional Issues	17
9:	Highlights of Community Participation	19
	Table 1	21
	Table 2	22
	Table 3	23
	Table 4	25
	Table 5	26
	Table 6	27
	Table 7	28
	Table 8	29
	Table 9	31
	Table 10	33
	Table 11	35
	Table 12	36

TABLE OF CONTENTS (con't)

SECTION

PAGE

Figure 1-1Site Location Map 37
Figure 1-2 Site Map 38
Figure 2: Hot spot location Map 39
Figure 3: Site Plan 40
Figure 4:Typical Part 30 Landfill Cap Cross Section with Gas vent 41
Figure 5: Alternative 2A 42
Figure 6: Alternative 2B 43
Figure 7: Alternative 3 44
Figure 8: Alternative 4 45
Figure 9: Alternative 5 46
Figure 10: Cross Section of Alternative 2B 47
Figure 11: Cross Section of Alternative 3 48

Appendix A: Responsiveness Summary A-1
Appendix B: Administrative Record B-1

Brookfield Avenue Landfill
Operable Unit No.1
New York City, Richmond County
Site No. 2-43-006
March 2002

SECTION 1: SUMMARY OF THE RECORD OF DECISION

The New York State Department of Environmental Conservation (NYSDEC) in consultation with the New York State Department of Health (NYSDOH) has selected this remedy to address the significant threat to human health and/or the environment created by the presence of hazardous waste at the Brookfield Avenue Landfill (the Landfill), Operable Unit#1, a Class 2, inactive hazardous waste disposal site. The NYSDEC decided that it would be more efficient for remediation purposes to separate the site into two Operable Units. An Operable Unit represents a portion of the site remedy which for technical or administrative reasons can be addressed separately to eliminate/mitigate a release, threat of release or exposure pathway resulting from the site contamination. Operable Unit #1 is the Landfill and Operable Unit #2 will be the Landfill's impacts to Richmond Creek. The first step in the investigation and remediation of Operable Unit #2 is the delineation of the wetlands adjacent to the Landfill. This took place and we are awaiting the results. As more fully described in Sections 3 and 4 of this document, the disposal of liquid industrial hazardous wastes with municipal solid waste at this landfill have resulted in the disposal of a number of hazardous wastes, including semi-volatile organic chemicals, pesticides and metals within the fill mass at the site, some of which were released or have migrated from the site to the groundwater and Richmond Creek. These disposal activities have resulted in the following significant threats to the public health and the environment:

(i) a significant threat to human health associated with ingestion of surface soil, ingestion of shallow groundwater, inhalation of volatile organics from shallow groundwater, and ingestion of shellfish from Richmond Creek.

(ii) a significant environmental threat associated with the impacts of chlordane, arsenic, copper, lead, and mercury to Richmond Creek.

In order to eliminate or mitigate the significant threats to the public health and the environment that the hazardous waste disposed at the Brookfield Avenue Landfill Site has caused, the following remedy was selected: Alternative 2B, capping with active gas collection, leachate collection and barrier wall. The components of the remedy are as follows:

A Remedial Design Program;
A Part 360 landfill cap;
Active landfill gas collection and treatment;
A barrier wall to prevent groundwater inflow into the landfill and prevent methane migration along Arthur Kill Road;
Surface water runoff collection;
Leachate collection and treatment;
Minimization of encroachment into freshwater and tidal wetlands;
Institutional controls including deed restrictions to supplement engineering controls; and
Initiation of a long term monitoring program to ensure that the contained hazardous waste does not leave the site.

The selected remedy, discussed in detail in Section 8 of this document, is intended to attain the remediation goals selected for this site, in Section 6 of this Record of Decision (ROD), in conformity with applicable standards, criteria, and guidance (SCGs).

SECTION 2: SITE LOCATION AND DESCRIPTION

The Brookfield Avenue Landfill, site # 2-43-006, is located to the north of Arthur Kill Road and to the east of Richmond Avenue in Richmond County, New York City. Approximately 132 acres of this 272-acre site have been used for the disposal of municipal solid waste. Figures 1-A , 1-B and Figure 2 show site location maps. The site is adjacent to a primarily suburban residential area and is adjoined immediately to the north by Richmond Creek.

SECTION 3: SITE HISTORY

3.1: Operational/Disposal History

The site was opened for receipt of municipal solid waste in 1966. The site was operated 24 hours per day, six days per week and accepted approximately 1000 tons of solid waste per day. The landfill ceased operation in 1980. In 1982, testimony before the New York State Select Committee on Crime indicated that, during the period from 1974 through 1980, industrial hazardous waste including waste oil, sludges, metal plating wastes, lacquers and solvents were dumped at several New York City landfills, including the Brookfield Avenue Landfill.

3.2: Investigation

Beginning in 1982 and in the following years, numerous site investigations were undertaken at the site in response to the allegation that illegal dumping had occurred, and to health related complaints that were made regarding the vapors/odors that were released during the excavation for a sewer line through the landfill. In 1983, the NYSDEC conducted a New York State Superfund Phase I site assessment, and the site was listed as a Class 2a Inactive Hazardous Waste Disposal Site. Class 2a is a temporary classification assigned to sites that have inadequate and/or insufficient data for inclusion in any of the other classifications. In 1986, a re-evaluation of existing data and testimony at the Senate Subcommittee hearing led the NYSDEC to upgrade the site to a Class 2 Inactive Hazardous Waste Disposal Site, meaning that "a significant threat to the public health or environment exists, and that action is required." In 1993, there was an allegation that illegal disposal of hazardous waste had occurred at Colonial Square, a housing development located on the eastern edge of the landfill. An Immediate Investigation Work Assignment (IIWA) was performed at this site. The Colonial Square Condominium development is 7 acres in size and is adjacent to Richmond Creek (and its unnamed tributaries). The investigation revealed the presence of some building debris, but did not indicate that hazardous waste was disposed at that site.

3.3: Remedial History

From 1982 to 1999, activities were undertaken to address off-site migration of methane, to remove onsite fuel tanks, and to prevent unauthorized access to the site. Methane is a combustible gas and a component of landfill gas which is generated as garbage decomposes. In 1982, capping of the eastern end of the site commenced, along with the installation of 10 passive gas vents. In 1984, a passive gas trench system was installed at the site in the vicinity of Brookfield and Colonial Avenues in response to high methane concentrations found off-site. In 1986, this trench was extended to further inhibit gas migration. In 1995, two 550 gallon diesel fuel tanks were removed from the area of the site entrance. In 1998, a sorbent boom was

placed to contain an observed oil seep in the center of the southern east cell of the landfill. In 1998 and 1999, additional fencing was placed to further limit access via the southern and western site borders.

SECTION 4: SITE CONTAMINATION

The New York City Department of Environmental Protection (NYCDEP) in 1998 completed a Remedial Investigation/Feasibility Study (RI/FS) to evaluate the contamination present at the site and to evaluate alternatives to address the significant threat to human health and the environment posed by the presence of hazardous waste.

4.1: Summary of the Remedial Investigation

The purpose of the RI was to define the nature and extent of the contamination resulting from previous activities at the site. The RI was conducted in three phases. Phase I of the field investigations was performed from December 1993 through July 1994. The Phase I activities are described in the original project work plan dated August 1993. The Phase II field investigations were performed from December 1996 through December 1997. Phase II included follow-up study activities recommended by the City, NYSDEC, USEPA, and the community. The Phase III investigations began January 1998 and concluded in May 1998 at the request of the Scientific Advisory Committee (SAC). This Committee was set up by the NYCDEP and Citizen Advisory Committee (CAC) in order to advise the residents of the surrounding community regarding the science and engineering of landfill remediation. The Phase III investigations included (1) additional acute, chronic, and bio accumulation studies to better evaluate Richmond Creek sediment toxicity and (2) three additional deep monitoring wells in the Cretaceous aquifer to better evaluate the connection between the Upper Glacial and Cretaceous aquifers (see section 4.1.2 for a description of these aquifers). Independent validation of the Phase I and Phase II analytical results were completed in March 1998. A report entitled "Brookfield Avenue Landfill Remediation Project, Final Remedial Investigation Report" was prepared in September 1998 and describes the field activities and findings of the RI in detail.

The RI included the following activities:

- Installation of soil borings and monitoring wells for analysis of soils, wastes, groundwater and leachate as well as physical properties of soil and hydrogeologic conditions;
- Excavation of test pits to determine the limits of solid waste disposal, to provide visual analysis of disposed wastes, and to allow for the sampling of the disposed wastes for chemical analysis;
- Collection of surface water samples from Richmond Creek and on-site ponds and drainage ditches to assess the potential impacts from landfill leachate (also to be used in OU-2);
- Collection of stream sediment samples for chemical analysis and biota toxicity assessment and bioaccumulation (also to be used in OU-2);
- Collection of ambient air samples to determine the potential impact of landfill gas emissions;
- Collection of soil gas samples to find potential hot spots and assess the migration of soil gas; and
- Measurement of surface flux emissions to evaluate landfill gas quality.

In order to determine which media (soil, groundwater, etc.) contain contamination at levels of concern, the RI analytical data were compared to environmental Standards, Criteria, and Guidance Values (SCGs). Groundwater, drinking water and surface water SCGs identified for the Brookfield Avenue Landfill site are based on NYSDEC Ambient Water Quality Standards and Guidance Values and Part 5 of NYS Sanitary Code. For soils, NYSDEC TAGM 4046 provides soil cleanup guidelines for the protection of groundwater, background conditions, and health-based exposure scenarios. Guidance values for evaluating contamination in sediments are provided by the NYSDEC Technical Guidance for Screening Contaminated Sediments. Ambient air samples are compared to NYSDEC Annual Guideline Concentrations (AGCs) and Short-term Guideline Concentrations (SGCs).

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

Chemical concentrations are reported in parts per billion (ppb) for ground water, parts per million (ppm) for soil, and micrograms per cubic meter (ug/m^3) for air samples. For comparison purposes, where applicable, SCGs are provided for each medium.

4.1.1 Geology and Hydrogeology

Three main aquifer systems were investigated at the landfill. These include the Recent/Shallow Glacial, Deep Glacial/Reworked Cretaceous and the Cretaceous aquifer systems. The first two systems comprise the Upper Glacial aquifer. Confining units separate the shallow Glacial, the deep Glacial, and the Cretaceous aquifer. A confining unit is a geological stratum (or layer) such as clay/silt which impedes vertical groundwater flow. The shallow Glacial is found from the surface to a depth of about 30 ft, the deep Glacial is generally found from about 30 to 50 feet below the surface, and the Cretaceous aquifer is generally found from about 50 to 150 feet below the surface. The shallow Glacial aquifer flows from south to north and discharges into Richmond Creek. The deep Glacial aquifer also flows from south to north; the Cretaceous aquifer flows from north to south, generally toward the ocean. A Cretaceous Sand formation forms the main aquifer formation within the Cretaceous flow systems. This unit dips to the southeast and increases in thickness in the southern portions of the site. In the northern portion of the site, this Cretaceous sand unit appears to be in contact with glacial till, which may form a pathway for the migration of contaminants downward from the shallow flow system to the Cretaceous flow system.

4.1.2 Nature of Contamination:

As described in the RI Report, soil, groundwater, leachate, sediment and air samples were collected at the Site to characterize the nature and extent of contamination. The main categories of contaminants which exceed their SCGs are inorganics (metals), volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), pesticides and polychlorinated biphenyls (PCBs). The specific inorganic contaminants of concern are calcium, copper, iron, lead, magnesium, mercury, nickel, potassium, and zinc. The specific volatile organic contaminants of concern are 2-butanone, 4-methyl-2-pentanone, acetone, benzene, chlorobenzene, xylenes and toluene. The specific semivolatile organic compounds are phenol, 1,4-dichlorobenzene, 2-methylnaphthalene, naphthalene, 4-methylphenol and 4-chloro-3-methylphenol. The specific pesticide compound is 4,4'-DDE. The specific conventional compound is ammonia. Ammonia is normally found in all hazardous and non-hazardous landfills, and in many cases is used as an indicator of leachate.

4.1.3 Extent of Contamination

Tables 1 through 11 summarize the extent of contamination for the contaminants of concern in soil, groundwater, leachate, surface water, and landfill gas and compare the data with the SCGs for the Site. The following media were investigated and the findings of the investigation are summarized below.

Surface Soil

Surface soil samples of 0 to 2" were taken at a number of locations. Surface soil at the landfill is not significantly contaminated. Polyaromatic hydrocarbon (PAH) compounds and a number of metals were commonly found to exceed SCGs in on-site surface soil samples.

PAHs are ubiquitous and typically found at elevated concentrations in highly urbanized areas due to emissions from furnaces, automobiles and other combustion processes. Background values of PAHs in surface soil of urbanized areas range into the thousands of parts per million. SCGs for these compounds (as specified by NYSDEC Technical and Administrative Guideline Memorandum (TAGM) 4046) are significantly lower. Therefore it is not surprising that PAHs were also found in off-site soil in the surrounding communities.

Likewise, metals are often found in elevated concentrations in urbanized areas. Six of nine metals detected above SCGs from both off-site and on-site locations, have associated background values (for eastern US soils) which exceed their SCGs. A summary of surface soil analysis is shown in Table 1. VOCs were not found in surface soil samples at levels above the NYSDEC cleanup criteria.

Subsurface Soil

Five potential areas of concern, selected by the Science Advisory Committee representing the community, were subject to additional investigation. These areas were called "Hot Spots" for identification purposes. The "Hot Spot" areas are shown in Figure 3.

Subsurface soil samples were taken to a maximum depth of 62 ft below ground surface (bgs) using a geoprobe.

