

**PFIZER INC
SITE B AND SITE D
OPERABLE UNIT 1
BROOKLYN, NEW YORK**

Remedial Action Work Plan

NYSDEC VCP Number: V00350

**Prepared for:
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FINAL REMEDIAL ACTION WORK PLAN

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LIST OF ACRONYMS

Acronym	Definition
AOC	Area of Concern
ARAR	Applicable or Relevant and Appropriate Requirement
ASP	Analytical Services Protocol
AWQSGV	Ambient Water Quality Standards and Guidance Values
CAMP	Community Air Monitoring Plan
C/D	Construction and Demolition
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
Cis-1,2-DCE	Cis-1,2-dichloroethene
CLP	Contract Laboratory Program
COC	Certificate of Completion
CQAP	Construction Quality Assurance Plan
CVOC	Chlorinated Volatile Organic Compound
CY	Cubic Yards
DER	Division of Environmental Remediation
DSHM	Division of Solid & Hazardous Materials
DUSR	Data Usability Summary Report
EC	Engineering Control
ECL	Environmental Conservation Law
EDD	Electronic Data Deliverable
ELAP	Environmental Laboratory Approval Program
FER	Final Engineering Report
FT BLS	Feet Below Land Surface

Acronym	Definition
GPS	Global Positioning System
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
IC	Institutional Control
IRM	Interim Remedial Measure
IS	Intermediate School
ISCO	<i>In Situ</i> Chemical Oxidation
µg/m ³	Micrograms per Cubic Meter
µg/L	Micrograms per Liter
MFR+XFR	Modified Fenton's Reagent + Extra Free Radicals
MS	Matrix Spike
MSD	Matrix Spike Duplicate
MW	Monitoring Well
NYCDEP	New York City Department of Environmental Protection
NYCRR	New York Codes, Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSDOT	New York State Department of Transportation
OER	Office of Environmental Remediation
OSHA	Occupational Safety and Health Administration
OU	Operable Unit
PAH	Polycyclic Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PCE	Tetrachloroethene

Acronym	Definition
PID	Photoionization Detector
PPE	Personal Protective Equipment
QA	Quality Assurance
QAPP	Quality Assurance Project Plan
QC	Quality Control
RAO	Remedial Action Objective
RAWP	Remedial Action Work Plan
RCRA	Resource Conservation and Recovery Act
RI	Remedial Investigation
RIR	Remedial Investigation Report
SCG	Standards, Criteria and Guidance
SCO	Soil Cleanup Objective
SEQRA	State Environmental Quality Review Act
SMP	Site Management Plan
SoMP	Soil/Materials Management Plan
SPDES	State Pollutant Discharge Elimination System
SPEED	Searchable Property Environmental E-Database
STARS	Spills Technology and Remediation Series
SVE/AS	Soil Vapor Extraction/Air Sparge
SVI	Soil Vapor Intrusion
SVOC	Semivolatile Organic Compound
TAL	Target Analyte List
TBC	To Be Considered
TCE	Trichloroethene

Acronym	Definition
TCL	Target Compound List
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
UST	Underground Storage Tank
VC	Vinyl Chloride
VCA	Voluntary Cleanup Agreement
VCP	Voluntary Cleanup Program
VOC	Volatile Organic Compound

CERTIFICATION

I, Charles J. McGuckin, certify that I am currently a NYS registered professional engineer and that this Remedial Action Work Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).

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.

Charles J. McGuckin, P.E.
NYS Professional Engineer #069509

February 13, 2015
Date



It is a violation of Article 145 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 145, New York State Education Law.

EXECUTIVE SUMMARY

On behalf of Pfizer Inc (Pfizer), Remedial Engineering, P.C. (Remedial Engineering) and Roux Associates, Inc. (Roux Associates) have prepared this Remedial Action Work Plan (RAWP) for Operable Unit 1 (OU-1) of Site B and Site D. OU-1 (a/k/a Site D) is owned by Pfizer and is located at 191 Harrison Avenue and 60-66 Gerry Street in Williamsburg, Brooklyn, New York. Site D is in the NYSDEC Volunteer Cleanup Program (VCP), Index Agreement No. D2-0010-0703, Site No. V00350. The Volunteers are Pfizer, Oholei Shloma, and YGS, Inc.

Site Description/Physical Setting/Site History

Site D is identified as Block 2269 and Lot 1 on the New York City Tax Map. Site D is bounded on the north by Gerry Street, on the south by Bartlett Street, on the east by a vacant lot, and on the west by Harrison Avenue.

In 1887, Site D was partly developed with rows of one to three-story dwellings and ground-level stores that included a wheelwright, soft soap facility, fur-dressing store, and an event hall with the name Teutonia Hall. The existing off-site five-story apartment building was constructed in 1904, at which time a tailor shop was also present on site. The Pfizer-owned buildings on Site D completely surround three sides of this off-site abandoned apartment building. A National Guard of the State of New York Armory replaced Teutonia Hall by 1918. A carriage repository and small soda water facility were also present on site. By 1935, the existing one and two-story buildings had replaced the armory, dwellings, and stores in its footprint.

Pfizer occupied Site D as early as 1947. Site D was divided into multiple lots at that time, and Pfizer did not own the entirety until the building on 66 Gerry Street (later designated as Building 25A) was purchased in 1965. Site D was known back then as Warehouse "F" and was used for storage purposes and general maintenance work supporting the Pfizer Brooklyn facility. Pfizer activities (circa 1965 as it relates to the current building layout) included welding at the location of the existing courtyard and metal working within the existing one and two-story building. Pfizer housed its engineering and maintenance departments in this building that supported all Brooklyn-based Pfizer manufacturing operations at that time. Arlington Press, a company that specializes in labels and package inserts for the pharmaceutical industry, leased

this facility from Pfizer from January 1987 to the end of 2007. Site D has been vacant since 2008.

A 1955 affidavit indicated a possible dry-cleaning solvent (tetrachloroethene) reclamation business was located at 66 Gerry Street.

Summary of the Remedial Investigation

In soil, chlorinated volatile organic compound (CVOC) exceedances of the Part 375 Protection of Groundwater Criteria were limited to depths ranging from six (6) to 16 feet below land surface (ft bls) at locations underneath the north-central portion of Building 25A, and one location in the main courtyard of Site D. Test pitting at areas of soil impacts did not uncover any CVOC source materials (e.g., sludge containing pit or trap). Multiple CVOCs in exceedance of their respective New York State Department of Environmental Conservation Ambient Water Quality Standards and Guidance Values (AWQSGVs) were detected in groundwater samples collected from underneath Building 25A and the main courtyard of Site D, and at downgradient locations in Site B. Elevated concentrations of CVOCs are present in the underlying aquifer to approximately 30 ft bls, which coincides with the top of a confining silt/clay layer that limits vertical migration. CVOC concentrations in soil vapor were highest proximate to Building 25A and the main courtyard of Site D, but attenuated with distance from these areas.

Semivolatile organic compounds (SVOCs) and metal exceedances of the Part 375 Restricted Residential Use Criteria are present in soil from ground surface to 10 ft bls for SVOCs, and from ground surface to 11 ft bls for metals. Although various SVOCs and metals have been detected at concentrations in exceedance of NYSDEC AWQSGVs, only sodium and manganese were consistently detected above NYSDEC AWQSGVs at multiple monitoring wells.

Qualitative Human Health Exposure Assessment

There are two on-site contaminant sources: the presumed historic tetrachloroethene (PCE) reclamation business and historic fill. The presumed operation of the historic PCE reclamation business likely contributed to CVOC soil impacts in the northern half of Building 25A and the adjacent courtyard. These soil impacts have resulted in a groundwater plume underneath Site B and Site D. The use of historic fill is prevalent and widespread across Site D, is typical of past

urban (i.e., Brooklyn) practices, and likely contributed to the concentrations of metals and polycyclic aromatic hydrocarbons (PAHs) present across Site D.

Although on-site workers and visitors may contact contaminants potentially present in soils and groundwater during general maintenance or construction activities, the potential is limited by the fact that all of Site D is covered with concrete. Furthermore, Site D and the surrounding properties are supplied with public drinking water. There is potential for CVOCs in soil vapor to enter the indoor air of Site D buildings via soil vapor intrusion. If such circumstances were to occur, building occupants could be exposed to contaminants via the indoor air inhalation route of exposure. However, Site D is currently vacant.

The proposed remedial action will remove known CVOC soil impacts and address elevated CVOC concentrations in groundwater, which will also mitigate the concentration of CVOCs in soil vapor.

Summary of the Remedy

The selected remedial action will consist of the following remedial elements:

1. Excavation of soil and materials exceeding the Part 375 Protection of Groundwater Criteria for VOCs, to the extent practicable;
2. Groundwater remediation consisting of *in situ* chemical oxidation injections in the Site D courtyard and in the vicinity of monitoring wells MW-18, MW-20, MW-D2, and MW-D2I;
3. Screening for indications of contamination by visual means, odor, and monitoring with a photoionization detector of all excavated soil during any intrusive site work;
4. Collection and analysis of end-point soil samples to evaluate the performance of the remedy with respect to attainment of soil cleanup objectives;
5. Import of materials to be used for backfill and cover in compliance with: (1) chemical limits and other specifications listed in Part 375-6.7(d), and (2) all Federal, State and local rules and regulations for handling and transport of material;
6. Implementation of a composite cover system consisting of concrete cover, concrete building slabs, and two feet of clean backfill in areas that are not paved or under a building slab to prevent public exposure to residual soil and groundwater impacts that could not be removed due to technical impracticability, and to achieve compliance with Part 375 Restricted Residential Use Criteria;

7. Appropriate off-site disposal of all material removed from Site D in accordance with all Federal, State and local rules and regulations for handling, transport, and disposal;
8. Recording of a Deed Restriction, including Institutional Controls, to prevent future exposure to any residual contamination remaining at the Site;
9. Publication of a Site Management Plan for long term management of residual contamination as required by the Deed Restriction, including plans for: (1) Institutional and Engineering Controls, (2) monitoring, and (3) reporting.

REMEDIAL ACTION WORK PLAN

1.0 INTRODUCTION

Pfizer Inc (Pfizer) entered as a Volunteer into a Voluntary Cleanup Agreement (VCA; Index Agreement No. D2-0010-0703, Site No. V00350) with the New York State Department of Environmental Conservation (NYSDEC) on September 19, 2003, to investigate and remediate a 0.8-acre property located in Williamsburg, Brooklyn, New York. The property is known as Site B and is divided into a western portion with a street address of 59-71 Gerry Street, and an eastern portion (formerly owned by Pfizer) with a street address of 73-87 Gerry Street. The VCA was amended on March 22, 2011 to include a 0.68-acre property across from Site B known as Site D, with street addresses of 191 Harrison Avenue and 60-66 Gerry Street. The VCA was amended on September 19, 2012 to include Oholei Shloma and YGS, Inc. (f/k/a Congregation YGS) as Volunteers.

