U.S. Dredging Shipyard Site

Tax Block 612, Lot 130

BROOKLYN, NEW YORK

Final Engineering Report

NYSDEC BCP Number: C224043

Prepared for:

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TABLES

In Text

Attached

FIGURES

APPENDICES

CERTIFICATIONS

I, Carl Vernick, am currently a registered professional engineer licensed by the State of New York. I had primary direct responsibility for implementation of the remedial program for the U.S. Dredging Shipyard Site (NYSDEC BCA Index No. W2-1023-04-10, Site No. C224043).

I certify that the description presented in this Final Engineering Report is identical to the description presented in the Environmental Easement, the Site Management Plan, and the Brownfield Cleanup Agreement for the U.S. Dredging Shipyard Site and related amendments.

I certify that the Remedial Action Work Plan was implemented and that all construction activities were completed in substantial conformance with the Department-approved Remedial Action Work Plan and were personally witnessed by me or a person under my direct supervision.

The data submitted to NYSDEC demonstrates that the remediation requirements set forth in the Remedial Action Work Plan and any other relevant provisions of ECL 27-1419 have been or will be achieved in accordance with the time frames, if any, established in the work plan.

I certify that the remedial activities were observed by qualified environmental professionals under my supervision and that the remediation requirements set forth in the Remedial Action Work Plan and any other relevant provisions of ECL 27-1419 have been achieved.

I certify that all use restrictions, Institutional Controls, Engineering Controls, and/or any operation and maintenance requirements applicable to the U.S. Dredging Shipyard Site are contained in an Environmental Easement created and recorded pursuant to ECL 71-3605 and that any affected local governments, as defined in ECL 71-3603, have been notified that such Easement has been recorded.

A Site Management Plan has been submitted by the Applicant for the continual and proper operation, maintenance, and monitoring of any Engineering Controls employed at the U.S. Dredging Shipyard Site including the proper maintenance of any remaining monitoring wells, and that such plan has been approved by NYSDEC.

I certify that all information and statements in this certification are true. I understand that a false statement made herein is punishable as Class “A” misdemeanor, pursuant to Section 210.45 of the Penal Law.

_____	_____	_____
NYS Professional Engineer #46377	Date	Signature

It is a violation of Article 130 of New York State Education Law for any person to alter this document in any way without the express written verification of adoption by any New York State licensed engineer in accordance with Section 7209(2), Article 130, New York State Education Law.

1.0 BACKGROUND

This Final Engineering Report (FER) was prepared to document remedial actions at the former United States Dredging Shipyard (USDS) (Site) located at 1 Beard Street in the Red Hook Section of Brooklyn, New York upon completion of the remedial actions taken under the New York State (NYS) Brownfield Cleanup Program (BCP) administered by the NYS Department of Environmental Conservation (NYSDEC) pursuant to NYS Environmental Conservation Law (ECL) Section 27-1401 et seq. (the Brownfields Law). A digital copy of this FER and the Site Management Plan (SMP) with all project documents approved under the BCP is included in Appendix A.

1.1 Site Location and Description

The Site is an approximately 48-acre property located in Red Hook, Brooklyn, New York which is more fully described in Appendix B, Metes and Bounds Description. A United States Geological Survey (USGS) topographical quadrangle map attached as Figure 1 shows the Property location. The Site is in a mixed-use commercial and industrial area of Brooklyn. A Land Use Map is provided as Figure 2.

The Site, which is located on the Erie Basin at the mouth of the Gowanus Canal, is identified as Block 612 and Lot 130 in Kings County, and is comprised of approximately 23 acres upland and 25 acres under water. The Site is bounded by Beard and Halleck Streets to the north, the Erie Basin and private property to the south, private property currently or formerly owned by Yellow Freight Systems to the east, and a deep-water slip portion of the Erie Basin (bordering the former Revere Sugar Refinery) to the west (see Figures 1 and 2). The boundary map included in the BCA, as required by ECL Title 14 Section 27-1419, is included in Appendix B.

1.2 Redevelopment Plan

The remedial actions performed under the Remedial Action Work Plan (RWP), dated March 2006 and approved by NYSDEC on March 31, 2006, will protect human health and the environment to standards consistent with the contemplated end use. Redevelopment efforts on the Site, which are described in the sections that follow, included (following removal of asbestos containing materials from numerous buildings on the Site, and the razing of approximately 19 buildings), remediation in accordance with the RWP of selected areas of environmental concern, and construction of an IKEA store (Main Building) as well as associated parking and a waterfront esplanade. The Site plan is depicted in Figure 3.

1.3 Past Uses and Ownership

The USDS operated a ship manufacturing and repair facility on a portion of the Site from the time it acquired the Site in or about 1985, until it sold the Site to One Beard Street, LLC in 2005. During that period, the balance of the Site was occupied by a variety of tenants for light manufacturing and other commercial uses. Former occupants and owners of the Site, or portions thereof, included the Anglo American Dry Dock & Warehouse Company and E. Ender & Son Yacht Company (circa 1886), Mannings Yacht Agency (circa 1904), John N. Robins Company Dry Docks, Beard's Yacht Basin, and Hudson & Langil (circa 1915), Todd Shipyards Corporation from 1938 to 1996, the US Navy from 1942 to 1962, and the New York Shipyard Company.

Historically, the Site contained dry docks, electrical sub-stations and associated transformers, a pump house, a salvage yard, machine shops, boat repair operations, automobile repair operations, varying quantities of paints, stains, oils, and other chemicals, waste piles, underground storage tanks (USTs), aboveground storage tanks (ASTs), and other underground structures.

2.0 REMEDIAL INVESTIGATION FINDINGS AND REMEDIAL ACTION ASSESSMENT

Details regarding the investigation activities that were conducted at the Site are provided in the following reports which are included in Appendix A of this FER:

- SMES; Phase I Environmental Site Assessment (Phase I ESA), September 2002;
- SMES; Preliminary Site Characterization Investigation Phase II (PSCI), November 2002;
- SMES; Supplemental Subsurface Investigation (SSI) Report, October 2003; and
- Testing Mechanics Corp.; Asbestos Containing Materials Inspection Report, 2002.

2.1 SUMMARY OF REMEDIAL INVESTIGATIONS AND FINDINGS

The Phase I ESA identified several environmental conditions that were further assessed in subsequent investigations. Those subsequent Site investigations included the collection of 198 samples from the following media, the results of which are summarized in the sections below:

- Soil;
- Groundwater;
- Waste piles, subsurface structures, building structures, and electrical transformers;
- Soil vapor; and
- Marine sediment.

Table A, in conjunction with Site Plans 1 and 2 of the PSCI, summarizes associated sample locations, analyses performed and results. Appendices B and C of the SSI contain the sample locations and results from that investigation. Remedial actions performed at the Site as a result of the remedial investigation findings are detailed in Section 3.0.

2.1.1 Geological Conditions

Geology of the area characterize the waterfront as having urban fill over native soils (Reconnaissance of the Ground-Water Resources of Kings and Queens Counties, New York; U.S.G.S. Open File Report 81-1186). Investigation at the Site confirmed that the upland portion was generally covered by 12 to 22 feet of miscellaneous soil and rubble fill, which was generally underlain by native organic silts and alternating layers of fine sands and silt/clay believed to be of glacial origin. Boring logs from pre-remediation soil borings are included in Appendix B of the SSI and as Figure 4 of the PSCI.

Groundwater in the upland area of the Site is located at a depth of approximately 5 to 14 feet below grade, has a generally westerly flow (towards the Erie Basin) and is likely saline and under tidal influence. Groundwater elevations in pre-remediation monitoring wells are included in Appendix L of the SSI. Groundwater in the Site vicinity consists of a shallow unconfined aquifer in the fill and soil. At the time of the remedial investigation, groundwater flow was noted to be affected by underground structures such as dry dock structures. Groundwater samples collected as part of the Site investigations were acquired from the shallow Upper Glacial Aquifer, the quality of which is documented to be regionally compromised. The Upper Glacial Aquifer is underlain by older glacial till material, which contains compact clay and is considered to be relatively impermeable.