Soil samples from Hot Spot No. 1 showed levels of contamination in excess of the NYSDEC Soil Cleanup Objective (SCO) for phenol in 1994 soil borings. In 1997, low to moderate levels of phenol were found to be widely dispersed throughout the study area. Soil samples taken from Hot Spot No. 2 in 1994 showed levels of contamination in excess of the NYSDEC SCO for polychlorinated biphenyl (PCB). Follow up testing in 1997, found only one PCB hit at 2.5 ppm. The SCO for PCBs in subsurface soil is 10 ppm as per TAGM 4046 (This soil will not be disturbed). Soil samples taken from Hot Spot No. 3 showed levels of contamination in excess of the NYSDEC SCO for phenol in 1994. In 1997, methylene chloride, tetrachloroethene, chlorobenzene, ethylbenzene, and xylenes were found in excess of NYSDEC SCOs. Xylene is the primary contaminant of concern for Hot Spot No. 3. (Additional information is provided in Section 4.2 IRM). Soil samples taken from Hot Spot No. 4 showed levels of chrysene and benzo(b)fluoranthene in excess of the NYSDEC SCO in 1994. Soil samples taken from Hot Spot No. 5 indicated the presence of some low levels of pesticides and PCBs, however only the compound heptachlor epoxide exceeded the NYSDEC SCO (Additional information is provided in Section 4.2 IRM).

VOC analysis of samples collected from the soil borings indicated only sporadic trace detections of several VOCs including acetone, methylene chloride and chlorobenzene, all below their respective TAGM SCO. Semivolatile analysis of boring samples identified low levels of semi-VOC contaminants in a number of

samples. No PCBs were detected within samples selected for analysis from the soil borings. The only pesticides detected were alpha-chlordane and gamma-chlordane. Both are below the TAGM SCO's. Numerous metals were found to be present, within samples collected from the environmental borings, that would be considered elevated above natural ambient levels.

VOCs analysis indicated most samples collected from test pits were free of VOCs or exhibited several VOCs at low to trace concentrations. As with boring samples, a number of phthalate compounds were present within the majority of test pit samples, but well below TAGM SCOs. Only trace levels of pesticides including 4,4'DDE, 4,4'DDD and methoxychlor were detected in two test pit samples. Low levels of PCBs including arochlor 1248 (0.29 ppm) and arochlor 1254 (0.47 ppm) were detected within one test pit. The SCO for total PCBs within subsurface soil is 10 ppm. As with samples collected from the soil borings, test pit samples exhibited metals concentrations well in excess of typical ambient concentrations. A summary of subsurface soil results is shown in Table 2. The maximum test pit depth is approximately 18 feet. The maximum depth of the monitoring wells is 171 to 176 feet.

Groundwater

Groundwater samples were collected from 18 designated on-site wells and 11 designated off-site wells installed in deep/shallow clusters. Shallow groundwater at the perimeter of the solid waste mound has been contaminated by the landfill. This contamination extends to Richmond Creek. Contaminant exceedances of Standards, Criteria, or Guidance (SCG) in the Upper Glacial aquifer and leachate mound include: 13 VOCs, 17 SVOCs, 8 pesticides, 2 PCBs and 13 metals. The most frequently detected contaminants in the shallow groundwater include: benzene, chlorobenzene, toluene, xylene, dichlorobenzene, napthalene, 4,4-DDE, barium, copper, iron, lead, manganese, sodium, zinc, ammonia, bromide, chloride, and sulfate. No VOC, SVOC or pesticide contamination was detected offsite in the Upper Glacial aquifer. Vertical migration of contamination from the shallow sand to the lower portion of the Upper Glacial aquifer occurs in the southwest area, the northern corridor between the two cells and the Holterman's Bakery area summaries of shallow upper glacial aquifer, deep glacial aquifer, and cretaceous aquifer analysis are shown in Table 3, Table 4, and Table 5.

Surface Water

Surface water surrounding the Brookfield Avenue Landfill has been impacted by contamination originating from the landfill. Surface water quality contraventions in Richmond Creek, include tetrachloroethene, copper, lead, zinc, total cyanide, nickel, mercury and a number of pesticides including DDD, DDE, BHC, heptachlor, aldrin, and endrin. Tidal portions of Richmond Creek are classified "SC," with a best use designation for fishing. Class SC waters are defined as suitable for fish propagation and survival as well as primary and secondary contact recreation. Primary contact recreation means recreational activities where the human body may come in direct contact with raw water to the point of complete body submergence. Primary contact recreations include, but are not limited to, swimming, diving, water skiing, skin diving and surfing. Secondary contact recreation means recreational activities where contact with the water is minimal and where ingestion of the water is not probable. Secondary contact recreation includes, but is not limited to, fishing and boating. Although there is no existing NYSDEC water quality standard for ammonia in Class SC waters to which the ammonia data can be compared, the Brookfield Avenue Landfill does contribute significant quantities of ammonia to the creek. Ammonia discharged from the landfill has resulted in exceedances of the EPA established continuous concentration criteria at four of eight surface water sample locations. With the exception of tetrachloromethane, all of these compounds mentioned above are present in the Brookfield Avenue Landfill leachate. In other words, the surface water contamination profile closely matches that of leachate. A summary of surface water analysis is shown in Table 6.

Leachate

Leachate may be defined as liquid that has percolated through solid waste and has extracted dissolved or suspended materials from it. In most landfills, the liquid portion of the leachate is composed of the liquid produced from the decomposition of the wastes and liquid that has entered the landfill from external sources, such as surface drainage, rainfall, ground water, and water from underground springs. Because of the long travel path, contaminants in the leachate undergo significant attenuation as they migrate from the Upper Glacial to the Cretaceous aquifer. This is primarily due to dispersion, adsorption and cation exchange. Ground water monitoring wells (GW-29, SAC-10, SAC-24B and D-13) screened in the Cretaceous aquifer, show very low levels of leachate indicators. SCGs are slightly exceeded for acetone, chloroform, toluene and chlorobenzene.

The Brookfield Avenue Landfill generates approximately 95,000 gallons of leachate per day. Approximately 92,000 gallons per day (96.5%) of the leachate discharge to the local surface water bodies such as Richmond Creek and associated wetlands. It is estimated that approximately 3,500 gallons per day of leachate (3.5%) leak into the Cretaceous aquifer. Because of the complex flow pathway from Upper Glacial to the Cretaceous, the leakage estimate of 3,500 gallons per day is considered a conservative i.e. high estimate.

The leachate within the landfill is of moderate strength and contravenes ground water quality standards in the Upper Glacial aquifer. A summary of leachate analysis is shown in Table 7 and Table 8.

Landfill Gas and Air

In general, the upwind-downwind ambient air data suggest that the Brookfield Avenue Landfill is not a significant source of most VOCs. The ranges of values for samples taken upwind of the landfill are of comparable magnitude to the values taken at downwind ambient air sampling stations. Exceptions to this include some of the methane related compounds (dichlorodifluoromethane, trichloromethane, chloroethane) and possibly benzene. On-Site gas emission sampling was conducted by means of a flux box sampling train. Usually, the Flux Box consists of a plexiglass dome on top of a stainless steel or plexiglass cylinder. A gas sampling port and real-time analyzer are usually attached by an outlet line to the plexiglass top. The flux box is placed over the landfill surface providing a sealed enclosure in which gases are collected. The flux box sampling method identifies the rate at which soil gases are emitted from the landfill surface. Use of the flux box provides a controlled environment to limit the influence of local meteorological conditions on the sampling event. The principle behind the operation of the flux box is to sweep gaseous emissions from an isolated surface through an exit port to the aforementioned portable air sampling system. Although the flux box data show that the landfill is emitting VOCs, the magnitude of the emissions is not large enough to be registered as a significant change between upwind and downwind concentrations. The flux box emission sampling and modeling results suggest that the Brookfield Avenue Landfill is a minor source of benzene, 2-hexanone, tetrachloroethene, carbon tetrachloride and trichloroethene. Acrolein and acrylonitrile were found offsite at estimated concentrations approaching 24% and 45%, respectively, of the Annual Guideline Concentration (AGC). Even though flux box emission samples and air dispersion models suggest that Brookfield is a source of acrolein and acrylonitrile in ambient air, the upwind-downwind ambient air sample analysis did not substantiate this conclusion.

The Brookfield Avenue Landfill is not a significant source of inhalable particulates. PM-10 (particulate matter, 10 microns in size) data for all four rounds were not found to exceed the Federal 24-hour standard for inhalable particulate of 150ug/m^3. In comparing the ambient air results, which were taken over a 24-hour period, to the annual standard, several samples do exceed the annual PM-10 standard of 50ug/m^3, although only one sample location has an average concentration (based on the four rounds) slightly greater than the

annual standard. No upwind-downwind relationship is apparent from the data. Higher concentration samples were just as likely to appear upwind as they were downwind. Because Brookfield is well vegetated, it is not considered a significant source of this particulate.

Hydrogen sulfide and mercaptans were detected in the landfill surface emission samples. They were found at very low levels in landfill gas within the landfill. Based on a landfill gas generation model estimate, the Brookfield Avenue Landfill, under anaerobic conditions, would generate approximately 500 to 760 standard cubic feet per minute (scfm) of gas during the constant phase of generation. Currently this is not expected to be the case due to significant infiltration of air into the waste mass. Gas generation rates are expected to increase once capping is completed and air infiltration is reduced. At that time, gas collection/venting will control gas emissions.

A summary of landfill gas analysis is shown in Table 9 and Table 10.

Radiation

The detailed radiation screening indicates that the soils found within the Brookfield Avenue Landfill do not contain radioactive waste materials. The only radionuclides present are naturally occurring, all with concentrations within the range expected for natural background.

DNAPL

DNAPLs, an acronym for Dense Non-Aqueous Phase Liquids, are heavy liquid compounds that under certain circumstances can flow downward or sink through the landfill and accumulate on confining layers such as bed rock or clay.

There is sufficient anecdotal information on the disposal practices at this site to conclude that chlorinated VOCs (potential DNAPLs) may have been disposed at this site. However, there is no soil or groundwater quality data that indicate the release of significant quantities of chlorinated solvents at this site. In addition, select wells were installed as interface probes for DNAPL. The monitoring results of the wells do not indicate the presence of DNAPL.

4.2 Interim Remedial Measures:

Interim Remedial Measures (IRMs) are conducted at sites when a source of contamination or exposure pathway can be effectively addressed before completion of the RI/FS. At the Brookfield Avenue Landfill, the following IRMs were conducted:

- Collection of product seep at Hot Spot #5

Sampling performed in 1997 revealed the presence of a Light Non Aqueous Phase Liquids (LNAPL) in Hot Spot No. 5. LNAPL is light free product floating on the groundwater (generally excluding groundwater) containing contaminants of concern. Laboratory analysis of the LNAPL indicated that it was a highly weathered, heavy oil that contained benzene, toluene, ethylbenzene, xylene, PCBs, and pesticides. On February 23, 1998, sorbent booms were installed as an IRM at Hot Spot No.5 to control seepage of the heavy oil at the ground surface.

- SVE system and flare at Hot Spot #3

Soil Vapor Extraction, known as SVE, is the most frequently used innovative treatment at Superfund sites. It is a relatively simple process that physically separates contaminants from soil. As the name suggests, SVE extracts contaminants from the soil in vapor form. Therefore, SVE systems are designed to remove contaminants that have a tendency to volatilize or evaporate easily. SVE removes volatile organic compounds (VOCs) and some semi-volatile organic compounds (SVOCs) from soil beneath the ground surface in the unsaturated zone - that part of the subsurface located above the water table. By applying a vacuum through a system of underground wells, contaminants are pulled to the surface as vapor or gas.

As an IRM, a SVE system has been implemented at the Hot Spot No. 3 location. The soil vapor extraction system was designed and built to provide an interim measure for treating soil gas in this area, until the landfill is capped, and a site-wide active collection system can be installed.

The flare equipment consists of the flare, flame arrestor, blower and motor, condensate trap, and electric controls, pipelines, and wells. Landfill gas is transported to the flare, where hazardous and undesirable constituents are thermally destroyed. This flare is now operational.

4.3 Summary of Human Exposure Pathways:

This section describes the types of human exposures that may present added health risks to persons at or around the site. A more detailed discussion of the health risks can be found in Section 6.1 of the RI Report. An exposure pathway is how an individual may come into contact with a contaminant. The five elements of an exposure pathway are: 1) the source of contamination; 2) the environmental media and transport mechanisms; 3) the point of exposure; 4) the route of exposure; and 5) the receptor population. These elements of an exposure pathway may be based on past, present, or future events.

Exposure pathways typically evaluated at sites such as the Brookfield Avenue Landfill include:

- Dermal (skin) contact with surface soils
- Ingestion of surface soils
- Inhalation of fugitive dust
- Inhalation of airborne contaminants
- Dermal contact with sediment
- Ingestion of sediment
- Dermal contact with surface water
- Ingestion of surface water
- Consumption of contaminated biota

Based on data collected during the Remedial Investigation, a risk assessment was performed to quantify the carcinogenic and noncarcinogenic risks associated with the above exposures. Using reasonable worst-case exposure scenarios for potential future uses of the site, the following exposure routes were found to produce risks above acceptable guidelines:

- Dermal contact with surface soils
- Ingestion of surface soils
- Dermal contact with leachate

The greatest site wide cancer risk is associated with exposure to benzo(a)pyrene in surface soils.

4.4 Summary of Environmental Exposure Pathways:

This section summarizes the types of environmental exposures which may be presented by the site. The Fish and Wildlife Impact Assessment included in the RI presents a more detailed discussion of the potential impacts from the site to fish and wildlife resources. The following pathways for environmental exposure have been identified:

- Leaching of contaminants from waste and soils into the groundwater (Leachate);
- Transport of contaminants from waste and soils into storm water runoff and surface waters;
- Transport of contaminants in shallow groundwater into surface waters(Leachate);
- Transport of contaminants in shallow groundwater into deep aquifers;
- Transport of contaminants from soils and landfill gas into the air;
- Transport of landfill gas into surrounding soils; and
- Transport of contaminants in surface waters.

SECTION 5: ENFORCEMENT STATUS

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

The NYSDEC and the City of New York entered into a Consent Order on May 15, 1992. The Order obligates the City to implement a full remedial program, and allows the City to apply for up to 75 percent of the eligible remediation cost under the 1986 Environmental Quality Bond Act (EQBA) Title 3 Grant.

Under the grant, the City would be required to seek compensation from responsible parties who generated, transported or disposed of hazardous waste at the site. This has already been accomplished. The total amount of settlement money received by the City of New York from responsible parties is $56,033,052.88 for the five landfill sites. As part of the agreement with New York State, the City will utilize $8,561,701 of the total amount received from the responsible parties at this site. This amount of settlement money will be subtracted from any future grant monies received by New York City for the site. The other $48 million is going towards the remedial construction of the other four landfills, Pelham Bay Landfill, Fountain Avenue Landfill, Pennsylvania Avenue Landfill, and Edgemere Landfill.