There are three (3) Operable Units (OUs) associated with Site B and Site D:

- OU-1 consists of the Pfizer Site D property;
- OU-2 consists of the western portion of Site B and Lot 52, which is the western most lot of the eastern portion of Site B; and
- OU-3 consists of the remainder of the eastern portion of Site B, Lots 45 through 50.

Remediation of OU-1 (a/k/a Site D) is the subject of this Remediation Action Work Plan (RAWP). When completed, Site D is expected to contain vacant buildings. Remediation of OU-2 was performed in accordance with the NYSDEC-approved RAWP dated August 22, 2011. When completed, OU-2 will contain a private high school and, in the future, an open air playground. Remediation of OU-3 will be performed under a separate RAWP to be submitted by Oholei Shloma. When completed, OU-3 is expected to contain a synagogue and residential buildings. Refer to the Voluntary Cleanup Program (VCP) application for additional details.

This Remedial Action Work Plan (RAWP) for OU-1 summarizes the nature and extent of contamination as determined from data gathered from multiple site investigations performed on Site B between 1996 and 2011, and during the Remedial Investigation (RI), performed between March 2012 and July 2013. It provides an evaluation of the recommended and preferred remedy. The remedy described in this document is consistent with the procedures defined in DER-10 and the NYSDEC May 2002 Draft Voluntary Cleanup Program Guide (Draft VCP Guide), and

complies with all applicable standards, criteria, and guidance. The remedy described in this document also complies with all applicable Federal, State and local laws, regulations and requirements. The RI did not identify fish and wildlife resources.

A formal Remedial Design document will not be prepared.

1.1 Site Location and Description

Site D is located in the County of Kings, Brooklyn, New York and is identified as Block 2269 and Lot 1 on the New York City Tax Map. A Brooklyn United States Geological Survey (USGS) topographical quadrangle map (Figure 1) shows the site location. Site D is situated on approximately 0.68 acres. It is bounded on the north by Gerry Street, on the south by Bartlett Street, on the east by a vacant lot, and on the west by Harrison Avenue. Plate 1 shows the location of OU-1. A boundary map is attached to the VCA as required by Environmental Conservation Law (ECL) Title 14 Section 27-1419.

1.2 Contemplated Redevelopment Plan

The Remedial Action to be performed under the RAWP is intended to make Site D protective of human health and the environment consistent with the contemplated end use. The proposed redevelopment plan and end use is described here to provide the basis for this assessment. However, the Remedial Action contemplated under this RAWP, which will allow OU-1 to be used for restricted residential or lower levels of use, may be implemented independent of the proposed redevelopment plan.

The contemplated future use for OU-1 is to remain a commercial use property.

1.3 Description of Surrounding Property

The adjacent and surrounding properties have historically been used for light manufacturing, residential and commercial purposes. Several properties in the area have been used for automotive repair garages and gasoline stations. Currently, the surrounding area is zoned for residential, commercial, and manufacturing use. Adjacent property usage includes a poultry market along the south side of Wallabout Street, residential buildings along Wallabout Street, and sheet metal shop, parking, and several vacant properties along Gerry Street. According to

the Office of Environmental Remediation (OER) Searchable Property Environmental E-Database (SPEED), one day-care center is located at 11 Bartlett Street, approximately 300 feet south of OU-1. Intermediate School (IS) 318 is located approximately 370 feet northeast of OU-1 at 101 Walton Street, and United Talmudical Academy is located approximately 475 feet southeast of OU-1 at 102 Bartlett Street. The Beginning with Children Charter School is also located at 11 Bartlett Street. No hospitals are located within 500 feet of OU-1.

2.0 DESCRIPTION OF REMEDIAL INVESTIGATION FINDINGS

Multiple site investigations were performed on Site B between 1996 and 2011, and a formal RI of OU-1 and OU-3 was performed between March 2012 and July 2013. The findings are detailed in the Remedial Investigation Report (RIR) for OU-1 dated March 27, 2014 and are summarized in this section. Please note there were only two OUs at the time the RI was performed. OU-1 consisted of the entirety of the current OU-1 (Site D) and OU-3 (Lots 45 through 50 of Site B), plus a small portion of the current OU-2 (Lot 52 of Site B). OU-2 consisted of the western portion of Site B. OU-1 and OU-3 investigation data and operational history are provided in this section for completeness, but as noted above, remedial action for OU-3 will be performed under a separate NYSDEC-approved RAWP.

2.1 Summary of Remedial Investigations Performed

The remedial investigations identified impacts in soil, groundwater, and soil vapor. The following sections summarize the findings in each media.

2.1.1 Soil

Tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), and vinyl chloride (VC) exceedances of the Protection of Groundwater Criteria in Title 6 of the New York Codes, Rules and Regulations (6 NYCRR) Part 375 (Part 375) dated December 14, 2006 are present underneath the north-central portion of Building 25A in Site D, and the eastern portion of the main courtyard of Site D. The exceedances are at depths ranging from six (6) to 21 feet below land surface (ft bls) at locations underneath the north-central portion of Building 25A, and from 14 to 16 ft bls at one location in the main courtyard.

Semivolatile organic compounds (SVOCs) and metal exceedances of the Part 375 Restricted Residential Use Criteria are present from ground surface to 10 ft bls for SVOCs, and from ground surface to 11 ft bls for metals. These intervals coincide with the historic fill layer. The types and concentrations of SVOCs and metals present are consistent with historic fill in urban environments (i.e., Brooklyn, New York) and not due to a release at Site B or Site D.

Concentrations of cyanide, polychlorinated biphenyls (PCBs), pesticides, and herbicides are below the Part 375 Restricted Residential Criteria.

2.1.2 Groundwater

A plume containing dissolved chlorinated volatile organic compounds (CVOCs) extends from the northern part of Site D to Site B. The primary CVOC constituents are PCE, TCE, cis-1,2-DCE, and VC. CVOC exceedances of the NYSDEC Ambient Water Quality Standards and Guidance Value (AWQSGV) have been detected at multiple monitoring wells within the plume. The highest exceedances are exhibited by monitoring wells MW-D1, MW-D1I, MW-D2, MW-D2I, MW-D3, and MW-D3I, which are located in Site D at or immediately downgradient of known soil impacts. The groundwater plume is present to approximately 30 ft bbls, which coincides with the top of a confining silt/clay layer that limits vertical migration.

Although various SVOCs and metals have been detected at concentrations in exceedance of NYSDEC AWQSGVs, only sodium and manganese were consistently detected above NYSDEC AWQSGVs at multiple monitoring wells. Therefore, there are no SVOC impacts, and metal impacts are limited to sodium and manganese.

Concentrations of cyanide, PCBs, pesticides, and herbicides in monitoring well samples were either non-detect or indicated no exceedances.

2.1.3 Soil Vapor

Numerous VOCs are present in soil vapor, including PCE, TCE, and cis-1,2-DCE. VC, however, has never been detected in any samples. The highest PCE and TCE concentrations were detected north of Building 25A at SV-AP4. The highest cis-1,2-DCE concentration was detected in the main courtyard of Site D at SV-AP3. CVOC concentrations in soil vapor, therefore, were highest proximate to Building 25A and the main courtyard of Site D. The soil vapor distribution pattern indicated attenuation with distance from these areas.

2.2 Site History

This section reviews historic operations at Site B and Site D. Both were part of Pfizer's Brooklyn facility, which began on or about 1849.

2.2.1 Site B

By 1887, the eastern portion of Site B was improved with contiguous two and three-story residential buildings, and a three-story building located in the central portion of Site B (i.e., 77/79 Gerry Street) that was occupied by a fur factory and otherwise used for residential purposes. By 1904, the fur factory building was used for storage purposes and occupied by a potential coffee roaster based on the small size of the shop. The building adjacent to the south (i.e., 75 Gerry Street) was used as a carriage repository and otherwise residential.

In 1918, the carriage repository was no longer present and a wholesale grocer operated in the same building as the roaster. By 1935, the buildings with a street address ranging from 73 to 79 Gerry Street, including residential buildings and the aforementioned roaster and wholesale grocer building, were demolished and replaced by a one-story 75-car garage. A 550-gallon gasoline underground storage tank (UST) was present in the southeastern corner of the garage. This UST was removed during the performance of the 2002 Interim Remedial Measure (IRM) activities.

The remaining residential buildings that had been present at 81 through 85 Gerry Street were demolished by 1947, replaced with a one-story truck renting facility. Site B remained unchanged through 1950.

Pfizer took ownership of the eastern portion of Site B on April 2, 1964, which consisted of a vacant building that was not utilized by Pfizer until the 1970s (where the aforementioned former garage and truck renting facility were owned and operated by previous Site B owners); a concrete loading dock unit was evident as a feature to the garage operation, and is the sole remaining historic feature in eastern Site B. Pfizer utilized the building, which covered the majority of the eastern portion of Site B, as a warehouse for the storage of raw materials/dry goods, spare equipment parts, and packaging materials. Additionally, a basement was present that contained a boiler and a 1,000-gallon capacity No. 2 fuel oil vaulted storage tank, which was not used by Pfizer (i.e., the tank was not active). The use of the building as a warehouse continued until the late 1980s, when Pfizer leased the building to Arlington Press for employee parking. By March 1, 1996, Pfizer had the building demolished and the abovementioned 1,000-gallon fuel oil tank and associated boiler removed. The eastern portion of Site B returned

to use as Arlington Press employee parking until Arlington Press closed near the end of 2007. Since then, the eastern portion of Site B has been vacant except for a remedial system equipment container that was removed in April 2013.

2.2.2 Site D

In 1887, Site D was partly developed with rows of one to three-story dwellings and ground-level stores that included a wheelwright, soft soap facility, fur-dressing store, and an event hall with the name Teutonia Hall. The existing off-site five-story apartment building was constructed in 1904, at which time a tailor shop was also present on-site. The Pfizer-owned buildings on Site D completely surround three sides of this off-site abandoned apartment building.

A National Guard of the State of New York Armory replaced Teutonia Hall by 1918. A carriage repository and small soda water facility were also present on-site.

By 1935, the existing one and two-story buildings had replaced the armory, dwellings, and stores in its footprint. Three gasoline underground storage tanks (USTs) were maintained at that time in the interior of that building, along Harrison Avenue.

Pfizer occupied Site D as early as 1947. Site D was divided into multiple lots at that time, and Pfizer did not own the entirety until the building on 66 Gerry Street (later designated as Building 25A) was purchased in 1965. (The multiple parcels were later merged to form Lot 1.) Site D was known back then as Warehouse "F" and used for storage purposes and general maintenance work supporting the Pfizer Brooklyn facility. Paints were also stored at ground level of the maintenance department of Arlington Press (central Gerry Street one-story building), together with lumber. The previous shops no longer operated on-site and the aforementioned gasoline USTs were no longer present. Pfizer activities (circa 1965 as it relates to the current building layout) included welding at the location of the existing courtyard and metal working within the existing one and two-story building. Pfizer housed its engineering and maintenance departments in this building that supported all Brooklyn-based Pfizer manufacturing operations at that time. Arlington Press leased this facility from Pfizer from January 1987 to the end of 2007. Site D has been vacant since 2008.