Accordingly, a hydrogeologic connection to a deeper aquifer is unlikely. The pre-remediation groundwater contour map is included as Plate 1 in the RWP.

Groundwater in Brooklyn is not used as a potable water supply. Nevertheless, any future withdrawal of groundwater for potable or process uses is prohibited pursuant to the Environmental Easement (see Appendix C).

2.1.2 Soil

The PSCI and SSI concluded that surficial soil had been impacted, primarily by semi-volatile organic compounds (SVOCs) and priority pollutant metals (PPM), and, to a far lesser degree, by volatile organic compounds (VOCs) and polychlorinated biphenyls (PCBs). The results of laboratory analyses of soil samples were that the soil exhibited constituents common to many properties throughout the City of New York. These constituents included some of potential concern, including certain VOCs, SVOCs, PCBs and metals, primarily arsenic, copper, lead, and mercury.

Contaminants are attributable primarily to the Site's imported fill material (which contained ash, cinders, and asphalt) and, to a lesser degree, by its historic usage. Some of the detected concentrations of metals are attributed to former Site activities. Detections of VOCs and PCBs were isolated and relatively low, providing further evidence that Site soil quality was consistent with other urban properties.

Toxicity Characteristic Leaching Procedure (TCLP) analysis of those samples with the highest overall total concentrations of targeted analytical parameters, conducted as part of the SSI, confirmed that a vast majority of the soil in the areas investigated did not meet the regulatory definition of hazardous waste. Fifteen samples were analyzed for hazardous waste characteristics in 2002. One sample failed for pH (corrosivity) and three failed for toxicity (TCLP-lead). Additional testing of 22 samples in 2003 provided similar results: three failed for toxicity (TCLP-lead); but none failed for corrosivity or other hazardous waste characteristics. Based on the entirety of the sampling results, 22 hotspots were identified as localized pockets of contamination that were to be removed during implementation of the RWP.

2.1.3 Groundwater

Groundwater data was compared to the Class GA Standards and Guidelines Values contained in NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1, *Ambient Water Quality Handling, Guidance Values and Groundwater Effluent Limitations*. Results of groundwater sampling conducted in 2002 and 2003 indicated concentrations of certain VOCs, SVOCs, and PPMs slightly above Class GA levels. However, the level of contaminants in groundwater beneath the Site was not indicative of a significant environmental concern warranting implementation of remedial efforts. The risk of impacts to human health from these concentrations was found to be very low, since the Class GA Standards are designed to be protective of groundwater used as a potable water source. Groundwater in Brooklyn is not used for potable supply and future withdrawal of groundwater at the Site is prohibited for potable and process use pursuant to the environmental easement conveyed to the State by the Volunteer and recorded against the Site pursuant to the Brownfields Law (Environmental Easement). Accordingly, no requirement for remediation of groundwater was included in the RWP.

2.1.4 Waste Piles

Three waste piles were located on the Site. Sampling of the waste piles indicated elevated concentrations of SVOCs, PCBs, arsenic, cadmium, chromium, mercury, and lead, but the levels were found not to be characteristic of regulated hazardous waste.

2.1.5 Miscellaneous Underground Structures

While none of the approximately 170 subgrade structures inspected appeared to have been designed to leach or inject storm/waste water or other wastes directly to the ground, many were found to contain significant volumes of soil/sludge phase material. Twenty three soil/sludge samples were collected from representative accessible drainage structures, pits, manholes, and miscellaneous structures. Laboratory analysis indicated that the soil/sludge contained selected SVOCs, PCBs, PPMs, and total petroleum hydrocarbon (TPHC) compounds. It was assumed that the remaining structures, which were not investigated, could have been similarly impacted.

2.1.6 Stained Wooden/Concrete Flooring

Stained wooden flooring material was identified throughout Buildings #6 and #93, as described in the RWP. Assessment of representative samples of the wooden flooring material indicated the presence of SVOC, PCB, and PPM constituents.

Stained concrete flooring was also identified within Buildings #6, 14, and 93. Assessment of representative samples of the concrete flooring material indicated the presence of SVOC, PCB, and PPM constituents.

2.1.7 Electrical Transformers

Electrical transformers were identified on the Site as containing dielectric fluids, some of which were associated with the stained concrete flooring discussed in the preceding subsection. Wipe samples collected from concrete surfaces within the transformer vaults detected PCBs, but at levels below NYSDEC Technical and Administrative Guidance Memorandum (TAGM) #4046 Recommended Soil Cleanup Objectives (RSCOs).

2.1.8 Soil Vapor

As part of the PSCI, soil-vapor monitoring wells were installed at locations selected in light of proposed redevelopment activities. Methane was identified at three locations within the footprint of the proposed main building at concentrations exceeding the lower explosive limit (LEL) for methane. Two additional such locations were identified during implementation of the SSI.

As part of the SSI, samples from the locations with the highest methane levels were analyzed for VOCs and SVOCs. Selected VOC constituents in soil vapor within the footprint of the proposed main building were found to be above USEPA and New York State Department of Health (NYSDOH) indoor air quality 75th percentile values (USEPA; *Natural Ambient Air VOCs Database Update - 600/3-88/010a* and NYSDOH; *Background Indoor/Outdoor Air Levels for VOCs in Homes Sampled by NYSDOH*, 1989-1996).

2.1.9 Sediment

Marine sediment sampling was initially performed in 2002 at ten locations near outfalls observed along the bulkhead of the Site with results compared to criteria contained in NYSDEC Division of Fish and Wildlife and Marine Resources *Technical Guidance for*

Screening Contaminated Sediments, January, 1999. Exceedances of certain SVOCs, PCBs, and PPMs were identified and NYSDEC requested confirmatory and supplemental sampling. In 2003, two samples were collected from each of six additional locations at a range of approximately 25 meters (80 feet) offshore. Results were reported in Appendices A and B of the RWP and four hotspot areas requiring remediation were identified.

2.2 SIGNIFICANT THREAT DETERMINATION

The NYSDEC and NYSDOH determined that the Site does not pose a significant threat to human health and the environment. Notice of that determination was provided for public review. The notice is included in Appendix A.

2.3 CONTAMINATION CONDITIONS

2.3.1 Identification of Standards, Criteria and Guidance

Standards, Criteria and Guidance (SCG) documents that applied to the Site during the remedial investigation and remedial action phases consisted of the appropriate regulatory documents and accepted industry practice at the time the work was completed.

In general, the SCGs for remediation of Site included the following:

- Site-Specific Soil Cleanup Objectives (SSCOs) established by NYSDEC/NYSDOH for the protection of human health and the environment, considering the contemplated use and anticipated institutional and engineering controls. The SSCOs were used for assessing areas of soil contamination requiring remediation (concentrations greater than SSCOs) and for assessing on-Site material suitable for reuse as backfill (concentrations less than SSCOs). The SSCOs were as follows:

Site-Specific Soil Cleanup Objectives

Parameter	Criterion
Individual Volatile Organic Compounds (VOCs)	TAGM 4046 RSCO
Total Polychlorinated Biphenyls (PCBs)	10 mg/kg
Arsenic	100 mg/kg
Copper	20,000 mg/kg
Lead	5,000 mg/kg
Mercury	100 mg/kg
Notes: TAGM 4046 RSCO – Technical and Administrative Guidance Memorandum #4046 Recommended Soil Cleanup Objectives, January 24, 1994 mg/kg – milligram per kilogram (mg/kg)	

- NYSDEC's TAGM #4046 RSCOs, January 24, 1994 and 6 NYCRR Part 375-6 Soil Cleanup Objectives (SCOs) for Commercial Use and Protection of Groundwater were used for assessing material for import as backfill.
- Class GA Standards and Guidelines Values contained in NYSDEC TOGS 1.1.1, *Ambient Water Quality Handling, Guidance Values and Groundwater Effluent Limitations* – June 1998 with Addenda and Errata Sheets through June 2004 were used for assessing pre-remediation groundwater concentrations.
- NYSDEC Draft DER-10 *Technical Guidance for Site Investigation and Remediation*, December 2002, was used in completing the remedial investigation and in preparing the RWP.