The following is the chronological enforcement history of this site.

Orders on Consent

On December 16, 1985, and again on April 17, 1990, the NYSDEC executed Orders on Consent (index #2-0952 and # 2-43-006 respectively) with the New York City Department of Sanitation (DOS) to properly close and remediate the site.

On May 15, 1992, the New York City Department of Environmental Protection (DEP) entered into an Order on Consent (index # 2-43-006) with the NYSDEC to perform a remedial program at the site.

SECTION 6: SUMMARY OF THE REMEDIATION GOALS

Goals for the remedial program have been established through the remedy selection process stated in 6 NYCRR Part 375-1.10. The overall remedial goal is to meet all Standards, Criteria And Guidance (SCGs) and be protective of human health and the environment. At a minimum, the remedy selected should eliminate

or mitigate all significant threats to public health and/or the environment presented by the hazardous waste disposed at the site through the proper application of scientific and engineering principles.

The goals selected for this site are:

- Eliminate, to the extent practicable, ingestion of groundwater affected by the site that does not attain NYSDOH Drinking Water Standards;
- Eliminate, to the extent practicable, off-site migration of groundwater that does not attain NYSDEC Class GA Ambient Water Quality Criteria;
- Eliminate, to the extent practicable, exposures to the contamination present in surface soils and waste disposal areas on site;
- Eliminate, to the extent practicable, infiltration of water into the landfill to prevent the generation of leachate;
- Eliminate, to the extent practicable, the migration of leachate into the adjacent freshwater wetlands, tidal wetlands, and to minimize impact to the wetlands during implementation of the remedial measures;
- Eliminate, to the extent practicable, exceedances of applicable environmental quality standards related to releases of contaminants to the waters of the State; and
- Eliminate, to the extent practicable, air emissions from the landfill and prevent the release of contaminants above annual air guideline concentrations (AGC), or risk-based levels.

SECTION 7: SUMMARY OF THE EVALUATION OF ALTERNATIVES

The selected remedy should be protective of human health and the environment, be cost effective, comply with other statutory laws and utilize permanent solutions, alternative technologies or resource recovery technologies to the maximum extent practicable. Potential remedial alternatives for the Brookfield Avenue Landfill Site were identified, screened and evaluated in the report entitled Brookfield Avenue Landfill Remediation Project, Feasibility Study Report, Operable Unit 1, July 2000. This report was approved by the Department.

A summary of the detailed analysis follows. As presented below, the time to implement reflects only the time required to implement the remedy, and does not include the time required to design the remedy, procure contracts for design and construction or to negotiate with responsible parties for implementation of the remedy.

7.1: Description of Alternatives

The potential remedies are intended to address the contaminated soils and groundwater at the site. Although these remedies may eliminate current discharges from the landfill to wetlands and Richmond Creek, they may not eliminate all existing environmental exposures. Therefore, contaminated sediments and surface water will be addressed in the upcoming Operable Unit 2 investigation.

ALTERNATIVE 1- NO ACTION

The no action alternative is evaluated as a procedural requirement and as a basis for comparison. It requires continued monitoring only, allowing the site to remain in an unremediated state. This alternative would leave the site in its present condition and would not provide any additional protection to human health or the environment. The Capital Cost will be for sign installation and replacement.

Present Worth:	$ 4,461,000
Capital Cost:	$2,000
Annual O&M (year 1):	$414,000
Annual O&M (years 2-5):	$413,000
Annual O&M (years 6-30):	$278,000
Time to Implement	0

ALTERNATIVES 2A to 5

Part 360 Cap, Active Gas Collection, On site treatment of Leachate (Oil /Water Separation), Institutional Controls.

Common elements of Alternatives 2A to 5 include the following:

- 6NYCRR Part 360 landfill cap with variable protection layer thickness (from 12 to 24 inches or greater). Figure 4 provides a cross section of this cap;
- Active gas collection (below ground system) and onsite treatment by flaring;
- Onsite treatment of leachate (oil/water separation) with discharge to the sewer; and
- Institutional controls and long-term monitoring of perimeter landfill gas, groundwater and treated leachate.

The following Alternatives contain design components unique to each one in addition to the four components mentioned above.

ALTERNATIVE 2A

Part 360 Cap, Limited Leachate Collection, Active Gas Collection and Trench, Barrier Wall

Alternative 2A also includes the following unique components (as shown on Figure 5):

- Perimeter (active) gas collection trench between the landfill and Arthur Kill Road;
- Leachate collection downgradient of Hot Spot No.3 and the West Cell;
- Barrier wall along the north face of the landfill between the leachate collection trenches; and
- Barrier wall separating the southeast and southwest drainage ditches from the landfill.

Present Worth:	$ 85,763,000
Capital Cost:	$70,681,000
Annual O&M (year 1):	$1,236,000
Annual O&M (years 2-5):	$1,158,000
Annual O&M (years 6-30):	$1,018,000
Time to Implement	41 months

ALTERNATIVE 2B
Part 360 Cap, Limited Leachate Collection, Active Gas Collection, Barrier Wall

Alternative 2B also includes the following unique components (as shown on Figures 6 and 10):

- Leachate collection along the entire north face of the landfill;
- Barrier wall along the entire south face of the landfill; and

Present Worth:	$ 86,745,000
Capital Cost:	$71,293,000
Annual O&M (year 1):	$1,278,000
Annual O&M (years 2-5):	$1,183,000
Annual O&M (years 6-30):	$1,043,000
Time to Implement	41 months

ALTERNATIVE 3
Part 360 Cap, Leachate Collection, Active Gas Collection, Barrier Wall

Alternative 3 also includes the following unique components (as shown on Figures 7 and 11):

- Leachate collection around virtually the entire landfill; and
- Barrier wall connecting the leachate collection trenches south of the landfill.

Present Worth:	$ 87,903,000
Capital Cost:	$71,624,000
Annual O&M (year 1):	$1,320,000
Annual O&M (year 2-5):	$1,242,000
Annual O&M (year 6-30):	$1,102,000
Time to Implement	41 months

ALTERNATIVE 4
Part 360 Cap, Limited Leachate Collection, Active Gas Collection, Barrier Wall

Alternative 4 also includes the following unique components (as shown on Figure 8)

- Limited leachate collection adjacent to Hot Spot No.3 and Hot Spot No.5; and
- Barrier wall along the entire south face of the landfill.

Present Worth:	$ 84,849,000
Capital Cost:	$70,288,000
Annual O&M (year 1):	$1,239,000
Annual O&M (years 2-5):	$1,119,000
Annual O&M (years 6-30):	$979,000
Time to Implement	36 months

ALTERNATIVE 5
Part 360 Cap, Limited Leachate Collection, Active Gas Collection, Barrier Wall

Alternative 5 also includes the following unique components (as shown on Figure 9)

- Limited leachate collection adjacent to Hot Spot No.3 and Hot Spot No.5; and
- Barrier wall separating the southeast and southwest drainage ditches from the landfill.

Present Worth:	$ 84,209,000
Capital Cost:	$69,648,000
Annual O&M (year 1):	$1,239,000
Annual O&M (years 2-5):	$1,119,000
Annual O&M (years 6-30):	$979,000
Time to Implement	36 months

7.2 Evaluation of Remedial Alternatives

The criteria used to compare the potential remedial alternatives are defined in the regulation that directs the remediation of inactive hazardous waste sites in New York State (6 NYCRR Part 375). For each of the criteria, a brief description is provided, followed by an evaluation of the alternatives against that criterion. A detailed discussion of the evaluation criteria and comparative analysis is included in the Feasibility Study.

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

1. Compliance with New York State Standards, Criteria, and Guidance (SCGs). Compliance with SCGs addresses whether or not a remedy will meet applicable environmental laws, regulations, standards, and guidance. The remedy for a site must conform with Standards and Criteria, which are officially promulgated rules and standards that are directly applicable, or relevant and appropriate to the action. Guidance documents are unpromulgated guidelines that, upon exercise of engineering judgement, are found to be applicable on a site-specific basis.

One applicable criterion for landfill closure is a cap with a continuous single or double impermeable layer, as specified in 6NYCRR Part 360. The no action alternative does not comply with this criterion.

NYSDEC expects that surface water quality standards adjacent to the landfill would be met by alternatives that provide a Part 360 cap, leachate collection, and barrier wall. Capping, regrading, leachate collection, and barrier wall would eliminate or greatly reduce subsurface leachate flow to surface water, and would eliminate contaminated surface runoff. Together, these are expected to achieve surface water standards for landfill-related contaminants. These objectives are met by Alternatives 2A, 2B, 3, 4 and 5.

Air quality SCGs would be expected to be met by those alternatives that provide active gas collection (Alternatives 2A through 5).

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

Human health would be protected by elimination of the routes of exposure identified in Section 4.3 as producing unacceptable health risks. Therefore, alternatives that prevent direct contact with surface soils and

wastes and prevent discharge of site-related contaminants to Richmond Creek surface water and sediments are considered to be protective. Alternatives that provide a landfill cover that reduce or eliminate contaminant flow to Richmond Creek would meet these objectives. Such alternatives would also be protective of the environment and would reduce or eliminate some of the ecological impacts identified in Section 4.4. These objectives would be met by Alternatives 2A, 2B, 3, 4 and 5.

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

3. Short-term Effectiveness. The short-term impacts of each alternative are evaluated, generally considering the following: 1) risk to workers during remedial construction; 2) the effectiveness of personal protective equipment and monitoring; 3) environmental impacts caused during construction including impacts to wetlands; 4) effectiveness of engineering controls and mitigative measures implemented during and after construction; 5) manners of transport of capping materials to the site and associated impacts; and 6) time required to complete construction.

Alternatives 2A, 2B, 3, 4, and 5 that provide for grading and capping the landfill would cause short term adverse impacts due to potential exposure to excavated wastes, contaminated runoff and airborne dusts, vapors and gases. Because the amount of waste regrading is the same for the five capping options under consideration, these short term impacts would also be similar.

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

Alternatives 2A, 2B, 3, 4, and 5, which provide leachate collection, would provide a high degree of long term effectiveness. The landfill cap would also minimize leachate production and limit its migration to surface waters. Alternatives 2B and 3 provide better long term leachate control.

5. Reduction of Toxicity, Mobility or Volume. Preference is given to alternatives that permanently and significantly reduce the toxicity, mobility or volume of the wastes at the site. Significant factors include: 1) the quantity of hazardous contaminants that will be destroyed, treated, or recycled; 2) the degree that treatment is used to reduce site hazards; 3) the degree that treatment is irreversible; and 4) the quantity and characteristics of treatment residuals.

Alternatives 2B and 3 would achieve the greatest reduction of toxicity, mobility and volume through treatment of leachate. Alternative 2A would achieve the greatest reduction of toxicity, mobility and volume through additional collection and destruction of landfill gas because of the trench.

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

Technically, the technologies under consideration are well developed and reliable. The greatest technical difficulty for cap construction would be the regrading of wastes to meet final slope requirements and the

availability of cover materials and their transportation to the site. The large volume of waste relocation required would require extensive odor and dust controls during construction.

Alternatives 2A, 2B, 3, 4, and 5 would be considered equally implementable with respect to the landfill cap. Alternatives 4 and 5 are marginally more implementable than Alternatives 2A, 2B and 3, due to less wetland disturbance. Implementability of the leachate collection and containment systems of Alternative 5 is expected to be the highest, followed by (in order) Alternative 4, 2A, 2B and 3.

Administratively, construction activities that effect wetlands would require approvals of several state and federal agencies depending on final designs. Approvals for the landfill cap design, air and surface water discharges would come from NYSDEC, and would require administrative coordination.

7. Cost. Capital and operation and maintenance costs are estimated for each alternative and compared on a present worth basis. Although cost is the last balancing criterion evaluated, where two or more alternatives have met the requirements of the remaining criteria, cost effectiveness can be used as the basis for the final decision. The costs for each alternative are presented in Table 11.

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

8. Community Acceptance - Concerns of the community regarding the RI/FS reports and the Proposed Remedial Action Plan have been evaluated. The "Responsiveness Summary" included as Appendix A presents the public comments received and the Department's response to the concerns raised.

In general the public comments received were supportive of the selected remedy. Several comments were received, however, which advocated the selection of Alternative 3, Part 360, Cap leachate collection, active gas collecting and barrier wall. Concern was expressed regarding the schedule for design and construction of OU#1 and for the investigation of OU#2. Interest was expressed in the proposed use of dredge material as a cover material. Also, there was concern expressed regarding the impact on the community when invasive construction activities occur.

People live extremely close to the site. Specifically, the entire southern boundary of the landfill is within several feet of Arthur Kill Road, immediately south of which is a heavily populated residential area. During the RI process, there have been many allegations of hazardous waste disposal both on and off the site. The concerns expressed by the public during the numerous meetings held indicate that there is a need for the landfill to be isolated or sealed off from the rest of the community, meaning the waste area should be covered and collection or containment measures should be installed around the entire site. The community has been an active participant throughout the entire process

SECTION 8: SUMMARY OF THE SELECTED REMEDY

Based on the results of the RI/FS, and the evaluation presented in Section 7, the NYSDEC is selecting Alternative 2B, capping with an active gas collection, leachate collection and barrier wall as the remedy for the Brookfield Avenue Landfill.

This selection is based upon the evaluation of the five alternatives developed for this site. With the exception of the no action alternative, each of the alternatives will comply with the threshold criteria. Alternative 2B will be more protective in the long-term because it gives better control of gas and more complete control of leachate than 2A. The barrier wall located along the southern perimeter of the landfill will prevent the potential offsite migration of methane, which could possibly occur, after the installation of the landfill cap, in

the direction of the homes on the south side of Arthur Kill Road. The barrier wall will also prevent leachate from leaving the landfill and will reduce the amount of leachate being generated from ground water that will have entered the landfill. The leachate collection system in Alternative 2B will provide additional prevention of leachate entering Richmond Creek. Alternative 2B is less expensive than Alternative 3, but provides similar control of leachate and gas. Alternatives 4 and 5 lack leachate containment capabilities along the north side of the landfill, and will not be sufficiently protective of the environment. Leachate collection for Alternatives 4 and 5 is limited to the downgradient perimeter of the landfill at Hot Spots No. 3 and No. 5. The long-term effectiveness of Alternatives 4 and 5 is considered to be moderate.