A 1955 affidavit indicated a possible dry-cleaning solvent (PCE) reclamation business was located at 66 Gerry Street. Additional discussion is provided in Section 2.4.1.

2.3 Geological and Hydrogeological Conditions

The following sections summarize regional and local geology.

2.3.1 Regional Geology

Site B and Site D are located within the Atlantic Coastal Plain Physiographic Province. The regional subsurface geology consists of unconsolidated sand, silt, clay, and gravel deposits that overlie crystalline bedrock. The unconsolidated strata gently dip to the southeast, following the topography of the bedrock surface.

2.3.2 Site Geology

During previous investigations of Site B and Site D, four distinct geologic strata were encountered from land surface to a depth of approximately 35 ft bls. Two cross sections are shown on Plate 2. The observed lithology is as follows:

- A brown sand stratum (i.e., fill material) throughout Site B and Site D with an approximate thickness of 8 to 10 feet. The fill material is characterized as predominately fine to coarse sand, some concrete, brick, and slag fragments, trace to some gravel, and trace clay.
- A green clay/silt/sand stratum that underlies the aforementioned fill material at Site B and Site D with an approximate thickness of two to three feet.
- A brown fine to medium sand stratum with minor amounts of silt and gravel that underlies the clay/silt and sand/silt layers (where present). This stratum was identified throughout Site B and Site D with an average approximate thickness of 10 to 15 feet.
- A minimum 10 feet thick gray silt/clay stratum that underlies the above sand stratum throughout Site B and Site D.

There are two other site-specific features in addition to the above. As a result of past development activities at Site B and Site D, most of the surface of Site D and portions of Site B are covered by concrete that is approximately one to two feet thick. A layer of clean backfill from near surface to approximately 10 to 12 ft bls is present within the central area of the eastern portion of Site B, where IRM activities (i.e., excavation) were conducted in 2002 to remove source areas.

2.3.3 Regional Hydrogeology

Groundwater in the area occurs under water-table (unconfined) conditions in the Upper Glacial Aquifer. Regional groundwater flow in the area is generally to the north, eventually discharging to the East River. Underlying the Upper Glacial Aquifer is the Jameco Aquifer.

2.3.4 Site Hydrogeology

During previous investigations, the estimated groundwater flow direction was determined to be northeast in Site D and the eastern portion of Site B. The estimated overall northerly direction of the groundwater flow is consistent with the regional groundwater flow direction. Groundwater flow direction in the western portion of Site B is influenced by continuous dewatering operations conducted by the Metropolitan Transit Authority for the G subway line along Union Avenue, evidenced by flow toward west-northwest from Gerry Street toward Wallabout Street. Plate 3 presents a map of the groundwater potentiometric surface and flow for Site B and Site D as of March 2014.

Perched water was identified on top of the upper clay/silt and sand/silt stratum at Site D (most of this stratum at Site B was removed as part of the IRM activities). The direction of flow of the perched water is not known, but the general direction of flow of the perched water underneath off-site Pfizer-owned properties is west-northwesterly and, hence, hydraulically disconnected from flow in the Upper Glacial Aquifer due to the semi-confining silt and clay layer.

2.4 Contamination Conditions

This section presents a conceptual model of site contamination and identifies the areas of concern that will be addressed by the proposed remedy.

2.4.1 Conceptual Model of Site Contamination

A potential contaminant source was recognized during the December 7, 2009 discovery of a 1955 affidavit related to a permit to construct by the owner of a PCE reclamation business located at 66 Gerry Street (a/k/a Building 25A). It is not clear whether PCE reclamation activities were actually conducted on-site, and if so, the duration. It is certain that Pfizer did not conduct any activities involving PCE since taking ownership of Site D and Building 25A in 1965. If the PCE reclamation facility had operated, then PCE releases could have occurred as

a result of substandard housekeeping practices, leaking pipes, drains, cracks in the floor, or spills from drums or daily operations. This assumption is consistent with finding the highest CVOC soil impacts underneath the northern half of Building 25A and the adjacent courtyard. It was also observed that PCE soil impacts are present to 16 ft bls, and CVOC soil impacts in general were not detected past 21 ft bls. The limited downward migration, despite presumed releases that occurred more than 50 years ago, is likely attributable to: (a) the lack of a vertical hydraulic gradient during and following precipitation events since concrete covers all of Site D; and (b) retardation due to adsorption to organic materials in the subsurface, such as the two to three feet of thick green clay/silt/sand present at eight to 10 ft bls.

As groundwater flows underneath this area, bound CVOCs desorb and partition into the aqueous medium. The CVOC plume migrates according to groundwater flow direction, beginning from the northern part of Site D, proximate to Building 25A and the main courtyard, and extending across Gerry Street to Site B. The eastern and western extents are approximately at the eastern and western boundaries of Site B; that is, east of monitoring well MW-8 and Harrison Avenue, respectively. Vertically, the plume spans the sandy aquifer from the water table to the silt/clay confining stratum, with higher CVOC concentrations typically detected in the lower portion of the aquifer. The spatial distribution of the CVOC plume reflects vertical and horizontal expansion as the plume travels underneath Site D, Gerry Street, and Site B in the higher hydraulic conductivity sand stratum; the natural tendency for CVOCs, which are denser than water, to “sink”; and attenuation resulting from dilution and biological breakdown of PCE to daughter products TCE, cis-1,2-DCE, and VC. These daughter products are detected in most groundwater samples, and generally comprise a greater percentage of total CVOCs at downgradient locations. This is indicative of bacteria induced biodegradation since there has been no remediation performed at Site D, and CVOC removal via soil vapor extraction/air sparge technology at Site B, which occurred from October 2006 to February 2011, would not result in the observed distribution.

Lastly, CVOCs in soils and groundwater also partition into the vadose zone, resulting in detectable soil vapor impacts. Concentrations are highest proximate to Building 25A and the main courtyard, but attenuate with distance even though Site D and the surrounding area is

mostly covered with concrete or asphalt, which limits upward migration and dissipation to the atmosphere.

With respect to SVOCs and metals, there are no discernible patterns to the distribution of soil impacts, consistent with the understanding of past usage of historic fill at Site B and Site D. The lack of groundwater impacts indicates SVOCs and metals are bound to the historic fill materials and will not migrate off-site.

2.4.2 Description of Areas of Concern

The areas of concern (AOCs) in Site D with respect to CVOC impacted soils are the northern part of Building 25A and the immediate area of the main courtyard adjacent to Building 25A, proximate to monitoring wells MW-D1 and MW-D1I. The AOCs in Site D with respect to CVOC impacted groundwater are those monitoring wells that exhibit total CVOCs greater than 1,000 micrograms per liter ($\mu\text{g}/\text{L}$): MW-D1, MW-D1I, MW-D2, MW-D2I, MW-D3, and MW-D3I. Although not located in Site D, monitoring wells MW-18 and MW-20 also exhibit total CVOCs greater than 1,000 $\mu\text{g}/\text{L}$ and will be addressed by the proposed remedial action.

2.4.3 Identification of Standards, Criteria, and Guidance

Standards, criteria and guidance (SCGs) are promulgated requirements (“standards” and “criteria”) and non-promulgated guidance (“guidance”) that govern activities that may affect the environment and are used by the DER at various stages in the investigation and remediation of a site. SCGs incorporate both the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended by the Superfund Amendments and Reauthorization Act of 1986 (CERCLA), concept of “applicable or relevant and appropriate requirements” (ARARs) and the United States Environmental Protection Agency’s (USEPA) “to be considered” (TBCs) category of non-enforceable criteria or guidance. SCGs applicable to the Site are as follows:

- Soil: NYSDEC DER-10 and 6 NYCRR Part 375;
- Groundwater: NYSDEC AWQSGVs – Technical & Operational Guidance Series 1.1.1;
- Soil Vapor: New York State Department of Health (NYSDOH) Guidance for Evaluating Soil Vapor Intrusion in the State of New York; and
- Monitoring Well Abandonment: NYSDEC CP-43 Groundwater Monitoring Well Decommissioning Policy.

Furthermore, in a letter dated February 28, 2013, the NYSDEC stated that PCE contaminated media from Site D is determined as an F-listed hazardous waste (F002) and a U-listed hazardous waste (U210). Therefore, the following SCGs apply to the management, handling, transport, and disposal of hazardous waste: 29 CFR Part 1910.120 – Hazardous Waste Operations and Emergency Response; 6 NYCRR Part 372 – Hazardous Waste Manifest System and Related Standards for Generators, Transporters and Facilities; 6 NYCRR Part 375, and 6 NYCRR Part 376 – Land Disposal Restrictions. Waste generated during performance of the remedial action would be regulated as a Resource Conservation Recovery Act (RCRA) hazardous waste unless a request is made to the NYSDEC for a contained-in determination based on the waste characterization sampling results.

2.4.4 Soil/Fill Contamination

VOCs in soil exceeding the Part 375 Protection of Groundwater Criteria are likely the result of the presumed PCE reclamation business that may have operated at 66 Gerry Street prior to Pfizer's ownership of the property. SVOCs and metals in soil exceeding the Part 375 Restricted Residential Use Criteria are the result of past uses of historic fill at Site B and Site D.

2.4.4.1 Comparison of Soil/Fill Data with SCGs

Tables 1, 2, and 3 list the soil samples that exhibited constituents exceeding their respective Part 375 criteria (Protection of Groundwater for VOCs, and Restricted Residential Use for all other constituents) based on the findings of previous RIs. The sample locations are presented in Plates 4, 5, and 6.

2.4.5 On-Site and Off-Site Groundwater Contamination

CVOCs in groundwater exceeding the NYSDEC AWQSGVs are attributed to soil impacts at Site D and ongoing biological breakdown of organic compounds. As detailed in Section 2.1.2, sodium and manganese are the only other constituents in groundwater that have consistently been detected in exceedance of their respective NYSDEC AWQSGV. These two metals are not related to releases from past site activities or contaminants in site media, and therefore will not be discussed further.

2.4.5.1 Comparison of Groundwater Data with SCGs

Extensive data exist for Site B monitoring wells, including from quarterly sampling conducted between September 2006 and September 2012, and from semi-annual sampling conducted between September 2012 and March 2014. For Site D, semi-annual groundwater sampling has been conducted since September 2013. The results have been documented in the Groundwater Remediation Progress Report for Site B and Site D and thus will not be reiterated in this RAWP. Based on the historical data, the following monitoring wells exhibit one or more CVOC exceedances: MW-3, MW-6R, MW-8, MW-12, MW-14, MW-16, MW-18, MW-19, MW-20, MW-D1, MW-D1I, MW-D2, MW-D2I, MW-D3, and MW-D3I. However, it should be noted that only monitoring wells MW-3, MW-18, MW-20, MW-D1, MW-D1I, MW-D2, MW-D2I, MW-D3, and MW-D3I exhibit CVOC concentrations greater than 1,000 $\mu\text{g}/\text{L}$.