- NYSDEC *Draft Brownfield Cleanup Program Guide*, May 2004, was used for the remedial action phases, including citizen participation and reporting.
- Waste management, hauling and disposal were performed in accordance with New York State (NYS) Solid Waste Regulations under 6 NYCRR Subchapter B.

2.4 ENVIRONMENTAL AND PUBLIC HEALTH ASSESSMENTS

2.4.1 Qualitative Human Health Exposure Assessment

A qualitative exposure assessment was conducted for the Site to evaluate the potential human health and environment exposures from contamination at the Site. The analysis included identification of potential exposure pathways by first identifying contaminated media, based on the sampling results, and then identifying points of exposure and exposure routes under three phases of site redevelopment: (1) site preparation (including demolition of existing facilities); (2) remediation; and (3) construction and future use. Where complete or potentially complete exposure pathways were identified, engineering and/or institutional controls were developed to address the contaminants of concern, and conclusions concerning qualitative risks were assessed.

The exposure assessment for the upland area of the Site:

- Identified potential pathways of exposure to those contaminants identified (noting any fate and transport of contaminants) for various receptors;
- Identified potential contaminants of concern for each of the environmental media; and
- Concluded whether significant risks to human health would result after the planned site redevelopment.

Results of this exposure assessment were used to determine the need for remedial action and to assist with the identification and selection of remedies, engineering controls and institutional controls.

2.4.2 Ecological Exposure Assessment of Upland Portion of the Site

Since no significant areas of vegetation or upland habitat existed on the Site prior to remediation, no assessment of ecological exposure associated with the upland portion of the Site was needed. The proposed redevelopment includes an approximately 6.3 acre waterfront esplanade, including paved paths, plantings, and other landscaping.

2.4.3 Ecological Exposure Assessment of Underwater Portion of the Site

The underwater portion of the Site (marine sediment) was also characterized by sampling discussed above. Appendix A of the RWP provided an analysis of sediment conditions, and addressed the potential for ecological exposure as a result of those conditions. That analysis served as the basis for the conclusion that ongoing natural sediment deposition is covering the identified contamination. It was determined that conditions prior to remediation did not pose a risk of significant exposure to biota in the Erie Basin and that remediation and redevelopment of the Site would further reduce such risk.

2.5 REMEDIAL ACTION OBJECTIVES

Based on the results of the Remedial Investigation, Remedial Action Objectives (RAOs) for soil were identified in the RWP.

2.5.1 Soil RAOs

RAOs for public health protection were to:

- Prevent ingestion/direct contact with contaminated soil; and
- Prevent inhalation of, or exposure to, contaminants volatilizing from contaminated soil.

RAOs for environmental protection were to:

- Prevent migration of contaminants that could result in groundwater or surface water contamination; and
- Prevent impacts to biota due to ingestion/direct contact with contaminated soil that could cause toxicity or bioaccumulation through the food chain.

2.5.2 Sediment RAOs

RAOs for Public Health Protection were to:

- Prevent direct contact with contaminated sediments; and
- Prevent surface water contamination that could result in fish advisories.

RAOs for Environmental Protection were to:

- Prevent release(s) of contaminant(s) from sediments that could result in surface water levels in excess of (ambient water quality criteria); and
- Prevent impacts to biota due to ingestion/direct contact with contaminated sediments that could cause toxicity or bioaccumulation through the food chain.

3.0 DESCRIPTION OF APPROVED REMEDIAL ACTIONS PERFORMED

3.1 SUMMARY OF REMEDIAL ACTIONS

The following is a list of the remedial actions required by the NYSDEC-approved RWP and detailed in Section 3.3:

- Decommissioning and off-Site disposal of electric transformers and remediation of associated stained concrete flooring;
- Removal and off-Site disposal of contaminated wooden flooring;
- Remediation of stained concrete surfaces;
- Closure and abandonment of existing groundwater and selected soil-vapor monitoring wells;
- Remediation of designated contamination hot spots, with off-Site disposal of excavated materials;
- Removal and off-Site disposal of waste stockpiles;
- Removal or abandonment of sub-grade drainage structures and pits;
- UST/AST removal;
- Remediation of soil vapors;
- Remediation of marine sediment; and.
- Placement of a cap covering the entire upland portion of the Site (Site Cap).

The following activities completed at the Site were not remedial actions required by the RWP; nevertheless, these activities generated documentation, e.g., related to disposal, and are therefore summarized in the FER. They include:

- Abatement of asbestos containing materials (ACMs) prior to commencement of demolition activities;
- Decommissioning and off-site disposal of the dust collection system;
- Disposal of fluorescent lighting;
- Disposal of miscellaneous chemicals;
- Disposal of electrical duct banks; and
- Disposal of pier pipes.

3.2 REMEDIAL PROGRAM ELEMENTS

3.2.1 Site Preparation

Prior to and following building demolition, various activities were performed, which were not remedial activities per the RWP, but, as noted above, generated relevant documentation. These activities are summarized below. Correspondence, disposal documentation, approvals, etc. are included in Appendix D.

3.2.1.1 ACM Abatement

ACMs were present at the Site including pipe insulation and roofing materials (per the ACM Inspection Report included in Appendix A). Removal of ACMs was conducted in

accordance with applicable federal, state and local requirements prior to building demolition.

3.2.1.2 Dust Collection System

Prior to demolition of Building #93, a large dust collection system (associated with the former ship building/repair activities) required proper cleaning as previous sampling had revealed the presence of SVOCs and metals in dust within the ductwork and collection hopper. Prior to removing the system from the Site as scrap metal, it was cleaned by removing the packed-on dust using power washers and scrapers. The generated wastes were containerized and removed from the Site by licensed haulers, and disposed of off-Site.

3.2.1.3 Fluorescent Lighting

Fluorescent bulbs and associated PCB-containing ballasts were present in the 19 on-Site buildings. Approximately 6,700 pounds of this material was removed from the site on February 21, 2006 and disposed of at Vexor Technologies Inc. in Medina, OH.

3.2.1.4 Miscellaneous Chemicals

Twenty three 55-gallon drums, eleven 5-gallon containers, and five 1-gallon containers of various liquids, solids, and aerosols were removed from the site and disposed of at Chem Tech Environmental Inc. in Contrecoeur, Quebec and WM/American Landfill in Waynesburg, OH.

3.2.1.5 Electrical Duct Banks

Concrete electrical duct banks associated with abandoned underground electrical lines were uncovered during excavation activities. The duct banks, constructed with transite pipe sleeves, were segregated upon observation and temporarily stockpiled on and covered with polyethylene sheeting. Approximately 270 cubic yards (CY) of this material was disposed of at 110 Sand Company in Melville, NY.

3.2.1.6 Pier #1 Pipes

Plumbing lines (approximately 3 inches in diameter) formerly containing motor fuel were emptied, cleaned, and disposed of at Loni-Jo Metal Corp in Westbury, NY.

3.2.2 General Site Controls

Screening for indications of contamination (by visual means, odor, and monitoring with a PID) occurred for all excavated soil during all intrusive site work.

In some instances, soil was stockpiled consistent with the RWP and documentation of this is included in Appendix A. Although excavated soil intended for disposal was generally loaded directly into vehicles, temporary stockpiling was necessary in some instances. Soil was stockpiled based on the known or anticipated waste classification and/or by approved disposal facility (based on previous data, PID readings, odor, staining, etc.). A double-layer of polyethylene sheeting with a minimum 6-mil thickness per sheet was placed beneath the area where material was to be stockpiled and surrounded with hay bales when appropriate. Stockpiles were covered with polyethylene sheeting and secured with large rocks or other anchors at the end of each work day or when loading operations were not occurring; sheeting was routinely inspected for damage and replaced as needed.