8.1 Selected Remedy

The elements of the selected remedy are as follows:

1. A remedial design program to verify the components of the conceptual design and provide the details necessary for the construction, operation and maintenance, and monitoring of the remedial program. Any uncertainties identified during the RI/FS will be resolved.

2. Construction of a Part 360 landfill cap, featuring a gas venting layer, synthetic membrane barrier layer, 12"-24" or greater soil barrier protection layer and vegetated topsoil layer.

3. Construction and operation of an active gas collection system, conceptually consisting of a series of perforated pipes set in gravel wells beneath the landfill cap. Landfill gas will be extracted from these wells via blowers to an enclosed flare for combustion.

4. Installation of a barrier wall along Arthur Kill Road to prevent the discharge of leachate to the southeast and landfill gas migration along Arthur Kill Road.

5. Construction of a surface water collection system.

6. Construction of a leachate collection trench along Richmond Creek and pretreatment system.

7. Minimization of encroachment into freshwater and tidal wetlands. The remedy design will meet the permitting standards of 6 NYCRR Parts 661 and 663. Wetland restoration and/or mitigation will be provided for any wetland disturbance along the northern edge of the landfill, and along the Richmond Creek edge between the east and west landfill cells.

8. Institutional controls consisting of deed restrictions or a comparable legal mechanism on the site to ensure that groundwater beneath the site is not extracted for potable use and to ensure that any future site construction or other invasive activity is pre-approved by NYSDEC and NYSDOH.

9. Initiation of a long term monitoring program to ensure that the contained hazardous waste does not leave the site. This program would allow the effectiveness of the selected remedy to be monitored. This long term monitoring program would be a component of the operations and maintenance plan for the site and would be developed in accordance with 6NYCRR Part 360 regulations.

8.2 Additional Issues

1. Holterman's Bakery

Behind Holterman's Bakery, located on Arthur Kill Road, approximately 10,000 ft^2 of the owner's property was used for the disposal of waste material as part of the Brookfield Avenue Landfill operation and requires

remediation. The City is currently investigating the best method of including this portion of the Holterman's Bakery property in its design plan for the landfill closure. If New York City is unsuccessful in acquiring the property, the City will submit a revised design plan to remediate this area.

2. Dredge Material

The New York City Department of Environmental Protection and Economic Development Corporation have initiated a pilot project at the Pennsylvania Avenue and Fountain Avenue Landfills (Penn/Fountain Avenue Dredged Materials Beneficial Reuse Pilot Study). It is designed to confirm that dredged materials are suitable for use under landfill liners for grading and to determine if dredged materials are suitable for use above liners as final cover at landfills with proposed end-use plans similar to Brookfield. The City has notified NYSDEC, that should the pilot project successfully demonstrate that dredged materials can meet all appropriate physical, chemical and agricultural closure specifications, it is interested in the use of these materials for the closure of Brookfield. Any dredge or alternative material will not be a hazardous waste as defined by NYCRR Part 371 and will have to meet specifications when used below the liner as a structural fill. Materials above the liner will have to meet chemical, physical, and structural specifications allowing parkland use and physical and agricultural specifications allowing use as a growing medium.

3. Topsoil (Manufactured)

The City has advised NYSDEC of its intent to consider the use of manufactured topsoil at this facility in areas where grass and other vegetation will be grown. Manufactured topsoil is not a virgin material and is typically composed of compost and other material, for example, silt, sand and clay in varying percentages depending on the soil conditions needed for growth of a specific vegetation. The topsoil will also contain nutrients such as nitrogen and phosphorus so that plant growth can be sustained. This material can not be a waste as defined in NYCRR Part 360 and must meet chemical and physical specifications. Chemical testing of proposed material shall be required in contract specifications.

8.3 End Use

The City has proposed a conceptual end use plan for the landfill that could include the following:

1. Reforestation of the eastern area of the landfill through the planting of trees.

   Among the 40 species to be grown at the landfill is beach plum, pitch pine, white oak, red oak, black oak, chestnut oak, American holly, and Amelanchier. The reasons these species were chosen are (i) they grow well in dry, infertile soil, (ii) they historically existed on Staten Island before human intervention, (iii) they provide a good wildlife habitat, (iv) they grow along the coast, and (v) they are aesthetically pleasing.

   In addition, trees and shrubs provide greater erosion protection than grass alone.

2. Preparation of the western side of the site for the construction of passive and active recreation areas.

3. Preparation of the central areas of the site for the future construction of a formal park entrance, education center, interpretive area, parking, maintenance compound, detention ponds, and canoe/kayak launching area.

4. Preparation of the eastern side of the site as a passive recreation area, including such features as hiking trails and observation areas

The estimated capital costs, operating costs and maintenance costs for construction of the End Use Plan are listed in Table 12. These costs are not reflected in the individual alternatives cost in Table 11.

SECTION 9: HIGHLIGHTS OF COMMUNITY PARTICIPATION

As part of the remedial investigation process, a number of Citizen Participation activities were undertaken in an effort to inform and educate the public about conditions at the site and the potential remedial alternatives. A highlight of the Citizen Participation Activities included the establishment of a Citizens Advisory Committee (CAC). The CAC and their Engineering and Scientific consultants made a real difference in the way the remedial investigation and subsequent activities were conducted. The following public participation activities were conducted for the site:

The following repositories for documents pertaining to the site were established:

Staten Island Public Library
Richmondtown Branch
200 Clarke Avenue
Staten Island, NY 10306
(718)668-0413

Staten Island Public Library
New Dorp Regional
309 New Dorp Lane
Staten Island, NY 10301
(718)351-2977

Staten Island Borough Hall
Room 100
Staten Island, NY 10301
(718)816-2000

Community Board #3
655-218 Rossville Avenue
Staten Island, NY 10309
(718)356-7900

Community Board #2
460 Brielle Avenue
Staten Island, NY 10301
(718)317-3235

New York City
Department of Environmental Protection
Office of Community Outreach
59-17 Junction Boulevard
Corona, NY 11365-5107
(718)595-3484

New York State Department of Environmental Conservation
Region 2 Office
47-40 21st Street
Long Island City, NY 11101
Nigel N. Crawford
(718) 482-4996

A site mailing list was established which included nearby property owners, local political officials, local media and other interested parties.

On April 20, 1998 a public meeting was conducted at which results of the Remedial Investigation and the Feasibility Study report were presented.

In May 2001, the Proposed Remedial Action Plan (PRAP) was issued. The PRAP public meeting was held at P.S. 32 at 32 Elverton avenue on Tuesday June 12, 2001. As mandated by 6NYCRR Part 375, a minimum thirty-day comment period was held for the PRAP from May 30, 2001 to June 29, 2001. This period was subsequently extended by two weeks. Fact sheets were sent out to everyone on the mailing list in addition to invitations to the PRAP public meeting. The PRAP public meeting was held at P.S. 32 at 32 Elverton Avenue on Tuesday June 12,2001. During this period NYSDEC staff was in contact with the CAC and their consultants.

In March, 2002 a Responsiveness Summary was prepared and made available to the public, to address the comments received during the public comment period for the PRAP.

Table 1
Extent of Contamination
Sampled from 05/94 to 05/97

MEDIA	CLASS	CONTAMINANT OF CONCERN	CONCENTRATION RANGE (ppm)	FREQUENCY of EXCEEDING TAGM	SCG (ppm)
Surface Soil	Semivolatile Organic Compounds (SVOCs)	Benzo(a)anthracene	ND to 5.3	6 of 16	.224
		Chrysene	ND to 4.1	4 of 16	.400
		Benzo(b)fluoranthene	ND to 5.1	2 of 16	1.100
		Benzo(k)fluoranthene	ND to 2.8	2 of 16	1.100
		Benzo(a)pyrene	ND to 3.8	11 of 16	.061
		Dibenzo(a,h)anthracene	ND to 0.56	8 of 16	.014
	Inorganics	Arsenic	2.6 to 25	2 of 17	7.5
		Barium	29.5 to 337	1 of 17	300
		Beryllium	ND to 0.52	1 of 17	0.16
		Cadmium	ND to 5.6	13 of 17	1
		Chromium	9.8 to 40.4	15 of 17	10
		Copper	10.5 to 171	9 of 17	25
		Iron	4,530 to 21,300	17 of 17	2,000
		Mercury	0.16 to 0.73	17 of 17	0.1
		Nickel	ND to 96.4	10 of 17	13
		Zinc	8.3 to 651	9 of 17	20

Table 2
Extent of Contamination
Sampled from 05/94 to 05/97

MEDIA	CLASS	CONTAMINANT OF CONCERN	CONCENTRATION RANGE (ppm)	FREQUENCY of EXCEEDING TAGM	SCG (ppm)
Subsurface Soil	Volatile Organic Compounds (VOCs)	2-Butanone	ND to 1,500	2 of 89	0.30
		Acetone	ND to 21	3 of 89	0.20
		Chlorobenzene	ND to 0.11	0 of 89	1.70
		Methylene Chloride	ND to 8.2	10 of 89	0.1
		Ethylbenzene	ND to 54	13 of 89	5.50
		Tetrachloroethene	ND to 0.024	0 of 89	1.40
		Toluene	ND to 150	1 of 89	1.50
		Xylenes (total)	ND to 190	17 of 89	1.20
	Semivolatile Organic Compounds (SVOCs)	Phenol	ND to 1.3	12 of 46	0.03
		Chrysene	ND to 2.5	2 of 46	0.40
		Benzo(b)fluoranthene	ND to 1.9	2 of 46	1.10
		Benzo(k) Fluoranthene	ND to 2.7	1 of 46	1.10
		Benzo(a)pyrene	ND to 2.0	6 of 46	0.061
		Dibenzo(a,h)anthracene	ND to 0.56	5 of 46	0.014
	Inorganics	Barium	6.7 to 368	2 of 43	300
		Beryllium	ND to 4.5	36 of 43	0.16
		Cadmium	ND to 3.3	7 of 43	1.00
		Chromium	2.7 to 95	37 of 43	10.00
		Iron	3,190 to 72,600	43 of 43	2,000
		Nickel	2.4 to 191	37 of 43	13.0
		Zinc	1.2 to 461	24 of 43	20.0
		Copper	1.2 to 161	24 of 43	25.0
		Mercury	ND to 0.91	24 of 43	25.0
	Pesticides/ PCBs	Aroclor 1254	0.47 to 22	3 of 46	10.00
		Heptochlor epoxide	ND	0 of 68	0.02

SCGs from TAGM 4046

Table 3
Extent of Contamination
Sampled from 05/94 to 05/97

MEDIA	CLASS	CONTAMINANT OF CONCERN	CONCENTRATION RANGE (ppb)	FREQUENCY of EXCEEDING SCGs	SCG (ppb)
Groundwater (in shallow upper glacial aquifer)	Pesticides	Aldrin	ND to 0.023	0 of 53	0.050
		Dieldrin	ND to 0.021	2 of 53	0.004
		4, 4'-DDE	ND to 0.062	0 of 53	0.2
		4, 4'-DDD	ND to 0.11	0 of 53	0.3
		Endrin	ND to 0.017	0 of 53	ND
		Alpha-Chlordane	ND to 0.12	1 of 53	0.05
		Aroclor 1232	ND to 4.5	1 of 53	0.09
		Aroclor 1254	ND to 1.9	1 of 53	0.09
		Alpha-BHC	ND to 0.0085	0 of 53	0.01
		Beta-BHC	ND to 0.014	0 of 53	0.04
	Inorganics	Aluminum	ND to 4,010	10 of 53	1318
		Arsenic	ND to 27.1	1 of 53	25
		Calcium	3510 to 261,000	50 of 53	8745
		Iron	120 to 67,600	43 of 53	300
		Magnesium	5,670 to 570,000	34 of 53	35,000
		Manganese	16.1 to 14,200	29 of 53	300
		Nickel	ND to 101	2 of 53	100
		Potassium	1,170 to 218,000	50 of 53	1353
		Sodium	17,000 to 4,840,000	41 of 53	20,000
		Vanadium	ND to 15.6	9 of 53	3
		Zinc	18.3 to 456	0 of 53	2,000
	Conventional	Ammonia	ND to 155,000	30 of 53	2,000

Table 3 (cont'd)
Extent of Contamination
Sampled from 05/94 to 05/97

MEDIA	CLASS	CONTAMINANT OF CONCERN	CONCENTRATION RANGE (ppb)	FREQUENCY of EXCEEDING SCG's	SCG (ppb)
Groundwater (in shallow upper glacial aquifer)	Volatile Organic Compounds (VOCs)	Benzene	ND to 12	18 of 53	1
		Chlorobenzene	ND to 48	22 of 53	5
		Toluene	ND to 49	2 of 53	5
		O-Xylenes	ND to 3.8	0 of 53	5
	Semivolatile Organic Compounds (SVOCs)	1,4-Dichlorobenzene	ND to 6	8 of 53	3
		4-Methylphenol	ND to 22	4 of 53	1
		4-Chloro-3-Methylphenol	ND to 10	9 of 53	1

Note: SB Site Background. ND: Non detect.

Table 4
Extent of Contamination
Sampled from 05/94 to 05/97

MEDIA	CLASS	CONTAMINANT OF CONCERN	CONCENTRATION RANGE (ppb)	FREQUENCY of EXCEEDING SCGs	SCG (ppb)
Groundwater (in deep glacial aquifer)	Volatile Organic Compounds (VOCs)	Chloroform	ND to 21	3 of 30	7
		Methylene Chloride	ND to 5.3	1 of 30	5
		Toluene	ND to 24	1 of 30	5
	Semivolatile Organic Compounds (SVOCs)	Bis(2-Ethylhexyl) Phthalate	ND to 7	1 of 30	5
	Inorganics	Aluminum	90.6 to 8,590	10 of 30	1318
		Calcium	1523 to 605,000	19 of 30	8745
		Barium	86.7 to 1,370	1 of 30	1,000
		Iron	46.2 to 59,200	20 of 30	300
		Magnesium	2,080 to 367,000	14 of 30	35,000
		Manganese	37.6 to 3,480	17 of 30	300
		Nickel	ND to 149	3 of 30	100
		Potassium	660 to 114,000	20 of 30	1353
		Sodium	8,800 to 3,100,000	13 of 30	20,000
		Vanadium	ND to 25.7	9 of 30	3.00
		Copper	ND to 368	1 of 30	200
		Cobalt	ND to 35.6	2 of 30	17.70
	Conventional	Ammonia	ND to 6.07	6 of 30	2,000

Note:
SB: Site Background.