2.4.6 On-Site and Off-Site Soil Vapor Contamination

CVOCs in soil vapor are attributed to soil and groundwater impacts at Site B and Site D. There are no SCGs for concentrations of volatile chemicals in subsurface vapors. However, the NYSDOH has developed indoor and outdoor air guideline values of 100 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) for PCE, and 5 $\mu\text{g}/\text{m}^3$ for TCE.

2.4.6.1 Comparison of Soil Vapor with SCGs

Based on the findings of the RI, the following sampling locations (see Plate 4) exhibit PCE and/or TCE concentrations greater than the indoor and outdoor air guideline values discussed above:

- SV-AP1 with PCE at 110 $\mu\text{g}/\text{m}^3$;
- SV-AP3 with PCE ranging from 23,000 to 37,000 $\mu\text{g}/\text{m}^3$, and TCE ranging from 4,000 to 4,700 $\mu\text{g}/\text{m}^3$;
- SV-AP4 with PCE at 76,000 $\mu\text{g}/\text{m}^3$ and TCE at 6,100 $\mu\text{g}/\text{m}^3$;
- SV-AP6 with PCE at 430 $\mu\text{g}/\text{m}^3$ and TCE at 28 $\mu\text{g}/\text{m}^3$;
- SV-AP7 with PCE at 360 $\mu\text{g}/\text{m}^3$ and TCE at 13 $\mu\text{g}/\text{m}^3$; and
- SV-AP9 with TCE at 7 $\mu\text{g}/\text{m}^3$.

2.5 Environmental and Public health assessments

As described in Appendix 3B of DER-10, “The overall purpose of the Qualitative Human Health Exposure Assessment (or the exposure assessment) is to evaluate and document how people might be exposed to site related contaminants, and to identify and characterize the potentially exposed population(s) now and under the reasonably anticipated future use of the site.” The following section details the exposure assessment based on data collected during the RI, as presented in the RIR.

2.5.1 Qualitative Human Health Exposure Assessment

An exposure pathway describes the means by which an individual may be exposed to contaminants originating from a site. An exposure pathway has five elements: (1) a contaminant source; (2) contaminant release and transport mechanisms; (3) a receptor population; (4) a point of exposure, and (5) a route of exposure. The following paragraphs provide an overview discussion of contaminant sources, contaminant release and transport mechanisms, and on-site and off-site exposure pathways that may potentially exist for Site D.

Contaminant Sources

There are two contaminant sources: the presumed historic PCE reclamation business and historic fill. The presumed operation of the historic PCE reclamation business likely contributed to CVOC impacts in the northern half of Building 25A and the adjacent courtyard. The use of historic fill is prevalent and widespread across Site D, is typical of past urban (i.e., Brooklyn) practices, and likely contributed to the concentrations of metals and polycyclic aromatic hydrocarbons (PAHs) present across Site D.

Contaminant Release and Transport Mechanisms

Potential releases of PCE from the historic PCE reclamation facility, due to substandard housekeeping practices, leaking pipes, drains, cracks in the floor, or spills from drums or daily operations, resulted in CVOC impacts to soil and groundwater beneath Site D. PCE potentially released at Site D exist in the subsurface adsorbed to soil particles in the unsaturated and saturated zones, dissolved in groundwater, and as soil vapor. PAHs and metals in historic fill are not associated with a release and are present in the subsurface adsorbed to soil particles in the unsaturated and saturated zones. Dissolved metals are also present in groundwater, but sodium

and manganese impacts are typically associated with naturally occurring materials and do not originate from historic fill.

Potential Receptor Population

Potential on-site receptors include workers, visitors, and trespassers. Potential off-site receptors include off-site workers and off-site residents.

Potential Points and Routes of Exposure

Onsite workers and visitors may contact contaminants potentially present in soils during general maintenance or construction activities. Such contact with potentially contaminated soils can result in exposure via dermal adsorption or incidental ingestion. However, the potential for workers and visitors to contact contaminated soils is limited by the fact that all of Site D is covered with concrete. The potential for trespassing is also limited because Site D is completely fenced and is regularly visited by Pfizer contracted security personnel.

Construction, excavation, and soil moving activities have the potential to generate fugitive dusts and also may allow volatilization of vapors from subsurface contaminated soil. Construction workers and other potential on-site and off-site receptors near or downwind from such activities may be exposed via the inhalation route of exposure.

Site D and the surrounding properties are supplied with public drinking water. As a result, there is no potential for exposure to site contaminants via ingestion of groundwater as a source of drinking water. Persons conducting excavation activities into the groundwater table have the potential to encounter groundwater. In such instances there is potential for contact with dissolved CVOCs, and for volatilization of CVOCs and for potential exposure via the dermal adsorption and inhalation routes. It is assumed that adults performing such activities would not ingest groundwater.

There is potential for CVOCs in soil vapor to enter the indoor air of Site D buildings via soil vapor intrusion. If such circumstances were to occur, building occupants could be exposed to contaminants via the indoor air inhalation route of exposure.

2.6 Interim Remedial Action

An IRM was performed in 2002 on the eastern portion of Site B to remove USTs and petroleum-impacted soils and groundwater. A total of nine USTs, two tank-like structures, 4,735 tons of soil, and 18,449 gallons of groundwater were removed. The vertical extent of the excavation was past the top clay/silt layer and terminated at the groundwater interface, which was at approximately 10 ft bls. The excavation was backfilled with 5,500 cubic yards (CY) of clean, off-site materials.

A soil vapor extraction/air sparge (SVE/AS) system consisting of nine AS wells, nine vertical SVE wells, 11 horizontal SVE wells, and an equipment container had operated primarily on the eastern portion of Site B from October 2006 to February 2011. The SVE/AS system removed an estimated 159 pounds of VOCs. With approval from the NYSDEC, the SVE/AS system was fully decommissioned in April 2013.

2.7 Remedial Action Objectives

Based on the results of the Remedial Investigation, the following Remedial Action Objectives (RAOs) have been identified for Site D.

2.7.1 Groundwater

RAOs for Public Health Protection

- Prevent ingestion of groundwater containing contaminant levels exceeding drinking water standards.
- Prevent contact with, or inhalation of, volatiles emanating from contaminated groundwater.

RAOs for Environmental Protection

- Restore ground water aquifer, to the extent practicable, to pre-disposal/pre-release conditions.
- Remove the source of ground or surface water contamination.

2.7.2 Soil

RAOs for Public Health Protection

- Prevent ingestion/direct contact with contaminated soil.

- Prevent inhalation of or exposure to contaminants volatilizing from contaminated soil.

RAOs for Environmental Protection

- Prevent migration of contaminants that would result in groundwater contamination.

2.7.3 Soil Vapor

RAOs for Public Health Protection

- Prevent inhalation of, or exposure to, contaminants volatilizing from contaminated media.

3.0 DESCRIPTION OF REMEDIAL ACTION PLAN

The following is a summary of the proposed Remedial Action to address CVOC impacted soil and groundwater at Site D.

1. Excavation of soil and materials exceeding the Part 375 Protection of Groundwater Criteria for VOCs, to the extent practicable;
2. Groundwater remediation consisting of *in situ* chemical oxidation (ISCO) injections in the Site D courtyard and in the vicinity of monitoring wells MW-18, MW-20, MW-D2, and MW-D2I;
3. Screening for indications of contamination by visual means, odor, and monitoring with a photoionization detector (PID) of all excavated soil during any intrusive site work;
4. Collection and analysis of end-point soil samples to evaluate the performance of the remedy with respect to attainment of soil cleanup objectives (SCOs);
5. Import of materials to be used for backfill and cover in compliance with: (1) chemical limits and other specifications listed in Part 375-6.7(d), and (2) all Federal, State and local rules and regulations for handling and transport of material;
6. Implementation of a composite cover system consisting of concrete cover, concrete building slabs, and two feet of clean backfill in areas that are not paved or under a building slab to prevent public exposure to residual soil and groundwater impacts that could not be removed due to technical impracticability, and to achieve compliance with Part 375 Restricted Residential Use Criteria;
7. Appropriate off-site disposal of all material removed from Site D in accordance with all Federal, State and local rules and regulations for handling, transport, and disposal;
8. Recording of a Deed Restriction, including Institutional Controls, to prevent future exposure to any residual contamination remaining at the Site;
9. Publication of a Site Management Plan for long term management of residual contamination as required by the Deed Restriction, including plans for: (1) Institutional and Engineering Controls, (2) monitoring, and (3) reporting.

Remedial activities will be performed at Site D in accordance with this NYSDEC-approved RAWP and the Department-issued Decision Document. All deviations from the RAWP will be promptly reported to NYSDEC for approval and fully explained in the FER.

3.1 Evaluation of Remedial Action

The proposed Remedial Action was evaluated based on the following six evaluation criteria presented in the Draft VCP Guide:

- Overall protection of public health and the environment;
- Standards, criteria and guidance;
- Short-term impacts and effectiveness;
- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, or volume of contamination through treatment; and
- Implementability.

3.1.1 Overall Protection of Human Health and the Environment

The Remedial Action will be protective of human health and the environment by eliminating VOC concentrations in soil in exceedance of the Part 375 Protection of Groundwater Criteria, to the extent practicable, and addressing elevated groundwater concentrations of CVOCs at select locations via ISCO injections. The potential for human and environmental exposure to these constituents on-site will be eliminated by excavation of soils and materials with VOC concentrations in exceedance of the Part 375 Protection of Groundwater Criteria, disposing of impacted soils and materials off-site, and backfilling the excavations with:

- on-site materials meeting the Part 375 Protection of Groundwater Criteria for VOCs and Restricted Residential Use Criteria for non-VOCs; or
- off-site materials meeting the lower of the Part 375 Protection of Groundwater or Restricted Residential Use Criteria.

The composite cover system provides protection for human health by preventing exposure to residual soil and groundwater impacts that could not be removed due to technical impracticability.

3.1.2 Standards, Criteria, and Guidance

The Remedial Action will achieve compliance with the Part 375 Protection of Groundwater Criteria for VOCs above and below the water table, to the extent practicable (with localized impacts remaining after remediation due to technical impracticability). Residual contamination

below the water table will be treated via *in situ* chemical oxidants injected into the groundwater. Compliance with the Part 375 Restricted Residential Use Criteria will be met based on the composite cover system. Removing soils impacted with CVOCs and addressing elevated groundwater concentrations of CVOCs via ISCO injections are expected to result in significant reductions in on-site groundwater and soil vapor concentrations with time. Groundwater performance monitoring will be conducted to evaluate conformance with SCGs.

The excavations will be backfilled with:

- on-site materials meeting the Part 375 Protection of Groundwater Criteria for VOCs and Restricted Residential Use Criteria for non-VOCs; or
- off-site materials meeting the lower of the Part 375 Protection of Groundwater or Restricted Residential Use Criteria.

Unsaturated on-site materials that meet the Part 375 Protection of Groundwater Criteria for VOCs but exceed the Restricted Residential Use Criteria for non-VOCs may be reused as backfill at depths greater than two (2) ft bls with approval from the NYSDEC.