Sediment and erosion control measures, such as the hay bales around stockpiles, were installed and maintained throughout remediation and construction, in accordance with the Site Stormwater Pollution Prevention Plan (SWPPP) included in Appendix A. Vehicle and construction equipment decontamination pads (consisting of gravel or crushed stone) were located at each of the construction entrance/exit gates. Prior to leaving an excavation area, vehicles were inspected for evidence of exterior contamination (including inside of wheels and undercarriage) and any such contamination was washed off the vehicle before it left the Site and wash water collected for treatment and disposal off-Site per an SMES letter included in Appendix D of this FER.

Sources of imported fill material proposed to be used as backfill were approved by the NYSDEC prior to transporting to the Site.

Secure fencing with gates was installed and maintained around the entire perimeter of the Site and manned by security personnel to restrict entry. Unauthorized persons were not allowed access to the work zones while excavation or handling of potentially contaminated soil was taking place.

Jobsite record-keeping included maintaining logbooks of incoming and outgoing vehicle logs, air monitoring logs, daily activity reports, copies of waste manifests and bills of lading, and health and safety briefing sign-in sheets.

3.2.3 Work Zone and Community Air Monitoring Results

Work zone and community air monitoring was conducted in accordance with the RWP for VOCs, respirable particulates less than 10 microns in size (PM_{10}), and visible dust during soil disturbance activities and demolition. At the start of work, air monitoring locations were established at the upwind and downwind perimeter of the work zone. Monitoring for VOCs and PM_{10} was performed at the downwind and upwind/background locations (and every time the wind direction changed). Monitoring focused on the downwind work zone perimeter. If exceedances of the action levels occurred, monitoring was conducted at the location(s) of any potential sensitive receptors, downwind especially at the closest area of potential public access.

The initial daily air monitoring measurement was taken prior to commencement of work to establish a background level and the final daily measurement was performed after the end of work. Measurements were made as close to the workers as practicable and at the breathing height of the workers. All readings, including readings that triggered response actions, were recorded in the project logbook or data sheets. Copies of the daily air monitoring logs that were submitted on a weekly basis to the NYSDEC are provided in Appendix E.

3.2.4 Reporting

Weekly reports were submitted to the NYSDEC and NYSDOH Project Managers throughout remedial activities and specific construction activities that required oversight by the Remedial Engineer (an engineer licensed by New York State). The weekly reports included a summary of daily activities and sampling results. Digital copies of all weekly reports are included in Appendix E.

3.3 CONTAMINATED MATERIALS REMOVAL AND BACKFILL

The following subsections detail the various removal and remedial activities undertaken at the Site as well as Site restoration activities. A photographic log of all remedial activities is included in Appendix E.

3.3.1 Closure and Abandonment of Pre-Remediation Monitoring Wells

The 58 wells (13 groundwater and 45 soil vapor) installed during the Site investigation were properly abandoned/decommissioned. The procedures used, per NYSDEC guidelines and Item III.C.1 of the RWP, were: (1) filling of the screened interval with clean/washed #1 sand; (2) filling of the remainder (except the top two feet) with bentonite chips; and (3) sealing the top two feet with concrete.

3.3.2 Remediation of Hotspots

Based on the sampling, summarized in Section 2.1.2, 22 localized pockets of contamination were identified as hotspots requiring removal because contaminant concentrations exceeded either hazardous waste thresholds or the SSCOs, or their removal was specifically requested by NYSDEC as concentrations of certain contaminants were significantly above the average elsewhere at the Site.

Prior to remediating the hot spots, their locations were identified by a SMES survey crew based on the previous soil investigation locations. Remediation was then performed in accordance with Item III.C.5 of the RWP including the following:

- Removal of soils from an approximately 20 ft radius from the center of the hotspot location to the groundwater table (with visual/odor observation). Although the RWP had called for screening (for VOCs using a PID, for metals using portable X-ray fluorescence (XRF), and for PCBs using the Clor-n-Soil system), instead, 24-hour turn around laboratory analyses were performed with the approval of NYSDEC;
- Stockpiling of excavated material (on and covered by polyethylene sheeting);
- Collection and analysis for comparison to SSCOs of four endpoint samples from the walls of each excavation (per the RWP, no bottom samples were required since excavations extended to the groundwater table). Each of the four samples was analyzed by Long Island Analytical Laboratories of Holbrook, NY separately for VOCs and PCBs, but initially composited for the metals analyses. Any exceedances for VOCs or PCBs triggered additional excavation in the appropriate direction followed by collection of an additional sample for analysis. Any exceedances for a particular metal in the composite sample triggered analysis of the four individual samples used to create the composite for that metal and thereafter additional excavation and retesting for that metal proceeded in a similar fashion to the procedures for VOCs and PCBs;
- Waste characterization sampling of stockpiled soils per requirements of the intended disposal facilities; and
- Transportation and disposal of stockpiled soils to appropriate facilities.

As all soil within the Soft Cap areas (i.e., any area other than those portions of the Site covered by asphalt, concrete or building structure, see Section 3.5.1) was removed to the water table, the four hotspots (B-8, -18, -19 and -81) located in Soft Cap areas did not

require confirmation endpoint sampling (per Item III.A.3 of the RWP), because the adjacent soils (beyond the 20-foot radius) were also removed to the water table.

Disposal manifests, waste characterization and endpoint laboratory analytical results and a site plan showing the hotspot locations are included in Appendix F. The Table below shows, for each hotspot, its number, location, and results of endpoint samples (including additional endpoint samples at the two hotspots where additional sampling was required as some of the initial endpoint samples exceeded SSCOs).

Hotspot Summary Table

Hotspot #	Location	Results of Endpoint Samples
1	B-8	Not required - in Soft Cap area
2	B-18	Not required - in Soft Cap area
3	B-19	Not required - in Soft Cap area
4	B-27	EP-6 to -9 (composited as EP-10) - no exceedances of SSCOs
5, 20 & 21 [1]	B-29, -86 & -89 [1]	EP-66 to -71 [2] (composited as EP-72) - no exceedances of SSCOs
6	B-30	EP-21 to -24 (composited as EP-25) - EP-25 exceedance for arsenic & lead: additional excavation to north, south and east successful as no exceedances in EP-21R, -22R or -23R
7	B-36	EP-11 to -14 (composited as EP-15) - EP-15 exceedance for arsenic & mercury: additional excavation to south, east and west successful as no exceedances in EP-12R, -13R or -14R
8	B-52	EP-77 to -80 (composited as EP-81) - no exceedances of SSCOs
9	B-54	EP-1 to -4 (composited as EP-5) - no exceedances of SSCOs
10	B-58	EP-16 to -19 (composited as EP-20) - no exceedances of SSCOs
11	B-61	EP-26 to -29 (composited as EP-30) - no exceedances of SSCOs
12	B-62	EP-31 to -34 (composited as EP-35) - EP-35 exceedance for arsenic & mercury, but no additional excavation required as no exceedances in individual samples (EP-35a to -35d)
13	B-64	EP-56 to -59 (composited as EP-60) - no exceedances of SSCOs
14	B-65	EP-61 to -64 (composited as EP-65) - no exceedances of SSCOs
15	B-67	EP-51 to -54 (composited as EP-55) - no exceedances of SSCOs
16	B-69	EP-46 to -50 (composited as EP-51) - no exceedances of SSCOs
17	B-71	EP-36 to -40 (composited as EP-41) - no exceedances of SSCOs
18	B-77	EP-72a, -73, -74 and -75 (composited as EP-41) - no exceedances of SSCOs
19	B-81	Not required - in Soft Cap area
22	TP-3	EP-41 to -44 (composited as EP-45) - no exceedances of SSCOs
Notes: 1 - merged into one excavation 2 – six samples due to the size of excavation		

3.3.3 Other Excavation

With the exception of the 22 hotspots discussed in Section 3.3.2, in general, fill material in Hard Cap areas (i.e., the areas of the Site covered by asphalt, concrete or building structures) was left in place. All soil and fill material above the water table in the Soft Cap areas and the fill from Hard Cap areas requiring removal for foundations, utilities, etc., was excavated and either reused on-Site (but only if the soil or fill material met SSCOs) beneath the Hard Cap, or sent for off-Site disposal. Disposal manifests, waste characterization and endpoint laboratory analytical results and a Site plan showing the excavation locations are included in Appendix G. A summary of the endpoint laboratory analytical results is shown in Table 2.