Table 5
Extent of Contamination
Sampled from 05/94 to 05/97

MEDIA	CLASS	CONTAMINANT OF CONCERN	CONCENTRATION RANGE (ppb)	FREQUENCY of EXCEEDING SCGs	SCG (ppb)
Groundwater (in cretaceous glacial aquifer)	Volatile Organic Compounds (VOCs)	Acetone	ND to 13	0 of 19	50
		Chloroform	ND to 24	1 of 19	7
		Chlorobenzene	ND to 5.4	1 of 19	5
		Methylene Chloride	ND to 5	1 of 19	5
		Toluene	ND to 12	2 of 19	5
		1,1,1-Trichloroethane	ND to 22	2 of 19	5
	Pesticides	Beta-BHC	ND to 0.029	0 of 19	0.04
	Inorganics	Calcium	8,600 to 84,000	6 of 19	8745
		Iron	42.8 to 6,150	6 of 19	300
		Magnesium	18.3 to 36,500	1 of 19	35,000
		Manganese	46.2 to 422	1 of 19	300
		Potassium	1,800 to 42,700	6 of 19	1353
		Sodium	9,730 to 29,400	4 of 19	20,000
		Lead	3.5 to 42.6	1 of 19	25
		Copper	5.9 to 92.8	0 of 19	200
		Zinc	ND to 5,930	2 of 19	2,000
	Conventional	Ammonia	146 to 1,850	0 of 19	2,000

Note:
SB: Site Background.

Table 6
Extent of Contamination
Sampled from 05/94 to 05/97

Media	Class	Contaminant of Concern	Concentration range (ppb)	Frequency of Exceeding SCGs	SCG(ppb)
Surface water	VOCs	Tetrachloroethylene	ND to 2	1 of 20	1.00
	Pesticides	4,4-DDE	ND to 0.0077	1 of 20	0.000011
		4,4-DDD	ND to 0.170	1 of 20	0.000011
		gamma BHC	ND to 0.016	1 of 20	0.008
		Heptaclor	ND to 0.019	1 of 20	0.0002
		Aldrin	ND to 0.015	1 of 20	0.001
		Dieldrin	ND to 0.029	1 of 20	0.0000006
		Endrin	ND to 0.035	1 of 20	0.002
	Inorganics	Lead	ND to 42.1	9 of 20	8.0
		Mercury	ND to 0.91	6 of 20	0.0007
		Nickel	ND to 17.8	7 of 20	8.2
		Zinc	ND to 108	2 of 20	66
		Cyanide	ND to 4.8	5 of 20	1.0
		Ammonia	ND to 5179	0 of 20	

Table 7
Extent of Contamination

Sampled from 05/94 to 05/97

MEDIA	CLASS	CONTAMINANT OF CONCERN	CONCENTRATION RANGE (ppb)	FREQUENCY of EXCEEDING SCGs	SCG (ppb)
Leachate Seeps	Volatile Organic Compounds (VOCs)	Benzene	ND to 33	1 of 10	10
		Chlorobenzene	ND to 3,200	1 of 10	400
		Xylenes	ND to 240	1 of 10	19
	Semivolatile Organic Compounds (SVOCs)	1,4-Dichlorobenzene	ND to 13	3 of 10	5.0 G
		1,2-Dichlorobenzene	ND to 160	1 of 10	5.0 G
		Naphthalene	ND to 64	0 of 1	16
		Benzo(a)pyrene	ND to 1	1 of 10	0.001
	Pesticides	4,4'-DDE	ND to 0.014	2 of 10	0.0000011
		Alpha BHC	ND to 0.0044	1 of 10	0.02
	Inorganics	Arsenic	ND to 230	3 of 10	63
		Chromium	3.1 to 1,140	5 of 10	54
		Lead	ND to 2,860	9 of 10	8
		Mercury	ND to 39	9 of 10	0.0007
		Nickel	ND to 647	9 of 10	8.2
		Zinc	56.7 to 9,610	9 of 10	66
		Cadmium	ND to 19.6	1 of 10	7.70
	Conventional	Ammonia	ND to 274,000	-	-

Note: Parenthesis indicates a non detect with the detection limit shown.
SB: Site Background.
G: Guidance value.
SCGs for Class SC waters

Table 8
Extent of Contamination
Sampled from 05/94 to 05/97

MEDIA	CLASS	CONTAMINANT OF CONCERN	CONCENTRATION RANGE (ppb)	FREQUENCY of EXCEEDING SCGs	SCG (ppb)
Ground-water (from leachate well)	Volatile Organic Compounds (VOCs)	2-Butanone	1.7 to 190,000	3 of 10	50
		4-Methyl-2-Pentanone	ND to 1,800	2 of 10	50
		Acetone	ND to 9,300	1 of 10	50
		Benzene	ND to 31	8 of 10	1
		Chlorobenzene	ND to 24	7 of 10	5
		Ethylbenzene	ND to 69	4 of 10	5
		Trichloroethylene	ND to 7	1 of 10	5
		Methylene Chloride	ND to 90	2 of 10	5
		Toluene	ND to 3,600	3 of 10	5
		Xylenes(total)	ND to 310	4 of 10	5
	Semivolatile Organic Compounds (SVOCs)	Phenol	ND to 58	1 of 10	1
		1,4-Dichlorobenzene	ND to 13	4 of 10	3
		2-Methylnaphthalene	ND to 18	0 of 10	50
		4-Chloro-3-Methylphenol	ND to 15	4 of 10	1
		2-Methylphenol	ND to 54	2 of 10	1
		4-Methylphenol	ND to 54	4 of 10	1
		2,4-Dimethylphenol	ND to 26	2 of 10	1
		Di-n-butylphthalate	ND to 98	1 of 10	50
		Naphthalene	ND to 200	8 of 10	10

SCGs are for Class GA waters

Table 8 (cont'd)
Extent of Contamination
Sampled from 05/94 to 05/97

MEDIA	CLASS	CONTAMINANT OF CONCERN	CONCENTRATION RANGE (ppb)	FREQUENCY of EXCEEDING SCGs	SCG (ppb)
Groundwater	Pesticides	4,4'-DDE	ND to 0.0096	0 of 10	0.2
(from leachate well)	Inorganics	Aluminum	368 to 7,000	4 of 10	1,318
		Calcium	19,300 to 145,000	10 of 10	8,745
		Chromium	ND to 115	2 of 10	50
		Cobalt	25.7 to 40	2 of 10	17.7
		Iron	744 to 65,700	10 of 10	300
		Magnesium	45,400 to 172,000	10 of 10	35,000
		Manganese	47.6 to 133,000	3 of 10	300
		Nickel	ND to 126	7 of 10	100
		Potassium	25,500 to 706,000	10 of 10	1353
		Sodium	6,930 to 2,820,000	9 of 10	20,000
		Vanadium	3.1 to 36.7	6 of 10	3
		Cyanide	3,100 to 27,500	0 of 10	200
		Lead	6.1 to 59.8	2 of 10	25
	Conventional	Ammonia	1,037 to 488,000	8 of 10	2,000

Note:
SB: Site Background.

Table 9
Extent of Contamination
Landfill Gas Sampling Analysis Results
Sampled from 05/94 to 05/97

Compound	Sample LW-2S	Sample LW-3S	Sample LW-4S	Sample LW-5S
Test Method NIOSH 6010 (1)				
HYDROGEN CYANIDE (ug)	<1	<1	<1	<1
Test Method ASTM D>3416				
METHANE	65%	8.4%	50%	49%
CARBON DIOXIDE	16%	20%	11%	13%
Test Method ASTM D-5504				
HYDROGEN SULFIDE	280	5,000	<5.2	<10
METHYL MERCAPTAN	<5.6	<26	16	<10
ETHYL MERCAPTAN	<5.6	<26	<5.2	<10
ISOPROPYL MERCAPTAN	<5.6	<26	<5.2	<10
tert-BUTYL MERCAPTAN	<5.6	<26	<5.2	<10
N-PROPYL MERCAPTAN	<5.6	<26	<5.2	<10
ISOBUTYL MERCAPTAN	<5.6	<26	<5.2	<10
n-BUTYL MERCAPTAN	<5.6	<26	<5.2	<10
Test Method EPA TO-14				
DICHLORODIFLUOROMETHANE	<9.3	71	<8.7	<22
FREON 114	220	140	200	110
CHLOROMETHANE	<9.3	<13	<8.7	<22
VINYL CHLORIDE	21	14	24	<22
BROMOMETHANE	<9.3	<13	<8.7	<22
CHLOROETHANE	<9.3	<13	290	<22
TRICHLOROFLUOROMETHANE	<9.3	<13	<8.7	<22
1,1-DICHLOROETHYLENE	<9.3	<13	<8.7	<22
FREON 113	<9.3	<13	<8.7	<22
METHYLENE CHLORIDE	<9.3	<13	<8.7	<22
1,1-DICHLOROETHANE	<9.3	<13	21	<22
Cis-1,2-DICHLOROETHYLENE	<9.3	<13	27	<22
CHLOROFORM	<9.3	<13	<8.7	<22

NOTES: U - Quantity undetected, E - Quantity estimated, Concentration in ppbv.

Table 9 (cont'd)
Extent of Contamination
Landfill Gas Sampling Analysis Results
Sampled from 05/94 to 05/97

Compound	Sample LW-2S	Sample LW-3S	Sample LW-4S	Sample LW-5S
Test Method NIOSH 6010 (1)				
1,1,1-TRICHLOROETHANE	<9.3	<13	<8.7	<22
CARBON TETRACHLORIDE	<9.3	<13	<8.7	<22
BENZENE	210	54	81	93

Table 10
Extent of Contamination
Landfill Gas Sampling Analysis Results
Sampled from 05/94 to 05/97

Compound	Sample LW-2S	Sample LW-2S	Sample LW-2S	Sample LW-2S
Test Method EPA TO-14 (con't)				
1,2-DICHLOROETHANE	<9.3	<13	<8.7	<22
TRICHLOROETHYLENE	<9.3	<13	<8.7	<22
1,2-DICHLOROPROPANE	<9.3	<13	<8.7	<22
Trans-1,3-DICHLROPROPANE	<9.3	<13	<8.7	<22
TOLUENE	36	36	24	56
Cis-1,3-DICHLOROPROPANE	<9.3	<13	<8.7	<22
1,1,2-TRICHLOROETHANE	<9.3	<13	<8.7	<22
TETRACHLOROETHYLENE	<9.3	<13	<8.7	<22
ETHYLENE DIBROMIDE	<9.3	<13	<8.7	<22
CHLOROBENZENE	140	770	<8.7	140
ETHYLBENZENE	20	71	82	56
m,p-XYLENE	69	710	52	380
o-XYLENE	36	330	24	22
STYRENE	<9.3	<13	<8.7	<22
1,1,2,2-TETRACHLOROETHANE	<9.3	<13	<8.7	<22
1,3,5-TRIMETHYL BENZENE	14	350	<8.7	190
1,2,4-TRIMETHYL BENZENE	58	1200	18	600
1,3-DICHLOROBENZENE	<9.3	<13	<8.7	<22
1,4-DICHLOROBENZENE	48	270	<8.7	<22
CHLOROTOLUENE	<9.3	<13	<8.7	<22
1,2-DICHLOROBENZENE	<9.3	<13	<8.7	<22
1,2,4-TRICHLOROBENZENE	<9.3	<13	<8.7	<22
HEXACHLOROBUTADIENE	<9.3	<1300	<8.7	<22
METHYL ALCOHOL	<930	<52	180,000 E	<2200
ACETONITRILE	<37	<52	<35	<86
ETHYL ETHER	150	<52	120	<86
ACETONE	94	<52	<35	290
ACRYLONITRILE	<37	<52	<35	<86
VINYL ACETATE	<37	<52	<35	<86
2-BUTANOL	<37	<52	<35	<86
1-BUTANOL	<930	<1300	<870	<2200

Table 10 (cont'd)
Extent of Contamination
Landfill Gas Sampling Analysis Results
Sampled from 05/94 to 05/97

Compound	Sample LW-2S	Sample LW-2S	Sample LW-2S	Sample LW-2S
4-METHYL-2-PENTANONE	<37	<52	<35	<86
2-HEXANONE	<37	<52	<35	<86
METHYL-T-BUTYL ETHER	<37	<52	<35	<86
ACROLEIN	<37	<52	<35	<86

NOTES: U - Quantity undetected, E - Quantity estimated, Concentration in ppbv.

Table 11

BROOKFIELD AVENUE LANDFILL CLOSURE
Remedial Alternatives Cost

ITEM	Alternative 1	Alternative 2A	Alternative 2B	Alternative 3	Alternative 4	Alternative 5
Capital Cost	$2,000	$70,681,000	$71,293,000	$71,624,000	$70,288,000	$69,648,000
Annual O & M Cost (year 1)	$414,000	$1,236,000	$1,278,000	$1,320,000	$1,239,000	$1,239,000
Annual O & M Cost (year 2-5)	$413,000	$1,158,000	$1,183,000	$1,242,000	$1,119,000	$1,119,000
Annual O & M Cost (year 6-30)	$278,000	$1,018,000	$1,043,000	$1,102,000	$979,000	$979,000
TOTAL PRESENT WORTH COST	$4,461,000	$85,763,000	$86,745,000	$87,903,000	$84,849,000	$84,209,000

Notes: (1) Total present worth cost is calculated using a 4% discount rate.
(2)The Total Present Worth Cost is not equal to the sum of the preceding numbers of each column.