3.1.3 Short-Term Effectiveness

The health and environmental risks associated with implementation of the Remedial Action are minimal. The remedy implementation time is relatively short (approximately 1 to 2 months). Potential adverse impacts to the community and workers (e.g., increased traffic and exposure to contaminants during soil excavation and transportation) can be mitigated with engineering controls. These potential impacts will be addressed in the site-specific HASP and CAMP, which also detail monitoring during the construction. These risks will be mitigated through the implementation of engineering controls as necessary (i.e., dust suppression, odor control, and traffic control).

3.1.4 Long-Term Effectiveness and Permanence

The Remedial Action removes all soil in exceedance of the Protection of Groundwater criteria for VOCs, to the extent practicable, addresses elevated groundwater concentrations of CVOCs via ISCO injections, and mitigates human health and environmental exposures via the composite cover system. Thus, the Remedial Action provides a permanent long-term solution for Site D.

3.1.5 Reduction in Toxicity, Mobility, or Volume through Treatment

By removing all soil above and below the water table in exceedance of the Part 375 Protection of Groundwater criteria for VOCs, to the extent practicable (with localized impacts remaining after construction due to technical impracticability), and addressing elevated groundwater concentrations of CVOCs via ISCO injections, the Remedial Action will permanently reduce the toxicity, mobility, and volume of CVOCs at Site D and will result in groundwater and soil vapor quality improvement with time.

3.1.6 Implementability

The materials, equipment, and personnel associated with the implementation of the Remedial Action are commercially available and have been proven effective and reliable for CVOC remediation in soil and groundwater.

4.0 REMEDIAL ACTION PROGRAM

4.1 Governing Documents

4.1.1 Site Specific Health and Safety Plan (HASP)

The site-specific HASP is provided as Appendix A. All remedial work performed under this plan will be in full compliance with governmental requirements, including site and worker safety requirements mandated by Federal OSHA.

The Volunteer and associated parties preparing the remedial documents submitted to the State and those performing the construction work, are completely responsible for the preparation of an appropriate Health and Safety Plan and for the appropriate performance of work according to that plan and applicable laws.

The Health and Safety Plan (HASP) and requirements defined in this Remedial Action Work Plan pertain to all remedial and invasive work performed at Site D until the issuance of a Certificate of Completion.

The Site Safety Coordinator will be determined prior to the start of the remedial construction. A resume will be provided to NYSDEC prior to the start of remedial construction.

Confined space entry, if any, will comply with all OSHA requirements to address the potential risk posed by combustible and toxic gasses.

4.1.2 Quality Assurance Project Plan (QAPP)

The QAPP (Appendix B) includes all procedures to be followed for sampling and analysis. The QAPP includes all requirements outlined in DER-10 Section 2.4.

4.1.3 Construction Quality Assurance Plan (CQAP)

The Construction Quality Assurance Plan (CQAP) provides a detailed description of the observation and testing activities that will be used to monitor construction quality and confirm that remedy construction is in conformance with the remediation objectives and specifications. In general, the work to be addressed by this CQAP consists of the excavation and proper management/disposal of impacted soils and associated construction waters at Site D.

Organization/Personnel

The Remedial Contractor will be responsible for the quality assurance of all of the tasks being implemented; assuring all components of site activities are conducted according to the remediation guidelines and the design specifications; and verifying that the daily site activities, both environmental and construction-related, are in compliance with all of the safety requirements and regulations governing site activities.

The Remedial Engineer will verify that the overall remedy construction is completed in accordance with the RAWP and/or NYSDEC-approved field changes, provide review of quality control measures implemented by the Remedial Contractor to insure compliance with the Site D remedial objectives, conduct perimeter air monitoring in accordance with the Site D CAMP, and collect end-point and waste characterization samples.

Submittals

The RAWP requires formal submittals of the HASP, CAMP, and this CQAP. These will all be submitted to the NYSDEC for approval prior to initiating the remedial action. Copies of all submittals will be maintained by the Remedial Engineer for reference by the project managers, project team, and NYSDEC and NYSDOH.

Submittals required of the Remedial Contractor will be provided to the Remedial Engineer in a timely manner for review and approval prior to use. All submittals must be provided electronically. Hard copies may be provided in addition to the electronic deliverables.

The Remedial Engineer will develop and maintain a Submittal Register, which details submittal requirements for this Project. The Submittal Register will track the dates of submission, action taken, and date of return. The Submittal Register will be used to control and track all required submittals. Data that will be provided in the Submittal Register will include:

- Submittal identification number;
- Name of company and individual preparing the submittal;
- Description of shop drawings and submittal;
- Date of submittal;

- Submittal return date;
- Action taken; and
- Re-submittal (if necessary).

Submittals will be made as specified in the Contract Specifications.

Construction Quality Control Testing

Implementation of quality control testing and measurement will be performed to insure compliance with the Site D remedial objectives. Prior to initial quality control testing procedures:

1. Verify that the testing procedures are within the manufacturer's recommendations.
2. Verify that the facilities and testing equipment are available and comply with testing standards.
3. Check testing instrument calibrations against certified standards.
4. Verify the recording forms, including all the test documentation requirements have been prepared.

Specific task-driven testing/certification obligations are as follows:

- All excavated soil and construction-generated water will require waste characterization analyses prior to disposal. *In situ* characterization sampling and analysis may be conducted prior to excavation to facilitate direct-load transport and disposal of the excavated impacted soils. Waste characterization analysis parameters and frequency are determined by the waste disposal facility's acceptance requirements. All excavated soils will be tested in accordance with the soil disposal facility's analytical acceptance requirements. Results will be provided to the disposal facility for review.
- The CAMP requires continuous real-time monitoring of VOCs and particulates during all intrusive site activities. This monitoring equipment will be inspected periodically throughout each day to check and manually record the concentrations of VOCs and particulates and to ensure that the equipment is working properly. The equipment will be repaired, recalibrated, or replaced, as necessary. The periodic measurements will be used to identify any potential risks of off-site migration and potential on-site exposure risks to on-site workers. This monitoring data will be collected and logged for review daily by the on-site representative of the Remedial Engineer, and made available for regulatory agency review. Action Limit Reports will be completed to document any and all action level exceedances, as defined in the CAMP.

In addition, end point sampling locations and frequencies will be as discussed in Section 5.2.

All testing data will be included in the Final Engineering Report (FER).

Project Coordination

A weekly progress meeting will be conducted to assess the prior week's progress, overall progress to date, quality control requirements, environmental and construction health and safety requirements, and future progress expectations. The Remedial Contractor, the Remedial Engineer, and possibly regulatory agency representatives, will be in attendance. This will provide the opportunity for all site tasks to be integrated and discussed collectively and provide for coordination of all site activities to maintain the overall construction schedule. The construction schedule may be modified, if necessary, based on the weekly project progress. Weekly meeting summaries will be distributed and maintained as part of the permanent project record. Routine task meetings will also be conducted on an as-needed basis to insure proper communication between the contractors and supervisory personnel.

Record Keeping/Reports

A tracking system will be created for all project-related contract deliverables. The tracking system will include a unique filing and document numbering system, secure record storage system, and provide for maintaining the appropriate project forms, including:

- document log books;
- drawings;
- specifications;
- addenda;
- contracts;
- written field orders and/or instructions;
- daily activity reports;
- field test records;
- photographs;
- manifest and/or bills of lading;

- safety and accident reports; and
- community air monitoring reports.

Daily activity reports will be maintained by the various contractors for all construction activities.

Daily activity reports will include:

- the date;
- the weather;
- personnel;
- major equipment on-site;
- work activities; and
- future work activities.

The Remedial Contractor will submit daily activity reports to the Remedial Engineer or his designee prior to leaving Site D. CAMP reports will be generated on a daily basis and maintained electronically by the Remedial Engineer. Daily activity reports and other above-referenced forms and documents relevant to documenting implementation of the remedial action will be included in the Final Engineering Report.

4.1.4 Soil/Materials Management Plan (SoMP)

The Soil/Materials Management Plan (SoMP) includes detailed plans for managing all soils/materials that are disturbed at the site, including excavation, handling, storage, transport, and disposal. The SoMP also includes all of the controls that will be applied to these efforts to assure effective, nuisance-free performance in compliance with all applicable Federal, State, and local laws and regulations. The SoMP is provided in Section 5.4.

4.1.5 Community Air Monitoring Plan (CAMP)

The CAMP is provided as Appendix C.

4.1.6 Citizen Participation Plan

No changes will be made to approved Fact Sheets authorized for release by NYSDEC without written consent of the NYSDEC. No other information, such as brochures and flyers, will be included with the Fact Sheet mailing.

Document repositories have been established at the following locations and contain all applicable project documents:

Brooklyn Public Library
Williamsburgh Branch
240 Division Avenue
Brooklyn, New York
(718) 302-3485
Call for hours

4.2 General Remedial Construction Information

4.2.1 Project Organization

The Remedial Contractor will be Metro Environmental Contracting Corp. A listing of key personnel involved in the remedial action will be provided to the NYSDEC. A copy of the professional profile of the Remedial Engineer for Roux Associates/ Remedial Engineering is provided in Appendix D.

4.2.2 Remedial Engineer

The Remedial Engineer for this project will be Charles J. McGuckin, P.E. The Remedial Engineer is a registered professional engineer licensed by the State of New York. The Remedial Engineer will have primary direct responsibility for implementation of the remedial program for OU-1 of the Pfizer Site B and Site D (NYSDEC VCA Index Agreement No. D2-0010-0703, Site No. V00350). The Remedial Engineer will certify in the Final Engineering Report that the remedial activities were observed by qualified environmental professionals under his 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 in full conformance with that Plan. Other Remedial Engineer certification requirements are listed later in this RAWP.

The Remedial Engineer or his designee will coordinate the work of other contractors and subcontractors involved in all aspects of remedial construction, including soil excavation, stockpiling, characterization, removal and disposal, air monitoring, emergency spill response services, import of back fill material, and management of waste transport and disposal. The Remedial Engineer or his designee will be responsible for all appropriate communication with NYSDEC and NYSDOH.

The Remedial Engineer or his designee will review all pre-remedial plans submitted by contractors for compliance with this Remedial Action Work Plan and will certify compliance in the Final Remediation Report.

The Remedial Engineer will provide the certifications listed in Section 10.1 in the Final Engineering Report.

4.2.3 Remedial Action Construction Schedule

A preliminary project schedule is provided in Section 13. A revised schedule will be prepared and submitted following development and finalization of work sequencing with the Remedial Contractor.

4.2.4 Work Hours

The hours for operation of remedial construction will conform to the New York City Department of Buildings construction code requirements or according to specific variances issued by that agency. DEC will be notified by Pfizer or the Remedial Engineer of any variances issued by the Department of Buildings. NYSDEC reserves the right to deny alternate remedial construction hours.