Hard Cap Areas

Approximately 16,000 CY of excavated material was screened for visual/olfactory indications of contamination and field-screened with a PID in accordance with the RWP.

Evidence of contamination was identified for approximately 1,000 CY of this material; consequently, the material was considered potentially impacted and stockpiled separately for testing for compliance with the SSCOs. Since the sample (S-106, representing the above 1,000 CY) showed an exceedance of the arsenic SSCO, this material required waste characterization sampling for off-Site disposal and was subsequently disposed of at the Coplay facility in Whitehall, Pa. (see Appendix G).

The remaining 15,000 CY of material showed no such evidence of contamination during field screening, but was tested prior to reuse in the same manner as the potentially impacted material. All samples S-114 to S-128 showed no exceedances of SSCOs. Approximately 9,000 CY was used beneath the Hard Cap as backfill on the Site, and the remainder was not reused but rather disposed of off-site at the Coplay facility.

Soft Cap Areas

Approximately 47,000 CY of material was excavated, and approximately 6,000 CY of the excavated material showed evidence of contamination during field screening and was characterized for off-site disposal. The remaining approximately 41,000 CY was tested for compliance with the SSCOs (samples ES-1 to ES-36 and S-107 to S-111). To minimize the need for stockpiling, representative composite samples were collected prior to excavation: from test pits (the ES- samples); or from borings (the S- samples). One sample showed exceedance of an SSCO (ES-17 for mercury). The approximately 1,000 CY of material associated with this sample was characterized for off-site disposal and was subsequently disposed of at the Coplay facility as was the remaining approximately 40,000 CY (which contained too much debris to be suitable for use as backfill).

Waste Management

With the exception of the approximately 2,000 CY of material with SSCO exceedances, which was disposed of off-site at a regulated facility without mechanical screening, the remaining material intended for off-site disposal (6,000 CY from Soft Cap areas and 40,000 CY from Hard Cap areas) was screened to remove debris, concrete, wood, etc. This resulted in 83,186.92 tons of non-hazardous waste soil, approximately 2,200 CY of wood/timbers, approximately 690 CY of concrete, and 8,334.57 CY of other construction/demolition debris. All these materials were transported off-site for disposal in accordance with applicable requirements.

3.3.4 Waste Stockpiles

The Phase I ESA identified three pre-existing waste stockpiles consisting of process wastes associated with ship repair and construction. The PSCI included analysis of samples from each stockpile, which indicated that they contained SVOCs, PCBs and metals (arsenic, cadmium, chromium, mercury, and lead). TCLP analyses indicated, however, that the detected concentrations were not at levels representative of hazardous waste.

The RWP required off-site disposal of this material at an appropriate facility. Initially, the material was screened to remove large pieces of concrete, steel, wood, timbers, etc. and a total of 2,185.00 CY of these large pieces were transported to a recycling facility (Carteret Biocycle of Carteret, N.J.). Waste characterization samples of the remaining material were analyzed in conformance with the requirements of the Clean Earth of Carteret, N.J. disposal facility and the remaining 3,443.41 tons was subsequently disposed of there. Disposal manifests, waste characterization and endpoint laboratory analytical results and a Site plan showing the locations are included in Appendix H. A summary of the endpoint laboratory analytical results is shown in Table 3.

In the former stockpile locations, underlying soils were assessed in accordance with Item III.C.3 of the RWP by visual screening, soil vapor sampling, and, where appropriate, the collection and laboratory analysis of a series of multi-point composite soil grab samples. The assessment was conducted to determine: (i) whether the underlying soil had been impacted at levels above the SSCOs by leachate from the former stockpiles; or (ii) whether the underlying soil quality was consistent with the remainder of the Site.

- Stockpile #1 had been located directly on exposed soil in the southeastern corner of the Site. Accordingly, per the RWP, five grab samples of the underlying soil (S-81 to S-85) were analyzed by Long Island Analytical Laboratories for comparison with the SSCOs (see Table 3). Levels of all parameters were below SSCOs, accordingly the soils did not require removal, but were capped in accordance with the RWP.
- Beneath Stockpiles #2 (located at the rear of former building #14) and #3 (located at the rear of former building #111), there was no bare soil, only asphalt and concrete in good condition with no evidence of cracks or damage likely to have permitted contamination to enter the subsurface. Following removal of the asphalt/concrete, there were no visual/olfactory signs of contamination or elevated organic vapor (PID) readings. Accordingly, no soil samples were collected and the areas were subsequently capped in accordance with the RWP.

3.3.5 Drainage Structures

The Phase I ESA identified the presence of numerous subgrade structures throughout the Site. Approximately 170 of these structures were investigated as part of the PSCI with 23 soil/sludge samples collected from representative structures throughout the Site. Laboratory analysis indicated that the structures had been impacted by SVOCs, PCBs, PPM, and TPHC. Remaining structures were assumed to be similarly impacted. Disposal manifests, waste characterization and endpoint laboratory analytical results and a site plan showing the excavation locations are included in Appendix I. A summary of the endpoint laboratory analytical results is shown in Table 4.

<u>Closure/Abandonment Activities</u>

Closure/abandonment commenced with a comprehensive survey. As a result, an additional 83 structures were identified. Except as discussed separately below, each of the 253 identified structures was addressed in conformance with Item III.C.4 of the RWP, as follows:

- All residual liquid was removed by pump-truck and transported to Clean Water of New York in Staten Island, NY (total 87,382 gallons).
- Residual soil/sludge was removed by a vactor or truck mounted industrial vacuum excavator and transported to Middlesex County Utilities Authority of East Brunswick, NJ (total 156.22 tons).
- The interior was power washed and all liquid generated was removed and transported to Clean Water of Staten Island, NY.
- Each interior was visually inspected to determine its integrity (presence of cracks or open joints). If no such conditions were found, no further remediation was required.
- Subgrade structures located in the Soft Cap areas were removed. Following removal, the excavations were observed, as per Item III.A.4 of the RWP, for any indications of contamination (odors, staining or elevated PID readings), although none were found. Accordingly, the excavations were backfilled as detailed in Section 3.5.1. In accordance with Item III.A.5 of the RWP, concrete from these structures was crushed and used as backfill under Hard Cap areas following the performance of laboratory analysis of composite samples. All piping associated with these structures that protruded through the bulkhead (except for one 2 foot- and one 4 foot-diameter pipe, which are being reused as part of the site redevelopment) were severed and sealed with concrete.
- Structures in Hard Cap areas, since they were to be covered with asphalt or concrete, were abandoned in place after cleaning and inspection and backfilled with crushed concrete from elsewhere on-Site.

Former Dry Dock #1 including Subgrade Structures

The structures located at the bottom of Former Dry Dock #1 were not backfilled as discussed above. Instead, they were backfilled, per NYSDEC approval of the Stormwater Pollution Prevention and Erosion Control Plan (Vollmuth and Brush, dated May 2006), with virgin crushed dolomitic limestone (VCDL) from Clinton Point (New Hamburg, N.Y.) a quarry operated by Tilcon, New York, Inc. in the following manner. The structure inlet grates were removed and the drains backfilled with 3.5 feet of 9-inch VCDL (total 889.68 tons), followed by a geotextile covered with NYSDOT #1 VCDL (total 161.55 tons) and 1-inch diameter VCDL (total 450.1 tons).

The dry dock itself was backfilled with approximately 104,000 CY of sand from the Ambrose Channel (located approximately three miles off the coast of Sandy Hook, N.J. and Breezy Point, N.Y.) delivered by barge. In conformance with Item III.D.1 of the RWP, imported fill material was screened and analyzed prior to use on-Site (further described in Section 3.3.6). Then, the backfilled structure was capped in conformance with Item III.B.2 of the RWP as detailed in Section 3.3.6.