Table 12

Conceptual End Use Plan Cost Estimate
Brookfield Avenue Landfill Feasibility Study

ITEM	Alternative 1	Alternative 2A	Alternative 2B	Alternative 3	Alternative 4	Alternative 5
Capital Cost	$7,417,000	$7,417,000	$7,417,000	$7,417,000	$7,417,000	$7,417,000
Annual O & M Cost (year 1)	$145,000	$145,000	$145,000	$145,000	$145,000	$145,000
Annual O & M Cost (year 2-5)	$508,000	$508,000	$508,000	$508,000	$508,000	$508,000
Annual O & M Cost (year 6-30)	$1,868,000	$1,868,000	$1,868,000	$1,868,000	$1,868,000	$1,868,000
TOTAL PRESENT WORTH COST	$6,340,000	$6,340,000	$6,340,000	$6,340,000	$6,340,000	$6,340,000

Note: The Total Present Worth Cost is not equal to the sum of the preceding numbers of each column.

BROOKFIELD AVENUE LANDFILL

RECORD OF DECISION

APPENDIX A

RESPONSIVENESS SUMMARY

APPENDIX A

RESPONSIVENESS SUMMARY

Brookfield Avenue Landfill
Proposed Remedial Action Plan
New York, Richmond County
Site No. 2-43-006

The Proposed Remedial Action Plan (PRAP) for the Brookfield Avenue Landfill, was prepared by the New York State Department of Environmental Conservation (NYSDEC) and issued to the local document repositories on May 30, 2001. This PRAP outlined the preferred remedial measure for the remediation of the contaminated soil at the Brookfield Avenue Landfill. The preferred remedy includes:

- A Part 360 landfill cap;
- A barrier wall to prevent both groundwater inflow into the landfill and methane migration along Arthur Kill Road;
- Surface water runoff collection;
- Leachate collection and treatment;
- Minimization of encroachment into freshwater and tidal wetlands;
- Active landfill gas collection and treatment;
- Institutional controls including deed restrictions to supplement engineering controls; and
- Initiation of a long term monitoring program to ensure that the contained hazardous waste does not leave the site.

The release of the PRAP was announced via a notice to the mailing list, informing the public of the PRAP's availability.

A public meeting was held on June 12, 2001 at which there was discussion of the proposed remedy. The meeting provided an opportunity for citizens to discuss their concerns, ask questions and comment on the proposed remedy. These comments have become part of the Administrative Record for this site. Written comments were received from:

State Senator John Marchi, 24th District
Libby Hikind, Former Candidate for NYC City Council, 50th District
W.F. Van Den Houten, Attorney-at-Law
Ransom Environmental, Engineering Consultants to the Citizens Advisory Committee
Charles Senger
Barbara Blake
Ajanay Feld
F.Ventura
Carol Melian
Josephine Senger
Sally A. Stein
Mr. Tramontano
Theodore A. Mrozinski (TM Environmental Consulting)

The public comment period for the PRAP ended on June 29, 2001.

This Responsiveness Summary responds to all questions and comments raised at the June, 12 2001 public meeting and to the written comments received.

The following are the comments/questions received at the public meeting and through the mail, with the NYSDEC's responses:

SUPERFUND REFINANCING

Written comments recommended that the State Superfund, previously considered to be a major source of funding for the projected $87 million cost, needs urgently to be fully financed by the state legislature and Governor. In their June 27, 2001 letter the Brookfield Avenue Landfill Citizen's Advisory Committee (CAC) expressed concern about the refinancing of the State Superfund program. The concern is whether the Brookfield Avenue Landfill cleanup can receive a portion of these funds. The NYSDEC may view the cleanup as an obligation on the part of New York City. The reality is that when the City budget gets tight there may be delays in the progress of the closure. The CAC requests that the NYSDEC establish a time frame with serious penalties for not meeting deadlines in the Record of Decision and/or Consent order. The CAC also urges the NYSDEC to convey their wishes that Superfund be refinanced to the Governor's Office.

Response

The Governor places a high priority on the environmental vitality of our State and recognizes that strong and effective remedial programs play a critical role in protecting public health and the State's natural resources. For these reasons, the Governor submitted a comprehensive Superfund financing and reform package as part of his Executive Budget for State Fiscal years 2001/2002 and 2002/2003.

The Administrative Consent Order(ACO) and an Environmental Quality Bond Act (EQBA) State Assistance Contract (SAC) are the mechanisms by which dedicated funding can be applied to the remedial construction of the Brookfield Avenue Landfill. The ACO also contains penalties which can be applied to the NYCDEP in instances where there is non-compliance with the terms of the order. The thirty year monitoring program will be the financial responsibility of the City of New York with oversight by the New York State Department of Environmental Conservation (NYSDEC). For answers regarding time-frames please see the **Response** in the section entitled **SCHEDULE.**

As requested, the NYSDEC will convey to the Governor the CAC's wishes that superfund be refinanced.

CONSTRUCTION IMPACTS /COMMUNITY AIR MONITORING PLAN

Written comments were received regarding construction impacts. Concern was raised that "Whenever we start digging something up, there is dust and it is going to land on the communities downwind, such as Richmond, Lighthouse Hill, Oakwood and Great Kills. I would like to ask the panel, what are we going to do to prevent that from happening?"

A letter dated June 27, 2001 was received from the Brookfield Avenue Landfill Citizen's Advisory Committee (CAC) which stated that close attention must be paid to the air monitoring program designed and implemented within and outside the Landfill during closure. They noted that the possibility exists that portions of the Landfill may be exposed during closure operations. The CAC and Ransom requested a review of the proposed air monitoring

program, proposed action levels and mitigation measures prior to acceptance by State and City agencies to ensure adequate precautionary measures are taken to protect public health and safety.

Response

During remedial construction there will be a Community Health and Safety Plan (CHASP) in place to address exposure concerns and to protect the surrounding communities. A Community Air Monitoring Plan (CAMP) will be included in the CHASP, the purpose of which is to provide significant protection for the surrounding communities from potential airborne contaminant releases as a direct result of remedial activities. The CHASP will be reviewed by the NYSDEC and NYSDOH and must receive final approval by these agencies prior to the commencement of remedial activities. These plans will monitor air quality in the work zone, to ensure there will be no adverse effects on the surrounding communities as a result of any invasive activity during remedial construction. There will be Community involvement and periodic meetings of a Community Air Monitoring Committee. Such Committees have been established at other remedial construction sites and can be an outgrowth of the Citizens Advisory Committee (CAC). These committees meet on a periodic basis and provide a forum for the community to present their views regarding the work and also provide an opportunity for the NYCDEP to give the community updates regarding the progress of the work and the measures being taken to guarantee their health and safety. During remedial construction, measures are usually taken (e.g. the use of a water truck and other engineering controls) so that the effects of the dust generated can be contained.

AQUIFER CONTAMINATION

Questions and statements were raised regarding aquifer contamination during the June 12, 2001 public meeting. Specific questions regarding how much of the 95,000 gallons of leachate generated per day will be collected and therefore, the percentage that might not be collected.

How does the NYSDEC monitor the volume of leachate generated by the landfill and the percentage of this leachate that migrates into the cretaceous aquifer?

The commenter suggested that all the leachate should be collected and that none of it should leave the landfill.

What is the latest data on possible future flow of deep water contaminants in the deep groundwater aquifer and the effect on the local users"?

What course of action will be taken if contaminant levels increase in the underlying aquifers? What are the action levels and how are these action levels developed?

Response

Preliminary hydraulic analyses using a groundwater flow model, as detailed in Appendix C of the Feasibility Study Report, indicated that under the conditions imposed by complete Landfill encapsulation (construction of an impermeable cap, a leachate collection trench downgradient of the east and west cells, and a hydraulic barrier between the east and west cells along the southern perimeter), leachate would no longer migrate to the underlying Cretaceous Aquifer. This analysis simulated an alternative very close to the one proposed in the PRAP(Alternative 2B). Further hydraulic analyses presented in Appendix C simulated less than complete encapsulation systems. For example, the lack of a leachate collection trench or barrier wall along the southwest side of the west cell, and the southeast side of the east cell would result in an estimated 400 gallons per day of leachate migration to the cretaceous aquifer.

The alternative specified in the PRAP calls for complete landfill encapsulation and containment of leachate through downgradient leachate collection and an upgradient hydraulic barrier wall. Effective implementation of the recommended PRAP alternative should prevent further leachate migration to the Cretaceous Aquifer. Once implementation of the recommended alternative is completed, the currently estimated 92,000 gallons per day of leachate discharging to surface waters will be captured by the leachate collection system. Over time, the reduction of infiltration through the landfill due to the encapsulation will lessen leachate generation and, subsequently, reduce the amount of leachate collected.

MANUFACTURED TOPSOIL

What will be the source and composition of the manufactured topsoil?

Response

The specifications regarding manufactured topsoil are usually contained in the construction documents. The composition usually consists of silt, sand and clay in varying percentages depending on the soil conditions needed for growth of a specific vegetation. The topsoil will also contain nutrients such as nitrogen and phosphorus so that plant growth can be sustained. The sources will vary depending on their ability to provide the "topsoil". There will be sampling and analysis of any material brought on site for purity and consistency. This analysis will be based on a plan developed that is specific to this site and will be reflected in the parameters chosen for such. This analysis will also be done on a periodic basis, e.g., every 3,000 cubic yards, on the material being brought on to the site. There are structural, chemical and agricultural specifications to be met.

GREENBELT

Is the Brookfield Avenue Landfill under consideration to become part of the Greenbelt?

A resident made the following statement: I would like to see this piece of land one day go back to the environment since it was taken away from the people of Staten Island. I want to see it go back to nature, the environment, walking trails, hiking trails, and I want to see part of that Greenbelt expand, that further expanse of the hiking trails that already exists".

Response

At this time the New York City Department of Parks and Recreation (NYCDPR) has no plans to include the Brookfield Avenue Landfill (BALF) in the Greenbelt because it is not yet remediated. After remedial construction is complete the end-use plan calls for the inclusion of the BALF in the Greenbelt.

THE SOUTHWEST LA TOURETTE TRUCKFILL

A written comment noted that this area, across the Richmond Creek and the southwest corner of La Tourette Park, at Richmond Avenue and Forest Hill Road, across from the bus Garage, is a former Landfill site, never properly capped and closed. Data from the USDA/Natural Resources Conservation Service-Cornell University NYC Soil Survey indicate that this Area is heavily contaminated. Eighteen (18) heavy metals were found with concentrations above standards. What are NYSDEC, NYCDEP, and NYCDPR going to do about this Site, which contains and abuts a recently established baseball field and a model airplane field? The 1991 Greenbelt Master Plan designated that corner of SW. La Tourette park for active recreation-never did we think it would be used without a full blown hazardous materials remediation and a legally required cap!

Questions were raised about what New York State DEC, New York City DEP and New York City DPR are going to do about this site which contains and abuts a recently established baseball field and a model airplane field. How many years are we going to study whether dredge materials can cap a landfill?

Response

The Southwest La Tourette (or Richmond) Truckfill was operated by the New York City Department of Sanitation (NYCDOS) and was closed prior to the promulgation of 6NYCRR Part 360 Solid Waste Management Facility Regulations. It is not on the Registry of Inactive Hazardous Waste Disposal sites in New York State. Should evidence of a consequential amount of hazardous waste be discovered, appropriate measures will be taken to investigate the site and determine its impact, if any, on public health and the environment.

Regarding the matter of dredge material, please see the response on the following page.

DREDGE MATERIAL

Barbara Warren of Staten Island Citizens for Clean Air (SICCA) commented at the June 12, 2001 public meeting that her organization remains very, very concerned about the use of any dredge material at this site.

Written comments indicated that the use of dredge material to cap this hazardous waste landfill sounds like an attempt to solve the problem of what to do with dredge spoils. Furthermore, this should not be considered at this time without testing and public review".

State Senator John Marchi submitted a letter dated June 28, 2001 in which he stated that safety of using dredged materials as cover has not been fully explored in connection with the Landfill's nearby communities and possible health hazards.

The Brookfield Avenue Landfill Citizen's Advisory Committee (CAC) submitted a letter dated June 27, 2001 which addressed the use of dredge material. In it the CAC and Ransom requested that the use of dredge material be considered as cover material only after extensive public review and comment. They further said that at this time there is no information that assured them that this material would be safe for use in such close proximity to the community. And there are no documents in the public record concerning the use of dredged material as cover for Landfill closures. In addition, the close proximity of the population in the Brookfield Avenue Landfill area may be reason enough not to allow dredged materials for cover. They asked the following questions: "What is the testing protocol for the dredge material? Can the CAC and Ransom review the pilot study information associated with dredge material used at the Penn-Fountain Landfill, and if so, when will we be able to receive this information?" Also, the CAC requested that Ransom participate with the Penn-Fountain Landfill pilot program, to observe this process as it relates to the Brookfield Avenue Landfill closure and that a public hearing be held prior to any decision being formalized regarding the use of dredge material as cover soil for the Brookfield Avenue Landfill.

Response

At this time, the use of dredge material remains a pilot project which got underway in January, 2002 at the Pennsylvania Avenue landfill in Brooklyn. The New York City Economic Development Corporation (NYCEDC) in conjunction with the New York City Department of Environmental Protection (NYCDEP) wants to test the suitability of using dredge material both above and below the synthetic liner during remedial construction at New York City Landfills. The New York State Department of Environmental Conservation believes that material should

not be placed at any of the landfills unless they meet the physical, chemical and agricultural specifications. There is a Technical Advisory Committee (TEAC) set up by the NYCDEP to keep the citizens of surrounding communities involved in the process. There have been and will continue to be public meetings in this regard.

The NYCDEP and the NYCEDC will be able to provide copies of the testing protocol and the pilot study information.

END USE

State Senator John Marchi asked the following question on the end-use plan in a letter dated June 28, 2001 : "Are arrangements in place should the parks department not have the resources to maintain the site"?

One statement made supported an end use plan, including reforestation of the eastern section, and the proposed passive and active recreation in the western section.

Barbara Warren of the Staten Island Citizens for Clean Air (SICCA) expressed the following at the PRAP Public Meeting: "We are concerned that the cleanup be completed and the Site be completed so that it is safe before we start having kids play there".

A written comment expressed the writer's thoughts on using the site for recreation while the other part is being remedied. Although this may be wanted by some members of the community he felt it would be in everybody's best interest to keep the entire area closed while construction is underway. No more residential development should be on the Brookfield side of Arthur Kill Road. As far as the end use for the Landfill, the initial plans which include a walking park, hiking trails, and canoe launching areas are nice. However, he also wanted to suggest a nine-hole golf course and asked that this immense area not be underutilized by the neighborhood. He stated that underutilization may just happen if we just plant trees on it.