4.2.5 Site Security

Security for the work, equipment, materials, supplies, facilities, personnel, and incidentals will be provided throughout the performance of the work at Site D. Site D is currently surrounded by perimeter fencing and locked access gates. Furthermore, Site D is video monitored and patrolled by Pfizer-contracted security. The fences and gates will be closed and locked when there is no activity at Site D, and any breaks or gaps will be repaired promptly by Pfizer. As necessary,

temporary fencing will be used to delineate and secure the area of ongoing remediation activities within Site D such as soil stockpiles and health and safety exclusion zones.

4.2.6 Traffic Control

The truck route for ingress and egress is presented in Figure 2. The routes were selected based on the existing access roads and an effort to limit transportation of work vehicles through neighboring residential and commercial areas, and may be modified based on input from the community prior to the start of construction. Any changes in the truck route will be submitted to NYSDEC for review and approval prior to implementation.

4.2.7 Contingency Plan

A contingency plan describes procedures to be conducted in the event of an emergency, or the remedial work fails to meet any of its objectives or otherwise fails to protect human health or the environment. This plan will also address the recommended procedures after encountering an unknown structure. Details of the contingency plan are discussed in Section 5.4.10.

4.2.8 Worker Training and Monitoring

All general site workers [as defined in OSHA 1910.120 (e)(3)(i)] that will be involved with earth disturbance activities or work that results in the potential for exposure to environmental contaminants in on-site or immediately adjacent off-site soil, groundwater and soil vapor, will have received a minimum of 40 hours of initial health and safety training for hazardous waste site operations (40-Hour HAZWOPER training) and meet medical surveillance requirements.

4.2.9 Agency Approvals

The Volunteer has addressed all SEQRA requirements for Site D. All permits or government approvals required for remedial construction have been, or will be, obtained prior to the start of remedial construction.

The planned end use for Site D is in conformance with the current zoning for the property as determined by New York City Department of Planning. A Certificate of Completion will not be issued for the project unless conformance with zoning designation is demonstrated.

A complete list of all local, regional, and national governmental permits, certificates or other approvals or authorizations required to perform the remedial and development work is attached in Table 4. This list includes a citation of the law, statute, or code to be complied with, the originating agency, and a contact name and phone number in that agency. This list will be updated in the Final Remediation Report.

4.2.10 Pre-Construction Meeting with NYSDEC

A pre-construction meeting was held at the NYSDEC Region 2 office on January 12, 2015. This meeting was attended by Pfizer, the Remedial Contractor, the Remedial Engineer, and the NYSDEC. The meeting agenda included: personnel roles, work hours, schedule, communications, training requirements, site preparation work status, and a discussion of upcoming activities with a focus on related environmental concerns of the NYSDEC.

4.2.11 Emergency Contact Information

An emergency contact sheet with names and phone numbers is included in the HASP. That document will define the specific project contacts for use by NYSDEC and NYSDOH in the case of a day or night emergency.

4.3 Site Preparation

4.3.1 Mobilization

Prior to commencement of remedial activities, the Remedial Contractor will perform the following mobilization and site preparation activities:

- Identification and markout of all aboveground and underground utilities;
- As necessary, de-energizing, turning off and disconnecting existing subsurface utility services known to be present in the work area (e.g., water, gas, electric and sewer);
- Mobilization of remediation equipment and materials;
- Traffic control measures;
- Work zone demarcation;
- Installation of erosion control devices;
- Installation of temporary facilities;

- Installation of dewatering and water treatment system, as applicable; and
- Installation of decontamination facilities.

4.3.2 Erosion and Sedimentation Controls

Floor drains in the Site D courtyard will be covered with filter fabric during the performance of excavation activities in the courtyard and/or management of stockpiled materials on-site. Stockpiles will be managed in accordance with Section 5.4.2 to prevent runoff from exiting the Site.

4.3.3 Utility Marker and Easements Layout

Pfizer, the Remedial Engineer, and their contractors are solely responsible for the identification of utilities that might be affected by work under the RAWP and implementation of all required, appropriate, or necessary health and safety measures during performance of work under this RAWP. Pfizer, the Remedial Engineer, and their contractors are solely responsible for safe execution of all invasive and other work performed under this RAWP. Pfizer, the Remedial Engineer and their contractors must obtain any local, State or Federal permits or approvals pertinent to such work that may be required to perform work under this RAWP. Approval of this RAWP by NYSDEC does not constitute satisfaction of these requirements.

The presence of utilities and easements on Site D has been investigated by the Remedial Engineer. It has been determined that no risk or impediment to the planned work under this Remedial Action Work Plan is posed by utilities or easements on Site D.

4.3.4 Sheeting and Shoring

Appropriate management of structural stability of on-site or off-site structures during on-site activities include excavation is the sole responsibility of Pfizer, the Remedial Engineer, and their contractors. Pfizer, the Remedial Engineer, and their contractors are solely responsible for safe execution of all invasive and other work performed under this Plan. Pfizer, the Remedial Engineer, and their contractors must obtain any local, State, or Federal permits or approvals that may be required to perform work under this Plan. Further, Pfizer, the Remedial Engineer, and their contractors are solely responsible for the implementation of all required, appropriate, or necessary health and safety measures during performance of work under the approved Plan.

4.3.5 Equipment and Material Staging

All equipment and work materials will be staged in a location proposed by the Remedial Contractor and agreed to by the Remedial Engineer.

4.3.6 Decontamination Area

The Remedial Contractor will prepare an area to decontaminate trucks and other vehicles/equipment leaving Site D. The decontamination area will have an underlying low permeability liner, be sized to accommodate the largest construction vehicle used, and be designed to collect decontamination water, if any. All decontamination material will be collected and properly disposed of off-site.

4.3.7 Site Fencing

The existing Site D fencing will be maintained for the duration of the remedial action.

4.3.8 Demobilization

Following the completion of all remedial activities, all temporary structures will be removed. Materials used to implement the remedial action (e.g., plastic sheeting, filter fabric, etc.) will be removed and disposed properly. All equipment will be decontaminated prior to leaving Site D.

4.4 Reporting

All daily and monthly Reports will be included in the Final Engineering Report.

4.4.1 Daily Reports

Daily reports will be submitted to NYSDEC and NYSDOH Project Managers by the end of each day of major excavation and backfill work or ISCO injection event following the reporting period and will include:

- An update of progress made during the reporting day;
- Locations of work and quantities of material imported and exported from Site D;
- A summary of any and all complaints with relevant details (names, phone numbers);
- A summary of CAMP finding, including excursions;
- An explanation of notable Site D conditions.

Daily reports are not intended to be the mode of communication for notification to the NYSDEC of emergencies (accident, spill), requests for changes to the RAWP or other sensitive or time critical information. However, such conditions must also be included in the daily reports. Emergency conditions and changes to the RAWP will be addressed directly to NYSDEC Project Manager via personal communication.

Daily Reports will include a description of daily activities keyed to an alpha-numeric map for Site D that identifies work areas. These reports will include a summary of air sampling results, odor and dust problems and corrective actions, and all complaints received from the public.

The NYSDEC assigned project number will appear on all reports.

4.4.2 Monthly Reports

Monthly reports will be included as part of the Progress Reports currently submitted to NYSDEC and NYSDOH Project Managers by the 10th of the month following the end of the month of the reporting period and will include:

- Activities relative to Site D during the previous reporting period and those anticipated for the next reporting period, including a quantitative presentation of work performed (i.e., tons of material exported and imported, etc.);
- Description of approved activity modifications, including changes of work scope and/or schedule;
- Sampling results received following internal data review and validation, as applicable; and,
- An update of the remedial schedule including the percentage of project completion, unresolved delays encountered or anticipated that may affect the future schedule, and efforts made to mitigate such delays.

4.4.3 Other Reporting

Photographs will be taken of all remedial activities and submitted to NYSDEC in digital (JPEG) format. Photos will illustrate all remedial program elements and will be of acceptable quality. Representative photos of Site D prior to any Remedial Actions will be provided. Representative photos will be provided of each contaminant source, source area, and Site D structures before, during, and after remediation. Photos will be included in the FER.

Job-site record keeping for all remedial work will be appropriately documented. These records will be maintained by the Remedial Engineer at all times during the project and be available for inspection by NYSDEC and NYSDOH staff.

4.4.4 Complaint Management Plan

Any complaints received from the public regarding nuisances or other site conditions will be communicated within 24-hours (one business day) to NYSDEC and NYSDOH, investigated and remedied, if required.

4.4.5 Deviations from the Remedial Action Work Plan

Any required deviations from this RAWP will be discussed by the Remedial Engineer or his designee with the NYSDEC. At that time, the reasons for necessary deviations from the approved RAWP will be explained and the effect of the required deviations on the overall remedy will be evaluated. If the deviation is deemed to be a significant change to the RAWP by the NYSDEC, a description and reasons for the proposed change will be emailed to the NYSDEC Project Manager for review and written approval. All deviations from the RAWP will be fully documented in the FER.

5.0 REMEDIAL ACTION: MATERIAL REMOVAL FROM SITE

The materials to be removed from Site D include soils and materials that exceed the Part 375 Protection of Groundwater Criteria for VOCs, and groundwater extracted during the excavation and removal of the aforementioned soils and materials. The estimated extent of materials to be removed is shown on Plate 7.

Soil Remediation

The proposed soil remediation is to excavate and remove CVOC impacted soils and materials from underneath Building 25A and the Site D courtyard, as shown on Plate 7. The proposed excavation within Building 25A is approximately 35.5 feet long by 21 feet wide. The excavation width may be reduced as necessary to maintain structural stability of the building walls. Due to a ceiling height of approximately 10 to 12 feet and limited ingress/egress from the adjacent Building 25, only a mini-excavator or similar sized equipment can enter Building 25A. This limits the feasible excavation depth to approximately 10 to 11 feet (2 to 3 feet into the groundwater table). The proposed excavation in the Site D courtyard is approximately 16.5 feet long by 10 feet wide. The excavation will be as close to Building 25A as feasible without compromising structural integrity. The excavation depth is anticipated to be 16 feet (8 feet into the groundwater table). A chemical oxidant (discussed in the groundwater remediation section) will be injected upgradient of the excavations as a polishing treatment.

In the event that contaminants of concern remain in soil which cannot be excavated due to building constraints, a contingency plan will be developed to address remaining contamination. The need for an alternative approach to address residual contamination in soil will be determined in consultation with NYSDEC based on physical observations and endpoint sampling results once the excavation limits have been reached. If required, a Remedial Design work plan would be submitted for any alternative soil remediation.

The estimated volume of soil to be removed from underneath Building 25A, assuming an excavation depth of 11 feet and a 10 percent contingency, would be approximately 340 CY. The estimated volume of soil to be removed from underneath the Site D courtyard, with a 10 percent contingency, would be approximately 110 CY. The total volume of soil estimated to be removed would therefore be approximately 450 CY. Some of the materials may be reused to backfill the

excavations as described below. The volume will be determined per the findings of a NYSDEC-approved pre-characterization sampling program.

The final horizontal limits of the excavations will be surveyed by a land surveyor licensed by the State of New York. The soil remediation portion of the Remedial Action is estimated to require two to four weeks to complete.