Structure SS-11

Subgrade Structure SS-11 was impacted with PCBs at concentrations exceeding 2,200 mg/kg. The RWP called for this structure to be pumped of its contents and the structure

and associated piping removed and disposed of as PCB-contaminated material. However, the structure was located within a Con Edison electrical transformer vault. Accordingly, Con Edison personnel pumped out the contents and scarified the surface per Con Edison's internal protocols. SMES personnel inspected the structure following these cleanup efforts and confirmed that: (i) the structure was limited to a 2' x 2' concrete pit; (ii) there was no associated piping or connections; (iii) there were no potential conduits for contamination to the subsurface; and (iv) any stained concrete surfaces were effectively remediated. Per the RWP (III.C.4) and since this structure was within a Soft Cap area, it was removed and disposed of at Triumvirate Environmental of Astoria, N.Y. (total 1200 lbs. in three @ 55-gallon drums). In conformance with Item III.C.4 of the RWP, a visual inspection of the excavation was conducted and revealed no signs of contamination; two confirmatory soil grab samples (identified as S-112 and S-113 see Table 4) did not reveal detectable levels of PCBs. The excavation was subsequently backfilled as described in Section 3.3.6 (as per Item III.B.6 of the RWP).

3.3.6 Backfill

Site remediation and subsequent redevelopment required a significant quantity of fill to:

- Backfill the hotspot excavations, the Soft Cap (landscaped) areas, the Former Dry Dock #1; and remaining underground structures;
- Raise the grade under the main building by 3.5 feet, within the asphalt parking field by an average of 2.75 feet and in the remainder of the Site a minimum of one foot; and
- Backfill the areas where marine sediments were excavated.

In Soft Cap areas, prior to backfilling, a 6-mil plastic demarcation layer was placed. The RWP allowed for the construction of three free-standing satellite buildings (also referred to as "pad buildings"). Because the decision was made not to construct the satellite buildings at the time the Main Building was constructed, the areas of the proposed satellite building footprints were addressed like Soft Cap areas (i.e., soil was excavated down to the water table). Should any future construction of these satellite buildings take place, their development would be in conformance with the Site Management Plan including installation of sub-slab vapor mitigation systems.

NYSDEC correspondence (backfill approvals) and laboratory analytical results are included in Appendix J. A summary of the source facilities and confirmatory sampling laboratory analytical results are shown in Table 5. Materials used for backfill included:

- Imported sand from the Ambrose Channel;
- Imported crushed stone;
- Imported soil fill material from a variety of sources;
- Imported recycled concrete aggregate (RCA); and
- Crushed material from former on-Site buildings and other concrete following laboratory analysis (Item III.A.5 of the RWP).

As per Item III.D.1 of the RWP, potential sources of imported fill were evaluated prior to acceptance by visiting the source site to acquire samples for laboratory analysis. In general, one composite sample per 1,000 CY was required and the fill was segregated at the source site until the sampling results were obtained. Samples were analyzed for

VOCs, SVOCs, metals, pesticides/PCBs, and herbicides for compliance with the Part 375 SCOs (calculated as the lower of the Commercial Use and Protection of Groundwater objectives). Results of analytical data were sent to NYSDEC (as a part of weekly reports - see Appendix E) for approval prior to delivering the material to the Site. At the Site, each load was inspected for any signs of contamination (i.e., visual, olfactory and PID screening).

Samples BS-1 to BS-242 and S-47, S-48, S-51 to S-68, S-96 to S-105 and S-129 to S-132, were collected and analyzed by Long Island Analytical Laboratories for TAGM #4046 RSCOs parameters and in conformance with the Quality Assurance/Quality Control Plan detailed in Item III.D.3 of the RWP. The various materials are discussed below.

Ambrose Channel Sand

Approximately 126,000 CY of sand from the Ambrose Channel (approximately 3 miles from both Sandy Hook, NJ and Breezy Point, NY) was brought to the Site by barge and used for backfilling Dry Dock #1 (approximately 104,000 CY), upland portions of the Site (approximately 13,000 CY), and marine sediment remedial excavations (approximately 9,000 CY) in accordance with conditions in a NYSDEC letter from Michael MacCabe dated November 15, 2006.

- Approximately 104,000 CY came directly from daily dredging operations within the channel, making the RWP approach for prior laboratory analysis impractical. Accordingly, with NYSDEC approval, samples BS-55 to BS-110 were collected in approximately 50' of water in situ by divers using self-contained underwater breathing apparatus (SCUBA) gear. Samples of approximately the top 12-inches of sand were placed in food grade plastic containers. At the surface, these samples were transferred into appropriate glassware and thereafter handled in the usual manner. SMES personnel aboard the sampling vessel documented these sampling operations.
- The remaining approximately 22,000 CY came indirectly, via the Amboy Aggregates facility. Samples BS-3, 168, 194, 201 to 203, 205, 207, 209 to 212, 218, 230 to 233, and 238-242 were collected and analyzed per the RWP (see Table 5).

Samples BS-55 to BS-119 showed slightly elevated concentrations of iron in samples BS-55 to 79, 83, 84, 97, 99, 102, 103, 105 to 109, and 115 to 119 and chromium in sample BS-71, but the detected concentrations were within eastern United States background concentrations per TAGM #4046 RSCOs. The material assessed by samples BS- 85, 86, 87, 100, 101, and 104 (approximately 6,000 CY in total), however, was determined to be impacted by SVOCs and/or metals and was not used for backfill operations of the former dry dock structure.

Imported Backfill from Upland Sources

Approximately 71,000 CY of material was delivered to the Site by truck and used to backfill Soft Cap areas and underground utility trenches. The 14 source sites are listed in the following table:

Backfill Source Site Summary

Assessment Sample #	Location	Approximate Volume Received (CY)

BS-2 and 124 to 127	Creedmore Hospital, Hollis Hills, N.Y.	5,000
BS-4, 129 to 131, 135 to 140, 145 to 152	35-40 30th Street, Astoria, N.Y.	18,000
BS-5 to 8, 120 to 123	Sutton Place and Pennsylvania Ave., Brooklyn,, N.Y.	8,000
BS-9, 206, 221 to 227, 229	Jodi Mining Operations, Kings Park, N.Y.	10,000
BS-128, 133, 134	96 St. and 89th Ave., Woodhaven, N.Y.	3,000
BS-141	8th Ave. and 50th St., Brooklyn, N.Y.	1,000
BS-142, 208	East 29th St. and Avenue L, Brooklyn, N.Y.	2,000
BS-144 , 164, 169	E. 15th St. between 7th and 8th Ave. Brooklyn, N.Y.	3,000
BS-155 to 160	59th St., Long Island City	5,000
BS-179	Queens College, Flushing, N.Y.	1,000
BS-186 to 188	Public School 244, Franklin Ave., Queens, N.Y.	2,000
BS-189 to 191, 195 to 197	Cooper Union College, 3rd Ave. and 7th St., N.Y., N.Y.	6,000
BS-213 to 217	Island Top-Soil, Farmingdale, N.Y.	5,000
BS-219, 220	Bergen St. and Schenectady Ave., Brooklyn, N.Y.	2,000

Recycled Concrete Aggregate

RCA was used as a sub-base for asphalt pavement. Although the required laboratory analysis indicated exceedance of certain SSCOs, NYSDEC allowed its use as backfill per NYSDEC Generic Beneficial Use Determination (BUD) #254, provided it only be used as sub-base with a thickness no greater than six inches, that it not have concentrations of polycyclic aromatic hydrocarbons (PAHs) higher than on-Site historic fill and that the material represented by samples BS-170 to -172 not be used on-Site. A total of 17,000 CY of RCA, represented by samples BS-161 to 163, 165 to 167, 180, 192, 193, 198 to 200, 228, and 234 to 237, were ultimately used at the Site in accordance with the BUD and NYSDEC requirements.

Crushed Virgin Dolomitic Limestone and Stone Screenings

Crushed virgin dolomitic limestone and stone screenings (total 14,508 CY) were used for backfilling:

- Subgrade pits at the bottom of Former Dry Dock #1;
- Immediately upland of the newly installed bulkheading; and
- In other Soft Cap areas.