Another written statement endorsed the end use plan for the site i.e., the passive recreation areas, hiking trails and canoe area. The writer also wanted a nine-hole golf course, which in his own words "... could easily be placed in this massive space."

The June 27, 2001 letter submitted by the Brookfield Avenue Landfill Citizen's Advisory Committee (CAC) stated:(i) "The CAC is pleased with the work being performed on the end use plan, however there must not be any compromise of the cleanup standards because of this plan. Will the NYSDEC agree not to compromise cleanup standards due to the implementation of the end-use plan?" (ii) "Institutional Controls related to the Landfill closure should prevent any further development adjacent to the Landfill and Arthur Kill Road. The CAC request no further development along the portion of Arthur Kill Road adjacent to the Brookfield Avenue Landfill. Will the NYSDEC agree to no further development along the Arthur Kill Road adjacent to the Brookfield Avenue Landfill?" (iii) "What course of Action will the NYSDEC take if the closure and remediation of the Landfill is not Completed in 30 years? The CAC and Ransom request that 100 percent of the Hazardous Materials, Leachate and Landfill gases be treated during the lifetime of the closure. Is the NYSDEC going to extend the 30-year post closure remedial/monitoring period if there are Hazardous Materials, Leachate and Gas in excess of the standards?" (iv) " The CAC and Ransom do not agree that the public recreation portion of the Brookfield Avenue Landfill should be utilized while other portions of the Landfill are still undergoing closure activities. Public use should be restricted until the closure of the entire Brookfield Avenue Landfill is complete in order to prevent unnecessary potential exposures to the citizens." (v) " In addition, the CAC and Ransom request that only Option 2B shall be utilized as the choice of cleanup at the Brookfield Avenue Landfill. Option 2B is the best choice for closure because the entire Landfill would be isolated by the cover cap and perimeter

barrier wall & leachate collection trench. The barrier wall proposed for the southern side of the Landfill will prevent groundwater from migrating onto the site which will reduce the production of leachate. The presence of the barrier wall will also reduce potential Landfill gas migration off-site to the south. The leachate collection trench proposed for the northern side of the Landfill will prevent migration of leachate off the site. Option 2B with a 6NYCRR Part 360 Landfill cap with an active gas collection and control system will provide maximum control of Landfill gases and provide the identical reduction of toxicity, mobility and volume of Landfill gases as option 2A."

Response

Immediately after remedial construction, and for a period that may extend up to 30 years, there will be long-term monitoring of the site by the New York City Department of Environmental Protection as part of the Operation, Maintenance, and Monitoring (OM&M) of this site. The OM&M Plan, which will be reviewed and must be approved by NYSDEC, is a requirement of the ROD. In addition, the proposed enhanced landscape plan has been designed to minimize the need for substantial maintenance requirements. The plants and plant communities chosen will require lower maintenance each year as they progress and develop. Therefore, costly or intensive maintenance requirements of the natural areas proposed in the plan should not be necessary. In addition, the NYCDEP has already held discussions with the NYC Parks Department so that appropriate fiscal plans can be developed for the maintenance of planned activities at the site. These discussions will be ongoing as the remedial design progresses.

In presentations to Community Boards 2 and 3, there was encouragement expressed toward opening up portions of the park as they are completed. The determination to allow public access to portions of the site during ongoing remediation is dependent on a number of factors, including the nature of the remedial work being performed and the associated health and safety risks posed to those individuals. If a determination is made to allow public access to portions of the Landfill during remediation, appropriate health and safety precautions will need to be taken and the Community Health and Safety Plan must address this potential exposure scenario and include stringent monitoring for airborne contamination. The end-use plan does not envision development on the Brookfield side of Arthur Kill Road with the exception of certain recreational support facilities.

There will be no compromise regarding the cleanup standards at this or any other Landfill due to the implementation of the end use plan.

The NYCDEP has prepared an end-use plan. The remedial design and thereafter remedial construction are done with an eye towards future uses of the site. In other words, the integrity of the cap must be protected in view of the future uses of the site. The design will take into account any future use and make sure that the barrier protection layer and other layers are designed to ensure future activities at the site do not negatively impact the subsurface conditions.

The New York State Department of Health will determine if there is a public health concern for children playing on one portion of the Landfill while another portion is under remedial construction.

Leachate and Landfill gases will be treated during the lifetime of the closure.

Option 2B was selected as the remedy for the Brookfield Avenue Landfill.

SCHEDULE

A written statement was received requesting Town Meetings for the Work Schedule, a timetable of the remediation work, and any additional information be posted at our local Libraries.

What is the schedule for the implementation of the Brookfield Avenue Landfill closure and monitoring? The CAC strongly urges the NYSDEC that there needs to be a firm rigid schedule for closure. The CAC requests that the NYSDEC establish a time frame with serious penalties for not meeting deadlines in the Record of Decision and/or Consent order for Operable unit #1.

Response

Two public libraries, the Staten Island Public Library, Richmondtown Branch at 200 Clarke Avenue, Staten Island , NY 10306 and the Staten Island Public Library, New Dorp Regional at 309 New Dorp Lane, Staten Island, NY 10301 serve as repositories for project documents. There will be a public meeting prior to the end of the remedial design period.

The NYCDEP will submit a proposed schedule to design and implement the remedy. This schedule will be reviewed and must include reasonable time frames in order to be approved by the NYSDEC. The remedial design for a landfill typically takes 14 to 20 months.

According to the Administrative Consent Order , within 180 days of the NYSDEC's approval of the remedial design, the NYCDEP must commence remedial construction.

OPERABLE UNIT #2

Barbara Warren of SICCA requested a definite Schedule for the completion of work on Richmond Creek.

A submitted letter requested that the work on Richmond Creek should be completed as soon as possible, and that a timetable be published so that the neighborhood can stay informed.

The June 27, 2001 letter submitted by the Brookfield Avenue Landfill Citizen's Advisory Committee (CAC) stated: "What is the schedule for the investigation of Richmond Creek that has been labeled Operable Unit #2? The CAC only agreed to the separation of the Units (OU#1 and OU#2) if there was firm commitment from the NYSDEC to a reasonable schedule for conducting and completing investigative and remedial activities for the Richmond Creek. The CAC requests that the NYSDEC establish a time frame with serious penalties for not meeting deadlines in the Record of Decision and/or Consent Order for Operable Unit # 2. To date, the CAC and the Citizens have received no commitments and no significant work has been conducted."

Response

The NYCDEP will be submitting the Scope of Work for Operational Unit #2 (OU#2) in the Spring of 2002, which will include a schedule for implementation of the Remedial Investigation and Feasibility Study activities. The Department will review this scope and schedule, then provide comments to the City so that a work plan will be generated. This workplan will then be sent to the Citizens Advisory Committee, the Borough President, and other elected officials for comments. A public meeting will then be held, probably in the late Fall of 2002.

Citizen participation is important in this portion of the project. Therefore, there will be regular public meetings to keep the residents informed regarding the progress of OU#2. Preliminary work on this project has already

started. The delineation of the current boundaries of freshwater and tidal wetlands is complete. The delineation of the wetlands will be helpful regarding both the completion of design and construction of OU#1 and the Remedial construction for OU # 2. It should be noted that there is more than one source of contamination of Richmond Creek. There must be a coordinated approach regarding the investigation and particularly the remediation of Richmond Creek.

INTERIM REMEDIAL MEASURES (IRM)/HOT SPOTS

A letter dated June 27, 2001 was received from the Brookfield Avenue Landfill Citizen's Advisory Committee (CAC) which included the following comment(s)/question(s): "The CAC and Ransom request the status of interim remedial measure on Hot Spot #3. When will testing of the influent and effluent gas begin and what testing will be done? What is the influence of the extraction points?"

Why did we not excavate and dispose off-site the contaminated material from Hot spots 3 and 5 particularly when section 4.2.5.1 stated that this alternative is considered to be effective for both hot spot areas?

Another written comment presented the writer's belief that the Proposed Remedial Action Plan (PRAP) for Operable Unit #1 was flawed due to the assumptions made, prior to its promulgation, which dismissed the excavation and offsite disposal of contaminated soils and groundwater at Hot Spot areas No.3 and 5 due to a higher cost than other more effective technologies".

Response

NYCDEP has already procured a contractor to do the stack testing on the flare at the Landfill which is part of the IRM. The stack testing protocol was received by the NYSDEC. It was reviewed and comments were provided to the NYCDEP. The stack test will determine whether the flare is working as designed i.e. destruction through thermal oxidation of the gases emanating from the Landfill especially in the neighborhood of Hot spot #3.

The NYSDEC approved a study to better define the gas production and assess extraction well influence. This study will begin in the first quarter of 2002.

As documented in Section 4 of the Feasibility Study Report, Screening of Remedial Technologies, Excavation and Offsite Disposal of contaminated soils at Hot spots 3 and 5 was considered in addition to the other IRMs already implemented. Effectiveness is only one of three criteria that are used to evaluate and compare remedial technology alternatives. The other two are implementability and relative cost. While this option was considered to be effective, it did not meet the requirements for the other two criteria. This option was eliminated from further consideration because (i) its implementability was considered to be less than the other alternatives based upon the lack of data defining the Hot Spots, large volumes of soil requiring excavation, and/or significant exposure risks to workers during excavation., and (ii) the relative cost is also considered to be higher than other more effective technologies. Therefore, excavation was eliminated from further consideration in the Feasibility Study (FS) phase of the Remedial Process. The Interim Remedial Measures (IRMs) will only be in place until the selected remedy is constructed.

LEACHATE TREATMENT

Questions regarding leachate management included: (i) I was wondering if you could tell me where the facility to treat leachate is going to be located and what happens to the stuff that doesn't get processed and goes to the City sewer? (ii) Where does that stuff get separated? (iii) Does it get trucked away? (iv) What happens to it?"

The June 27, 2001 letter submitted by the Brookfield Avenue Landfill Citizen's Advisory Committee (CAC) stated: "How will the leachate collected from the Landfill be treated? What will be the final destination point of the treated leachate?

Response

An oil-water separator will be constructed on site to pretreat the leachate. At this time it hasn't been determined whether the water portion of the leachate will be trucked or piped through a force-main to a Publicly Owned Treatment Works (POTW). Pretreated leachate will not go to the City combined sewer system. A decision has not been made regarding which POTW will receive the water portion of the leachate. The oil portion will be disposed of off site in compliance with all applicable laws and regulations.

HEALTH STUDY /SWEETBROOK CREEK/ABINGDON AVENUE

Is there any information whether previous flooding brought any contaminants into the neighborhood adjacent to the landfill? (ii) Was there any information on people's health risks? (iii) What would explain the high concentration of cancer and Down Syndrome in the area, maybe along Arthur Kill Road and Abingdon Avenue?

The June 27, 2001 letter from the Brookfield Avenue Landfill Citizen's Advisory Committee (CAC) stated: "Citizens within this area have indicated that a creek, the Sweetbrook Creek, currently contained in two 12 feet wide by 6.5 feet high storm sewers beneath Abingdon Avenue, has flooded many times in the past and may have spread contaminants from the Brookfield Avenue Landfill into the neighborhood. Adequate testing of this area has not been initiated. Citizens have indicated there is an apparent high rate of health problems, including cancer and Down's Syndrome, in the area. The CAC requests an investigation along Abingdon Avenue (former location of the Sweetbrook Creek and Flood Plain) and vicinity. Will the NYSDEC agree to an investigation in this area? Will there be any health studies of this area"?

Another statement made at the meeting noted that:" We heard from a woman, Camille from Columbia, at the Landfill hearing, and she showed us data that we did have more cancer in Staten Island than other neighborhoods within the City of New York. And, she showed it to us. She did a whole charting of it. We were close to New Jersey in the same kind of numbers but we were different than the other boroughs. So we do have a greater risk here. And the other health point that I want to bring up is the asthma since I've been in Staten Island teaching in one of the Staten Island Public Schools. I see every year I have three or four children in my class and one or two of them will be on nebulizer treatments, which I never saw when I was teaching before. So I know it is more here and then I see it among my friend's children. It is here and you may not want to say it is here because the City did this to us and you don't want to lay the blame and open up yourselves to lawsuits of a great deal of money, but it is here and it is time that we all said it is here. She went on to ask the following questions: What about the infant mortality rate in Staten Island? Has it gone up?

Another written comment stressed the importance of neighborhood monitoring for any toxics that may escape from the site and additional personal health testing.

Response

Infant mortality rates for the years 1986 through 1999 were obtained from the New York City Department of Health, Office of Vital Statistics. Rates for Staten Island were compared with rates for New York City as a whole (NYC). This comparison shows that except for the year 1998 rates in Staten Island were always lower than rates in New York City. In 1998, the infant mortality rate per 1000 live births was 7.6 for Staten Island and 6.8 for NYC . While rates in both areas have overall shown a downward trend, rates in Staten Island have fluctuated up and down within that trend. Such fluctuations are to be expected in areas with smaller populations. Infant mortality rates in Staten Island are not indicative of environmental problems.

In March 1996, the New York City Department of Health (NYCDOH) issued a report about cancer incidence in Staten Island. The study evaluated cancer incidence for the ten year period from 1979 to 1988 in a study area comprised of the census tracts adjacent to the Fresh Kills and Brookfield Avenue Landfills and also in the Borough of Staten Island as a whole. The study found that among people living in the study area, cancer incidence was generally lower than among residents of the rest of Staten Island. In addition, for most cancer sites, cancer incidence in a demographically similar comparison community was similar to that in the study area. On Staten Island, the incidence of most types of cancer was similar to that of the rest of NYC and to the comparison community. These findings provide some reassurance that there was no increase in cancer incidence in the study area during the 1980s. While certain cancers were slightly to moderately elevated, the data do not suggest a common underlying cause.

In March 2000, the NYCDOH issued an addendum to the March 1996 Cancer Incidence Study to evaluate more recent cancer incidence data(1989 to 1992) for the study area and for Staten Island as a whole. Another objective of this update was to determine if there are overall trends of increasing or decreasing cancer incidence rates in Staten Island and the study area over the 15 year period from 1978 to 1992 and if trends in these areas are significantly different from trends elsewhere. This update did not indicate consistent evidence of elevated cancer rates specific to the study area. Cancer rates in the study area were lower than, or equivalent to, rates in the rest of Staten Island. The additional analyses also indicate that cancer incidence for most cancers in Staten Island, as a whole, was not significantly different than elsewhere in the City.