Dewatering will be required during excavation to facilitate work below the groundwater table. Drainage sumps or other similar means will be used to maintain dry conditions within the excavation. Extracted groundwater will be containerized for off-site disposal.

If the excavated soil contains free liquids, dewatering may be required to satisfy the moisture content requirements of the selected disposal facility. The paint filter test using USEPA Method 9095 and/or visual observation may be used to determine if the excavated soil contains free liquids.

Due to a limited amount of open space at Site D, excavated soils may be directly loaded for off-site disposal or staged on-site in containers (i.e., roll-offs) in addition to stockpiling.

The quantity of groundwater to be extracted and treated (if necessary) will be determined based upon the following factors:

- duration of excavation work below the water table;
- depth of excavation beneath the water table;
- permeability of the support of excavation used;
- frequency and intensity of precipitation events during the performance of the excavation; and
- hydrogeologic factors including hydraulic permeability, hydraulic gradient, and rate of recharge into the excavation.

The actual volume of extracted groundwater will be reported in the FER.

Backfilling

Backfilling will occur after all end-point samples for an excavation indicate VOCs comply with Part 375 Protection of Groundwater Criteria. All backfill material in the top two (2) feet will consist of:

- on-site materials meeting the Part 375 Protection of Groundwater Criteria for VOCs and Restricted Residential Use Criteria for non-VOCs; or
- off-site materials meeting the lower of the Part 375 Protection of Groundwater or Restricted Residential Use Criteria.

The backfill material will be free of extraneous debris or solid waste. The source of the fill will be documented by the supplier, including the location where the fill was obtained and a brief history of the site that is the source of the fill. Proposed sources of backfill will be collected and analyzed for VOCs, SVOCs, metals, PCBs, herbicides, and pesticides at the frequency established in DER-10. Analytical results will be submitted to the NYSDEC, and acceptance received, prior to use of the backfill.

Unsaturated on-site materials that meet the Part 375 Protection of Groundwater Criteria for VOCs but exceed the Restricted Residential Use Criteria for non-VOCs may be reused as backfill at depths greater than two (2) ft bls with approval from the NYSDEC.

Off-Site Disposal and Equipment Decontamination

All impacted soil and groundwater removed from Site D and other remediation-derived waste will be transported and disposed of in accordance with all applicable federal, state, and local regulations. The remediation-derived waste that will be generated during construction activities include:

- Soil impacted from presumed historic PCE releases;
- Historic fill;
- Personal Protective Equipment (PPE);
- Dewatering groundwater; and
- Decontamination water, if any is generated.

Soil, groundwater, and decontamination water generated during implementation of Site D remedial activities will be disposed as RCRA hazardous waste unless a request is made to the NYSDEC for a contained-in determination based on the waste characterization sampling results.

Haul vehicles for bulk soil will be secured with appropriate tight-fitting covers prior to exiting Site D to prevent a release of waste. Loose-fitting canvas covers will be prohibited. PPE waste generated during the implementation of the remedy will be consolidated and stored in appropriate bulk containers and temporarily staged on-Site. Any full or partially filled containers will be appropriately labeled.

Trucks will be appropriately decontaminated before they leave Site D.

All wastewater generated from equipment decontamination will be disposed of off-site at an approved disposal facility.

5.1 Soil Cleanup Objectives

The Soil Cleanup Objectives for Site D are Part 375 Protection of Groundwater Criteria for VOCs, and Part 375 Restricted Residential Use Criteria for SVOCs and metals.

Soil and materials management on-site and off-site will be conducted in accordance with the Soil Management Plan as described below.

While not expected to be encountered, UST closures will, at a minimum, conform to criteria defined in DER-10.

5.2 Remedial Performance Evaluation (Post Excavation End-Point Sampling)

5.2.1 End-Point Sampling Frequency

End-point bottom soil samples will be collected at a frequency of one sample per 900 square feet of bottom area, or a minimum of one per excavation, and analyzed for Part 375 VOCs. Areas that appear more heavily impacted, if any, will be given sampling preference. If the end-point bottom soil sample results indicate that VOC concentrations meet the Part 375 Protection of Groundwater Criteria, the excavation activities will be considered complete. Otherwise, the

excavation activities, including additional end-point bottom soil sampling, will continue deeper until VOC concentrations meet the Part 375 Protection of Groundwater Criteria or the maximum depth practicable is reached.

End-point sidewall soil samples will be collected at a frequency of one sample per 30 linear feet, or at least one sample per sidewall, and analyzed for Part 375 VOCs. Areas that appear more heavily impacted, if any, will be given sampling preference. If the end-point sidewall soil sample results indicate that VOC concentrations meet the Part 375 Protection of Groundwater Criteria, the excavation activities will be considered complete. Otherwise, the excavation activities, including additional end-point sidewall soil sampling, will continue until these conditions are met or to the extent feasible due to excavation limitations associated with underground utilities, building foundations, and sidewalk or property boundaries.

5.2.2 Methodology

Each soil sample collected for end point sampling will be inspected for visual evidence of contamination (i.e., staining, presence of petroleum or odors) and field screened for VOCs using a portable PID. Soil samples to be submitted for analysis will be placed in a laboratory sample jar, and transported to the laboratory in an iced container. Samples will be submitted for analysis for Part 375 VOCs. Laboratory analysis will be performed by a NYSDEC-approved laboratory using USEPA SW846 Method 8260 for VOCs. The sampling and analysis described will be conducted in accordance with the QAPP included as Appendix B and in accordance with NYSDEC ASP (Category B deliverables).

The locations of the end-point samples will be surveyed using a Global Positioning System (GPS) device and included in the FER.

5.2.3 Reporting of Results

The laboratory will report analytical results in Analytical Services Protocol (ASP) Category B deliverable packages. An electronic data deliverable (EDD) will also be provided by the laboratory.

All end-point sample data generated for the Remedial Action will be logged in a database and organized to facilitate data review and evaluation. The electronic dataset will include the data flags provided in accordance with USEPA Laboratory Data Validation Functional Guidelines for Evaluating Organic Analysis and Inorganic Analyses, as well as additional comments of the data review for ASP/CLP analyses. The data flags include such items as: 1) concentration below required detection limit, 2) estimated concentration due to poor recovery below required detection limit, 3) estimated concentration due to poor spike recovery, and 4) concentration of chemical also found in laboratory blank.

5.2.4 QA/QC

Quality control (QC) samples serve as checks on both the sampling and measurements systems and assist in determining the overall data quality with regard to representation, accuracy, and precision. Field duplicates and matrix spike samples are analyzed to assess the quality of the data resulting from the field sampling. Field duplicate samples are individual portions of the same field sample. These samples can be used to estimate the overall precision of the data collection activity. Sampling error can be estimated by the comparison of field sample result and duplicated sample result. During end-point sampling, one field duplicate sample will be collected for each 20 grab samples collected. Matrix spike and matrix spike duplicates are used to evaluate analytical accuracy and precision, respectively. MS/MSDs will be analyzed by the laboratory at a frequency of one per preparation batch.

5.2.5 DUSR

A Data Usability Summary Report (DUSR) will be prepared to evaluate the end-point samples by a party independent from the laboratory performing the analysis in accordance with Appendix 2B of DER-10.

5.2.6 Reporting of End-Point Data in FER

Chemical labs used for all end-point sample results and contingency sampling will be NYSDOH ELAP certified. Category B laboratory data deliverables, as defined in the ASP, will be requested.

End point sampling, including bottom and side-wall sampling, will be performed in accordance with DER-10 sample frequency requirements. Side-wall samples will be collected a minimum of every 30 linear feet. Bottom samples will be collected at a rate of one for every 900 square feet. The FER will provide a tabular and map summary of all end-point sample results and exceedances of SCOs.

5.3 Estimated Material Removal Quantities

The estimated quantity of soil to be removed from Site D was discussed in Section 5.0. On-site soil/fill approved by the NYSDEC will be reused to backfill the excavations. As needed, off-site soil/fill will be imported to Site D for backfill and cover soil.

The estimated quantity of construction wastewater (e.g., extracted and treated groundwater, decontamination water, runoff etc.) to be removed from Site D will be highly dependent upon the construction duration, excavation depth, and weather during the construction period. The final volume will be reported in the FER.

5.4 Soil/Materials Management Plan

5.4.1 Soil Screening Methods

Visual, olfactory and PID soil screening and assessment will be performed by a qualified environmental professional during all remedial and development excavations into known or potentially contaminated material (Residual Contamination Zone). Soil screening will be performed regardless of when the invasive work is done and will include all excavation and invasive work performed during the remedy and during development phase, such as excavations for foundations and utility work, prior to issuance of the COC.

All primary contaminant sources (including but not limited to tanks and hotspots) identified during Site Characterization, Remedial Investigation, and Remedial Action will be surveyed by a surveyor licensed to practice in the State of New York. This information will be provided on maps in the Final Engineering Report.

Screening will be performed by qualified environmental professionals. Resumes will be provided for all personnel responsible for field screening (i.e., those representing the Remedial Engineer) of invasive work for unknown contaminant sources during remediation.

5.4.2 Stockpile Methods

Excavated materials will either be stockpiled in a designated area on-site or direct loaded into trucks for off-site disposal. Materials known to be hazardous waste will be staged separately from non-hazardous waste and stockpiles will be labeled accordingly. The Remedial Engineer or his designee will be responsible for overseeing the waste segregation process and confirming that waste is segregated and stockpiled in the appropriate locations on-site. The Remedial Contractor will be responsible for installation, operation, and maintenance of the staging area, and Roux Associates/Remedial Engineering on-site personnel will be responsible for inspection and monitoring of the staging area and for recommending any corrective actions should issues be identified. In general, stockpiles will be constructed by the Remedial Contractor to provide a 12-mil polyethylene base liner below the excavated materials. Stockpiles will be kept covered at all times with appropriately anchored tarps of 10-mil thickness or greater. Stockpiles will be routinely inspected by Roux Associates/Remedial Engineering on-site personnel and damaged tarp covers will be promptly replaced by the Remedial Contractor. If containers (i.e., roll-offs) are used, the containers will be covered with tarps of 10-mil thickness or greater.

Stockpiles will be inspected at a minimum once each week and after every storm event. Results of inspections will be recorded in a logbook and maintained at Site D and available for inspection by NYSDEC.

5.4.3 Materials Excavation and Load Out

The Remediation Engineer or a qualified environmental professional under his supervision will oversee all invasive work and the excavation and load-out of all excavated material.

Pfizer, the Remediation Engineer, and their contractors are solely responsible for safe execution of all invasive and other work performed under this Plan.

The presence of utilities and easements on Site D has been investigated by the Remedial Engineer. It has been determined that no risk or impediment to the planned work under this Remedial Action Work Plan is posed by utilities or easements on Site D.

Loaded vehicles leaving Site D will be appropriately lined, tarped, securely covered, manifested, and placarded in accordance with appropriate Federal, State, local, and NYSDOT requirements (and all other applicable transportation requirements).