Per the RWP, this material did not require laboratory testing because it was a virgin product delivered via barge directly from the quarry.

Reused On Site Material

Reused excavated soil is discussed in Section 3.3.3. Concrete, brick, and similar materials encountered during excavation or from demolition of former Site buildings

were crushed and stockpiled. Following crushing the volume was approximately 34,000 CY and results of ignitability, corrosivity, reactivity, and toxicity testing of samples S-47, 48, 51 to 68, 96 to 105, and 129 to 132 confirmed that none of the material met the definition of a characteristic hazardous waste. This material was used as backfill only under Hard Cap areas.

3.3.7 Electrical Transformers and Stained Wooden/Concrete Flooring

Prior to demolition of the Site buildings, the following three activities were undertaken. Disposal manifests, waste characterization and endpoint laboratory analytical results and a Site plan showing the excavation locations are included in Appendix K. A summary of the endpoint laboratory analytical results is shown in Table 6.

Removal of electrical transformers and associated concrete (Item III.C.2 of RWP)

As discussed in more detail in the RWP, 43 transformers that were not utility-owned required removal from the Site. These were decommissioned and cleaned (following removal of the dielectric fluid) by appropriately trained and licensed contractors. Liquid wastes from the transformers (total 5,200 gallons) were disposed of at Environmental Recycling of Bowling Green, Ohio and the cleaned transformers (total 127,500 pounds) were sent for recycling in Wauseon, Ohio. Following the removal, inspections revealed some areas of stained concrete, but no conduits were observed for contaminants to enter the subsurface, (e.g., cracks, open joints or nearby floor drains). Given these findings, in accordance with the RWP, subsurface sampling was not required, but the stained concrete was scarified to a depth of ¼ inch (and deeper if still not visibly clean). The generated waste materials were properly handled; and post-scarification testing was conducted by collecting a sample from a ½" diameter hole drilled to a depth of approximately 1". Nineteen such samples (S-27 to S-39, S-43 to S-46, S-94, and S-95) were analyzed for PCBs and detectable levels were found in only two samples (S-34 and S-35), but at levels below the TAGM #4046 RSCO of 1 mg/kg. As such, no additional remediation was required.

Removal of stained wooden flooring and associated concrete (Item III.C.6 of RWP)

Since sampling of areas of wooden flooring in Buildings #6 and #93 with "oil-like" staining had revealed the presence of SVOCs, PCBs, and/or PPMs, the RWP required this material be removed and properly disposed of prior to building demolition. A total of 388.69 tons of material was removed and disposed of at Vexor Technology of Medina, Ohio. All underlying concrete was then inspected and all stained surfaces were cleaned and then sampled in the same manner as that described above for concrete beneath transformers. The waste concrete was sent for disposal and 25 samples (S-1 to S-17, S-19 to S-24, S-88, and S-89) were analyzed for SVOCs, PCBs and PPMs, with results compared to TAGM #4046 RSCOs. Sampling results indicated that no further action was needed for 23 areas (associated with samples S-1 to 5, 7 to 15, 17 to 24, 88, and 89), but that lead levels in the areas associated with samples S-6 and S-16 warranted the removal of additional concrete, the effectiveness of which was confirmed by subsequent samples S-6a and S-16a. For the areas associated with the eight remaining samples where one or more SVOC TAGM #4046 RSCOs was exceeded, NYSDEC confirmed after reviewing the data, which was submitted with the weekly reports, that the exceedances were not significant and no additional remediation was required.

Remediation of interior soil/sludge, per Item III.C.7 of RWP

Since sampling of "packed-on soil/sludge" over concrete flooring in Buildings #6, #14, and #93 had revealed the presence of SVOCs, PCBs, and/or PPMs, the RWP required the soil/sludge be removed (using power washers and/or scrapers) and properly disposed of prior to building demolition. A total of 6,400 pounds of material was removed and disposed of at SQS Inc. in Canton, MI. The cleaned concrete was then sampled in the same manner as that described above for concrete under transformers. Seven samples (S-18, S-86, S-87, and S-90 to S-93 in Table 6) were analyzed for SVOCs, PCBs and PPMs, with results compared to TAGM #4046 RSCOs. Although the sampling indicated some exceedances of SVOCs, NYSDEC confirmed after reviewing the data, which was submitted with the weekly reports, that the exceedances were not significant and no additional remediation was required.

3.3.8 USTs and ASTs

During remedial activities, three 550-gallon ASTs, one 80,000-gallon UST, and eight 20,000-gallon USTs were closed/abandoned in place and one 550-gallon UST was removed, cleaned, and disposed of off-site in accordance with all local, State, and Federal requirements. Disposal manifests, petroleum bulk storage applications, and site plans of UST locations are included in Appendix L.

3.3.9 Sediment

Marine sediment sampling conducted in the vicinity of the Site's bulkhead and outfalls indicated concentrations of SVOCs, PCBs, or metals above NYSDEC sediment criteria contained in NYSDEC Division of Fish and Wildlife and Marine Resources *Technical Guidance for Screening Contaminated Sediments*, January, 1999. Based on this data, four hotspots totaling approximately 80,000 square feet required remediation in accordance with Item III.C.11 of the RWP (described below) and a June 4, 2007 NYSDEC letter from Michael MacCabe to Altan Gulum of SMES (included in Appendix A). Disposal documentation, including sediment surveys and disposal invoices, waste characterization results and bathymetric surveys are included in Appendix M. Remediation was conducted as follows:

- Each hotspot was marked with buoys and benchmarks along the bulkhead and pre-remediation bathymetric surveys were conducted by Rodgers Surveying, PLLC (NY State License #50215) of Staten Island, NY.
- Prior to any debris or sediment removal, a weighted silt curtain was installed around each hotspot, extending from the water surface to the sediments. It was left in place during and for a minimum of 24 hours after the completion of dredging. To confirm the effectiveness of the curtain, during dredging total suspended solids (TSS) concentrations were measured hourly at the water surface immediately outside of the silt curtain. Any visible breaches or breaches noted due to elevated TSS levels were to be promptly repaired, though no significant breaches ever occurred.
- Where necessary, prior to dredging, sufficient debris was removed to allow access to the underlying sediment and all generated debris (a total of approximately 180 CY) was subsequently disposed of off-site.
- A minimum of one foot of sediment was removed from the hotspot areas, totaling approximately 5,043 CY, using an environmental clam shell dredge and/or a cable-arm bucket and placed directly into barges. The sediment was left to settle for at least three hours before allowing excess water to discharge. The discharge was monitored

for visible suspended solids and if any were observed, the discharge was halted and the sediment was allowed to settle, prior to resuming the discharge.

- The barges were taken to the Don Jon Marine Co. facility in Port Newark, NJ, where large debris (such as timbers) was removed from the sediment and other limited processing conducted in order to make the sediment suitable for its final disposition as landfill cover at Fresh Kills Landfill in Staten Island, NY.
- Prior to its placement at Fresh Kills, the sediment was mixed with Portland cement to stabilize it and the resulting total volume of approximately 5,320 CY was placed at Fresh Kills.
- To confirm sufficient sediment had been removed, post remediation bathymetric surveys were performed and pre/post difference (delta value) surveys prepared and submitted to NYSDEC on February 21 and March 19, 2008. NYSDEC granted permission to backfill the remedial excavations (see May 5, 2008 e-mail in Appendix M) and the hotspots were backfilled to approximately the pre-dredge grades with sand from the Ambrose Channel (see Section 3.3.6, Backfill). Subsequent final bathymetric surveys showed that there was no loss of water column.

3.3.10 Soil Vapor

During the PSCI and SSI, soil vapor monitoring wells were installed in various locations where buildings were proposed:

- Methane was identified at levels exceeding the lower explosive limit (LEL) in five locations within the proposed footprint of the Main Building and, following hot spot removal (see Section 3.3.2), by additional sampling as required by Item III.C.9 of the RWP in six locations, including some within the footprints where satellite buildings A and B may be built.
- VOCs and less frequently SVOCs (see Table 7) were identified, and per Item III.C.9 of the RWP, VOC testing was conducted following hot spot removal (see Table 7). That sampling found some individual VOCs above indoor air comparison values of the USEPA and NYSDOH (75th percentile values from *Background Indoor/Outdoor Air Levels for VOCs in Homes Sampled by NYSDOH, 1989-1996*; and *USEPA - Natural Ambient Air VOCs Database Update - 600/3-88/010a*) within the footprint of the proposed Main Building.