In 1998, the Federal Agency for Toxic Substances and Disease Registry (ATSDR) was petitioned to evaluate health concerns of residents living near the Brookfield Avenue Landfill. Residents expressed concerns about children's health problems, miscarriages, infertility, and cancer being associated with exposure to Landfill-related contamination. To address the health concerns, ATSDR evaluated data collected during the remedial investigation of the Landfill. ATSDR also evaluated a limited amount of historic environmental data and health outcome studies. Their findings are presented in a November 17, 1999 Petitioned Public Health assessment, and include the following conclusions:

1. Based on available sampling data, breathing the levels of contaminants detected in ambient air at and around the Brookfield Avenue Landfill is not expected to result in adverse health effects. Current air emissions from the Landfill pose no apparent health hazards.

2. Subsurface migration of methane from the Landfill currently represents no apparent physical health hazard.

3. No apparent public health hazards are associated with leachate seeps or contamination of groundwater, surface water, sediment, or biota resulting from migration of leachate from the Landfill. Levels of

contamination to which people are likely to be or were likely to have been exposed are below levels expected to cause adverse health effects.

4. The soil data collected from areas where children and adults might come in contact indicated the concentrations of contaminants are comparable to background levels and exposures to detected levels were unlikely to result in adverse health effects.

5. Five areas of the Landfill where hazardous waste may have been illegally disposed of were identified using historical information. These areas were the subject of focused "hot spot" investigations. The hot spots, due to inaccessibility to the public, pose no apparent public health hazards under existing exposure scenarios.

In June 1999, staff from the NYSDOH Congenital Malformation Registry (CMR) responded to a similar inquiry from Dr. Susan Sklower Brooks, Institute for Basic Research in Developmental Disabilities. An evaluation of the number of live births reported in Richmond County from 1983 to 1996 showed that, other than some fluctuations due to small numbers, the prevalence of liveborn Down cases in Staten Island was not markedly different than the rest of the state or New York City. The CMR does not currently have a complete count of liveborn and terminated cases of Down and therefore could not calculate a population prevalence for comparison. Consequently, the CMR evaluated data presented in a publication by Caroline Olsen (Prenatal Diagnosis 1996; 16: 991-1002). Ms. Olsen estimated, using various data sets, the total prevalence of Down in New York State including estimates for women under 35 years of age and for women who were 35 years of age and older. Using these data, the CMR calculated an expected number of Down cases for Staten Island, approximately 4.7 cases per year to women under 35 and 4.8 cases per year to women 35 and older. The findings resulting from a comparison of observed versus expected Down cases were not statistically significant.

The NYSDOH has no current plans to conduct any additional health studies for the communities surrounding the Brookfield Avenue Landfill.

REMEDIAL DESIGN

The Brookfield Avenue Landfill Citizen's Advisory Committee (CAC) submitted the following questions in a letter dated June 27, 2001: "The CAC requests an opportunity to review and comment on the Remedial Design for the Brookfield Avenue Landfill closure followed by public comment prior to implementation. This portion of the closure process is critical and must have input from the citizens. Will the NYSDEC agree to the CAC and Ransom request that the remedial design be reviewed and the public be allowed to comment? Will this decision be part of the Record of Decision or Consent Order?"

One written comment suggested the use of Alternative 3, which provides more collection and processing of the toxic leachate and would keep more of it from seeping into the neighborhood.

Another written comment recommended the complete removal of toxic substances and the use of Alternative 3 because it includes more leachate collection trenches which will prevent the seeping of the leachate from the landfill into the surrounding soil.

Another written comment stated that none of the five plans (Alternatives) are appropriate as they fail to include a leachate containment wall around the entire perimeter of the site.

At the June 12, 2001 PRAP Public Meeting, Barbara Warren of the Brookfield Avenue Landfill CAC stated: "Strict cleanup standards for Brookfield, nothing less than Option 2B, which is the recommended Alternative."

One question on the Landfill cap. A person asked during the public meeting whether closure will have the same procedure they are doing in Freshkills.

Response

As stated above, there will be a public meeting prior to the end of the remedial design period at which the CAC and other members of the public will have an opportunity to comment on the remedial design. The NYSDEC, NYCDEP, CAC, SAC, political leaders and other members of the public have all agreed that the Alternative 2B, the recommended alternative in the Proposed Remedial Action Plan (PRAP) is the best choice from a scientific, engineering and health standpoint. Please see the previous response regarding "Aquifer Contamination". This response addresses issues relating to the collection and processing of leachate and the prevention of it seeping into the neighborhood.

As stated in the Feasibility Study Section 4.2.5, excavation and removal of the contaminated material from the site is not a feasible option. It is financially prohibitive and operationally unsound.

There are similarities in the closure requirements for the Freshkills Landfill and the remediation requirements for the Brookfield Avenue Landfill, but there are also site-specific differences, such as the extent of the barrier walls and leachate collection systems. The engineering solutions generated at each site are based on the results obtained from thorough investigations. Therefore the remedial construction that took place at the Freshkills Landfill is applicable to that site and that site alone. The components of the landfill cap used at both of these sites is the same (see Figure 4 which shows a cross-section of a typical Part 360 landfill cap) although the actual thicknesses of the soil components may vary to support different types of plantings or end-uses.

MISCELLANEOUS

The June 27, 2001 letter submitted by the Brookfield Avenue Landfill Citizen's Advisory Committee (CAC) stated: "(i) The CAC would like to see NYSDEC and NYCDEP's support for a pilot study of state of the art composting technology, which would enable food and yard waste composting and generate wonderful planting material for the plantings to be done on the site. It should also be noted that beds of compost have successfully been used as odor control media, which may also have applicability when digging is done at this site. (ii) The CAC requests the continued guidance of their consultants. Will the NYSDEC require the NYCDEP to continue to fund the CAC consultants during the entire Brookfield Avenue Landfill closure process? Will this funding also be part of the Record of Decision or Consent Order?"

A statement made during the public meeting addressed zoning. The speaker noted that there are 140 acres of the 272-acre Brookfield site that were not used for the disposal of waste. The most critical is the need to immediately eliminate the residential zoning and create a Uniform Land Use Review Procedure (ULURP) application to change the City Map to "Park" for the entire Brookfield Property, bounded by Richmond Creek /La Tourette Park, Richmond Avenue, Arthur Kill Road, Colonial Square and Historic RichmondTown. Staten Island does not have and will not receive the infrastructure to support significant additional development. New development, especially residential, should be directed to areas of the city that already have the infrastructure. New development should occur where there are subways."

The June 28, 2001 letter submitted by State Senator John Marchi stated: "The favored option of Alternative Plan 2B, when fully implemented, would appear to address most of the concerns of our community. Can the planting of trees, shrubs, hedges, etc. in capped landfills lead to eventual exposures in the capping material which could lead to emissions? If the 10000 sq. ft. behind Holtermann's Bakery is not included in this remedial plan when will a revised plan be issued and will this impact on the Brookfield (P)RAP as a whole?"

Response

The NYCDEP maintains a Natural Resources Office that has proposed the conceptual end-use plan. The proposed plantings have been chosen with great care. One of the responsibilities of the office will be to insure that the plantings receive the appropriate planting media for growth. They continuously evaluate potential planting media and adjust to advances in this science accordingly. NYC Parks Department currently has a successful compost program throughout the city and continuously evaluates potential improvements. NYCDEP will coordinate with the Parks Department regarding requirements to maintain the plantings through the O&M period. Compost is expected to be integrated into the maintenance activities, since virtually any soil source requires some amendment to meet the agricultural specifications required for successful plant growth. Accordingly, the essence of the comment letter is already incorporated into the overall end-use plan. In addition, NYCDEP will consult with the Parks Department to see if there is a need for an additional composting site at the Landfill. However, a pilot project at this site regarding the use of compost for odor control during invasive activities in the remedial construction portion of the project will be impractical because of the complexity of the construction activities.

After the completion of remediation of the Brookfield Avenue Landfill, the end-use plan calls for the NYC Parks Department to oversee and Maintain the Brookfield Avenue Landfill as a park and as part of the Staten Island Greenbelt. The end-use plan, including any ULURP applications necessary to effectuate such an arrangement will move forward once the final design has been endorsed by the community. In addition, any issues relating to ULURP applications must be addressed by the New York City Department of City Planning.

Research by Rutgers University and other scientific studies have clearly shown that tree and shrub roots will not penetrate the impermeable liner system. All data shows that the roots will change direction and continue to run laterally over the liner. This lateral re-direction of the roots leads to a greater stability of the plant. Also, the planting of trees, shrubs and native warm season grasses provides greater soil erosion control than conventional cool season lawn grasses. In addition, the size of the plants chosen will minimize the formation of deep rooting taproots. To accommodate the trees and shrubs, the depth of the planting layer will be adjusted according to the plant material proposed. In some locations, the depth of the cap may be as much as 5 feet thick. In addition, there will be on-going maintenance after the closure during which the cap will be monitored and repaired as necessary. In closing, we reiterate that to the best of our knowledge, the planting of trees, shrubs, hedges etc. in capped Landfills will not lead to eventual exposures in the capping material which could lead to emissions.

The NYCDEP Legal Office is coordinating with the NYC Law Department and representatives for the Holtermann's Bakery regarding a solution to the disposition of the land behind Holtermann's Bakery. The preferred solution at this time is a land swap, which would not require an amendment to the PRAP/ROD. If this solution does not materialize, a modification to the remedial design may be necessary, but it would likely be minor and is not expected to impact the current closure plans or schedules.

Although there is no legal requirement, the NYCDEP has indicated its total support for the continued funding of the CAC consultants for as long as there is a valid need during the entire Brookfield Avenue Landfill Closure

process. Neither this document nor the Administrative Consent order mandates the NYSDEC to require the NYCDEP to continue to fund the CAC Consultants during the entire Brookfield Avenue Landfill closure process.

BROOKFIELD AVENUE LANDFILL

RECORD OF DECISION

APPENDIX B

ADMINISTRATIVE RECORD

APPENDIX B

Administrative Record

1. Consent Order, Index #2-43-006 dated May 4,1992

2. Brookfield Avenue Landfill Drinking Water Quality Report prepared by the New York City Department of Environmental Protection dated August 13,1993

3. Final Work Plan Remedial Investigation/Feasibility Study Brookfield Avenue Landfill Remediation, Richmond County, Staten Island, New York prepared for the City of New York Department of Environmental Protection (NYCDEP) by Camp Dresser & McKee August 30, 1993.

4. Report on the Immediate Investigation Work Assignment (IIWA) Remedial Investigation/Feasibility Study Brookfield Avenue Landfill prepared by the New York State Department of Environmental Conservation (NYSDEC) dated December 1993

5. Aqua Survey Inc. (technical report for sampling and testing of material from Brookfield Avenue Landfill) prepared for Camp Dresser & McKee dated June 30,1994

6. Draft Interim Report Hot Spot Issue, Remedial Investigation/Feasibility Study Brookfield Avenue Landfill Remediation Project Richmond County, Staten Island, New York prepared for the City of New York (NYCDEP) by Camp Dresser & McKee dated July 13, 1994.

7. Staten Island Cancer Incidence Study prepared by the New York City Department of Health dated March 1996.

8. (Step 1- Summary), Supplemental RI Services Brookfield Avenue Landfill prepared for the NYCDEP by Camp Dresser & McKee dated June 1996

9. Final Field Plan Addenda, Remedial Investigation, Brookfield Avenue Landfill Remediation Project, Richmond County, Staten Island, New York prepared for the City of New York (NYCDEP) by Camp Dresser & McKee dated March 1997

10. Draft Landfill Gas Emission and Ambient Air Characterization Brookfield Avenue Landfill Remediation Project dated November 21,1997 prepared by Camp Dresser &McKee.

11. Draft Brookfield Avenue Landfill Hot Spot Investigation prepared for the City of New York (NYCDEP) by Camp Dresser & McKee dated January 27,1998 (Hotspot # 3 Flare & Hotspot # 5)

12. Transcript Brookfield Avenue Landfill Remediation Project Public Information meeting held April 20, 1998.

13. Transcript Brookfield Avenue Landfill Remediation Project Public Information meeting held May 20, 1998, as a follow up to the April 20, 1998 meeting.

14. Brookfield Avenue Landfill Remediation Project Final Remedial Investigation Report prepared by the New York City Department of Environmental Protection (NYCDEP) with the assistance of CDM

Camp Dresser & McKee dated September 1998, Volume I, Volume II (Appendices B-G), Volume III (Appendices H-U).

15. Project Manual Brookfield Avenue Landfill Remediation, Hotspot #3, Interim remedial Measure prepared for the City of New York Department of Environmental Protection (NYCDEP) by Camp Dresser & McKee dated March 1999. IRM at location #3 (Plans & Specs for Flare)

16. Brookfield Avenue Landfill Remediation Project Operable Unit 1 Feasibility Study Report prepared by the New York City Department of Environmental Protection (NYCDEP) with the Assistance of CDM Camp, Dresser & McKee dated March 2001

17. Proposed Remedial Action Plan (PRAP) prepared by the New York State Department of Environmental Conservation (NYSDEC) dated May 2001.

18. The PRAP Public Meeting Transcript June 12, 2001.

19. The following correspondence related to the PRAP:
A letter from Libby Hikind, dated June 12, 2001
A letter from Charles Senger dated June 22, 2001
A letter from Theodore A. Mrozinski dated June 29, 2001
A letter from Barbara Blake dated June 22,2001
A letter from Ajanay Feld dated June 22, 2001
A letter from F. Ventura dated June 22, 2001
A letter from Carol Melian dated June 22, 2001
A letter from Josephine Senger dated June 22, 2001
A letter from Sally Stein dated June 22, 2001
A letter from P. Tramontano dated June 22, 2001
A letter from Ransom Environmental, the consultants to the Brookfield Avenue landfill Citizens Advisory Committee(CAC) dated June 27, 2001
A letter from State Senator John Marchi dated June 28, 2001
A letter from W.F. van den Houten dated June 29, 2001