Based on the above findings:

- An active methane mitigation system was required by NYSDEC for the Main Building, and satellite buildings A and B, when and if they are constructed. Although no elevated levels of methane or organic vapors were found within the footprint of satellite building C, a similar system would also be required there as a precaution. The March 2007 *Methane Mitigation Work Plan* (MMWP), attached as Appendix A, was approved by NYSDEC on March 27, 2007. For the Main Building, the system was installed consistent with the MMWP and is currently operational (the future operation of the system is discussed in the SMP). Although the satellite buildings were not constructed at this time, any future construction would be undertaken in conformance with the MMWP, as described in the SMP.

- Fifteen soil vapor monitoring wells were required by NYSDEC to be installed at the Site's perimeter and monitored for methane. These wells were installed. The locations and the (quarterly) monitoring schedule are presented in the SMP.

Laboratory analytical results and soil vapor monitoring well installation logs are included in Appendix N.

3.4 RESIDUAL CONTAMINATION REMAINING ON-SITE

3.4.1 Soil

Residual contamination (defined as soil beneath the Site Cap that could exceed SCOs for Commercial Use or Protection of Groundwater) remains at the Site. For simplicity, the area where residual contamination may be found (the "Residual Management Zone") is assumed to be anywhere beneath the Site Cap. Future disturbance of soil in the Residual Management Zone will require adherence to protocols for soil handling, and oversight by the Remedial Engineer or Qualified Environmental Professional, as outlined in Section 2.4 of the SMP.

As part of remediation, excavations were backfilled using: (1) soil or fill from the Site which met the SSCOs; (2) concrete and brick from on-Site demolition which met the SSCOs; and/or (3) rock and soil obtained from off-site sources which met SCOs established by the Brownfields Regulations for Commercial Use, and Protection of Groundwater or other imported material for which specific approval was given by NYSDEC. Figure 4 shows the Site Cap components and the final development. Backfilled excavations were covered by the Site Cap meeting the specifications contained in the RWP.

3.5 ENGINEERING CONTROL SYSTEMS

3.5.1 Composite Cover System

Exposure to residual contamination is prevented by an engineered composite Site Cap built on the Site. The Site Cap is comprised of a Hard Cap component and a Soft Cap component. In accordance with the RWP, all soil in the areas under the Soft Cap was excavated down to the water table, a demarcation barrier was placed at the soil/groundwater interface, and at least 4 feet of clean fill was backfilled as cover. The soil in the Hard Cap areas remains in place (except in certain hot spot locations, as described above), and is covered by no less than a foot of clean soil and a cap of asphalt, concrete or building structure. Specifically:

- The "Hard Cap" consists of a minimum of 1 foot of fill material that meets Part 375 SCOs calculated as the lower of the SCOs for Commercial Use or Protection of Groundwater or other imported material for which specific approval was given by NYSDEC, covered by one of the following: (i) the building's 12-inch thick concrete slab; (ii) asphalt-paved parking fields (constructed with 2.5 inches of asphalt over 4-inches of sub-base); or (iii) concrete walkways (4-inch thick concrete); and
- The "Soft Cap" consists of a minimum of four (4) feet of cover in the landscaped areas that meets SCOs calculated as the lower of the SCOs for Commercial Use or Protection of Groundwater or other material for which specific approval was given by NYSDEC, with a plastic demarcation barrier placed at the soil/groundwater interface.

Figure 4 shows the location of each current cover type on the Site. Any changes in the Site Cap components or disturbance of the residual contamination must meet the requirements of the SMP and be detailed in the Annual Site Management Report called for by the SMP.

A Soil Management Plan included in Section 2.4 of the SMP outlines the procedures required in the event the Site Cap and underlying residual contamination are disturbed. Procedures related to maintenance of the Site Cap are provided in Section 4 of the SMP.

3.5.2 Vapor Mitigation System

The MMWP was implemented during remedial activities and involved the installation of a vapor barrier and sub-slab vapor mitigation system with a perimeter soil-vapor monitoring well network.

Exposure to potential residual vapors is minimized by the sub-slab vapor mitigation system installed beneath the Main Building as shown on Figure 5. The mitigation system design consists of: (i) a sub-slab network of horizontal slotted screen PVC piping in a gravel layer under portions of the building separated into two manifolds or zones; (ii) two separate riser pipes (one per manifold) that extend from the piping network to the roof; (iii) two blower units (one per riser) mounted on the roof; and (iv) a Liquid Boot brand vapor barrier membrane that was sprayed over the gravel layer and attached to the underside of the building's structural slab. When operating, the blowers create negative air pressure or suction in the horizontal well network. As vapors enter the gravel layer, they are captured by the horizontal well network via the negative pressure created by the blowers. Recovered vapors are discharged through short stacks on top of the blowers to the atmosphere. Further details and specifications for the sub-slab vapor mitigation system and Methane Mitigation Work Plan are included in Appendix A.

Procedures for operating and maintaining the sub-slab vapor mitigation system are documented in the Operation and Maintenance Plan (Section 4 of the SMP). Procedures for monitoring the system are included in the Monitoring Plan (Section 3 of the SMP). The Monitoring Plan also addresses inspections in the event that a condition occurs that may affect operation of the sub-slab vapor mitigation system.

3.6 INSTITUTIONAL CONTROLS

The Environmental Easement is the primary IC that has been established for the Site in order to ensure the ECs are implemented, maintained and monitored in accordance with the SMP. The Environmental Easement was granted by the Volunteer to NYSDEC and is enforceable by NYSDEC and the City of New York. The Environmental Easement: (i) requires compliance with the approved SMP; (ii) allows only commercial or industrial development of the Site; (iii) prohibits the use of groundwater at the Site as a source of potable or process water; and (iv) requires that a licensed engineer inspect the Site Cap and methane/VOC ventilation system on an annual basis, and submit to NYSDEC a report certifying that the ECs are continuing to serve their intended function. The Environmental Easement requires the Volunteer to take the steps needed to assure the continued effectiveness of the long term ECs, and will thereby assure the viability of such controls with minimal expense to the State of New York.

3.7 SITE MANAGEMENT PLAN

As noted above, residual contamination may remain on the Site. The SMP sets forth the requirements for managing the residual contamination at the Site in accordance with the Environmental Easement executed by the Volunteer and recorded against the property with the

Kings County Clerk pursuant to ECL Section 27-1419(2)(e) and in accordance with the Brownfields Regulations.

ECs and ICs were identified in the RWP and ECs were incorporated into the Site remedy to ensure the proper management of residual contamination in the future, in order to protect public health and the environment. The SMP includes all procedures necessary to ensure compliance with the ECs and ICs specified by the RWP. The SMP has been approved by the NYSDEC, and pursuant to the Environmental Easement is binding upon the Volunteer and its successors and assigns.

The Site management phase is triggered by the approval of the Final Engineering Report and issuance of the Certificate of Completion (COC) by NYSDEC. As the grantor under the Environmental Easement, the Volunteer and its successors and assigns must adhere to the SMP in perpetuity or until such time as the Environmental Easement is extinguished in accordance with the BCA.

The SMP provides a detailed description of all procedures required to manage known and potential residual contamination at the Site following the completion of the remedial work in accordance with the RWP. The plan includes the procedures that must be followed to: (a) implement the ECs and the ICs; (b) implement a monitoring plan for the Site; (c) operate and maintain the Site Cap, as well as the sub-slab vapor mitigation systems that have been installed at the Site; (d) perform inspections and submit Site management reports certified in accordance with the Brownfields Law and Regulations; and (e) define criteria to terminate operation of the sub-slab vapor mitigation system and soil-vapor monitoring system at the Site.