All trucks will be staged on pavement on-site and those areas will be maintained clean to avoid the need for truck washing. Any truck wash waters that are generated will be collected and disposed off-site in an appropriate manner.

Locations where vehicles enter or exit Site D shall be inspected daily for evidence of off-site sediment tracking.

The Remediation Engineer will be responsible for ensuring that all egress points for truck and equipment transport from Site D will be clean of dirt and other materials derived from the site during site remediation and development. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to site-derived materials.

Pfizer and associated parties preparing the remedial documents submitted to the State, and parties performing this work, are completely responsible for the safe performance of all invasive work, the structural integrity of excavations, and for structures that may be affected by excavations (such as building foundations and bridge footings).

The Remedial Engineer will ensure that Site D development activities will not interfere with, or otherwise impair or compromise, remedial activities proposed in this Remedial Action Work Plan.

Each hotspot and structure, if any, to be remediated (USTs, vaults and associated piping, transformers, etc.) will be removed and end-point remedial performance sampling completed before the excavations are backfill.

Mechanical processing of historical fill and contaminated soil on-site is prohibited.

All primary contaminant sources (including but not limited to tanks and hotspots) identified during Site Characterization, Remedial Investigation, and Remedial Action will be surveyed by a surveyor licensed to practice in the State of New York. The survey information will be shown on maps to be reported in the Final Engineering Report.

5.4.4 Materials Transport Off-Site

All transport of materials will be performed by licensed haulers in accordance with appropriate local, State, and Federal regulations, including 6 NYCRR Part 364. Haulers will be appropriately licensed and trucks properly placarded.

Truck transport routes are described below. All trucks loaded with site materials will exit the vicinity of Site D using only these approved truck routes.

Truck transport routes to/from the nearest main artery (I-278) are as follows:

- Inbound Truck Route (shown in green on Figure 2)
 1. I-278 East (Brooklyn Queens Expressway) toward Exit 30
 2. Take Exit 30 toward Flushing Avenue
 3. Turn left onto Gerry Street
 4. Continue onto Gerry Street (destination will be on the right)
- Outbound Truck Route (shown in blue on Figure 2)
 1. Head northeast on Gerry Street toward Broadway
 2. Turn left onto Broadway
 3. Turn right onto Union Avenue
 4. Turn right onto Meeker Avenue
 5. Make a U-turn at McGuinness Boulevard
 6. Merge onto I-278 West via the ramp to Brooklyn-Queens Expressway/Staten Island

Proposed in-bound and out-bound truck routes to Site D are shown in Figure 2. This is the most appropriate route and takes into account: (a) limiting transport through residential areas and past sensitive sites; (b) use of city mapped truck routes; (c) prohibiting off-site queuing of trucks entering the facility; (d) limiting total distance to major highways; (e) promoting safety in access to highways; and (f) overall safety in transport.

Trucks will be prohibited from stopping and idling in the neighborhood outside the project site.

Egress points for truck and equipment transport from Site D will be kept clean of dirt and other materials during Site D remediation and development.

Queuing of trucks will be performed on-site in order to minimize off-site disturbance. Off-site queuing will be prohibited.

Material transported by trucks exiting Site D will be secured with tight-fitting covers. Loose-fitting canvas-type truck covers will be prohibited. If loads contain wet material capable of producing free liquid, truck liners will be used.

All trucks will be staged on pavement on-site and those areas will be maintained clean to avoid the need for truck washing. Any truck wash waters that are generated will be collected and disposed off-site in an appropriate manner.

5.4.5 Materials Disposal Off-Site

Disposal locations will be established at a later date and will be reported to the NYSDEC Project Manager.

The total quantity of material expected to be disposed off-site was discussed in Section 5.0.

All soil/fill/solid waste excavated and removed from Site D that will not be reused on-site will be treated as contaminated and regulated material and will be disposed in accordance with all local, State (including 6NYCRR Part 360) and Federal regulations. If disposal of soil/fill from Site D is proposed for unregulated disposal (i.e., clean soil removed for development purposes), a formal request with an associated plan will be made to NYSDEC's Project Manager.

Unregulated off-site management of materials from Site D is prohibited without formal NYSDEC approval.

Material that does not meet Track 1 unrestricted SCOs is prohibited from being taken to a New York State recycling facility (6NYCRR Part 360-16 Registration Facility).

The following documentation will be obtained and reported by the Remedial Engineer for each disposal location used in this project to fully demonstrate and document that the disposal of material derived from Site D conforms with all applicable laws: (1) a letter from the Remedial Engineer or Volunteer to the receiving facility describing the material to be disposed and requesting formal written acceptance of the material. This letter will state that material to be disposed is contaminated material generated at an environmental remediation site in New York State. The letter will provide the project identity and the name and phone number of the Remedial Engineer. The letter will include as an attachment a summary of all chemical data for the material being transported (including Site Characterization data); and (2) a letter from all receiving facilities stating it is in receipt of the correspondence (above) and is approved to accept the material. These documents will be included in the FER.

Non-hazardous historic fill and contaminated soils taken off-site will be handled, at minimum, as a Municipal Solid Waste per 6NYCRR Part 360-1.2

Historical fill and contaminated soils from Site D are prohibited from being disposed at Part 360-16 Registration Facilities (also known as Soil Recycling Facilities).

Soils that are contaminated but non-hazardous and are being removed from Site D are considered by the Division of Solid & Hazardous Materials (DSHM) in NYSDEC to be Construction and Demolition (C/D) materials with contamination not typical of virgin soils. These soils may be sent to a permitted Part 360 landfill. They may be sent to a permitted C/D processing facility without permit modifications only upon prior notification of NYSDEC Region 2 DSHM. This material is prohibited from being sent or redirected to a Part 360-16 Registration Facility. In this case, as dictated by DSHM, special procedures will include, at a minimum, a letter to the C/D facility that provides a detailed explanation that the material is derived from a

DER remediation site, that the soil material is contaminated and that it must not be redirected to on-site or off-site Soil Recycling Facilities. The letter will provide the project identity and the name and phone number of the Remedial Engineer. The letter will include as an attachment a summary of all chemical data for the material being transported.

The Final Engineering Report will include an accounting of the destination of all material removed from Site D during this Remedial Action, including excavated soil, contaminated soil, historic fill, solid waste, and hazardous waste, non-regulated material, and fluids. Documentation associated with disposal of all material must also include records and approvals for receipt of the material. This information will also be presented in a tabular form in the FER.

Bill of Lading system or equivalent will be used for off-site movement of non-hazardous wastes and contaminated soils. This information will be reported in the Final Engineering Report.

Hazardous wastes derived from on-site will be stored, transported, and disposed of in full compliance with applicable local, State, and Federal regulations.

Appropriately licensed haulers will be used for material removed from Site D and will be in full compliance with all applicable local, State and Federal regulations.

Waste characterization will be performed for off-site disposal in a manner suitable to the receiving facility and in conformance with applicable permits. Sampling and analytical methods, sampling frequency, analytical results, and QA/QC will be reported in the FER. All data available for soil/material to be disposed at a given facility must be submitted to the disposal facility with suitable explanation prior to shipment and receipt.

5.4.6 Materials Reuse On-Site

Unsaturated on-site materials meeting the Part 375 Protection of Groundwater Criteria for VOCs and Restricted Residential Use Criteria for non-VOCs will be used to backfill the excavations. On-site materials that meet the Part 375 Protection of Groundwater Criteria for VOCs but exceed the Restricted Residential Use Criteria for non-VOCs may be reused as backfill at depths greater than two (2) ft bls with approval from the NYSDEC.

Concrete crushing or processing on-site is prohibited.

Organic matter (wood, roots, stumps, etc.) or other solid waste derived from clearing and grubbing of Site D is prohibited for reuse on-site.

Contaminated on-site material, including historic fill and contaminated soil, removed for grading or other purposes will not be reused within a cover soil layer, within landscaping berms, or as backfill for subsurface utility lines. This will be expressed in the final Site Management Plan.

5.4.7 Fluids Management

Construction wastewater will be generated from personnel/equipment decontamination and run-off/run-on in bermed soil stockpile. Construction wastewater will be collected and stored on-site in leak-tight drums or temporary storage tanks. The wastewater will be sampled and submitted for analysis for disposal/discharge characterization. Based on the laboratory analytical results, the construction wastewater will be disposed off-site at a permitted disposal/recycling.

Containers used for storing construction wastewater will conform to both federal and state requirements. All storage tanks or containers will be decontaminated following disposal/discharge of wastewater.

All liquids to be removed from Site D, including dewatering fluids, will be handled, transported and disposed in accordance with applicable local, State, and Federal regulations.

Dewatered fluids will not be recharged back to the land surface or subsurface of Site D. Dewatering fluids will be managed off-site.

Discharge of water generated during remedial construction to surface waters (i.e., a local pond, stream, or river) is prohibited without a SPDES permit.

5.4.8 Demarcation

After the completion of soil removal and any other invasive remedial activities and prior to backfilling, a land survey of the limits of excavation will be performed by a New York State licensed surveyor. The on-site representative of the Remedial Engineer will obtain and record

field measurements of the top elevation of residual contaminated soils. A physical demarcation layer, consisting of clean washed stone used as backfill for beneath the groundwater table will be placed on this surface to provide a visual reference. This demarcation layer will constitute the top of the ‘Residuals Management Zone’, the zone that requires adherence to special conditions for disturbance of contaminated residual soils defined in the Site Management Plan. The on-site representative of the Remedial Engineer will obtain and record field measurements of the grade covered by the demarcation layer and the grade at the top of the demarcation layer before the placement of cover soils, pavement and sub-soils, structures, or other materials. This survey and the demarcation layer placed on this grade surface will constitute the physical and written record of the upper surface of the ‘Residuals Management Zone’ in the Site Management Plan. A map showing the survey results will be included in the Final Remediation Report and the Site Management Plan.

5.4.9 Backfill from Off-Site Sources

Clean fill and stone will be imported onto Site D to backfill the excavated hot spots. This material will meet the lower of the Protection of Groundwater or Restricted Residential Use Criteria presented in Part 375, and the specifications of the Remedial Engineer. The source approval process will require a review of the following information:

- Sources of backfill material
 - Past usage of backfill material source site origin.
 - Source area background check.
- Chemical sampling data
 - Source analytical data to confirm that material meets the above criteria.
 - Frequency to be determined by Remedial Engineer and will comply with guidance provided in DER-10.

The clean washed stone will be used as backfill for beneath the groundwater table and will be imported without chemical testing if it contains less than 10% by weight material which would pass through a size 80 sieve and consists of:

- gravel, rock or stone, consisting of virgin material from a permitted mine or quarry; or
- recycled concrete or brick from a DEC registered construction and demolition debris processing facility if the material conforms to the requirements of Section 304 of the

New York State Department of Transportation Standard Specifications Construction and Materials Volume 1 (2002).

All materials proposed for import onto Site D will be approved by the Remedial Engineer and will be in compliance with provisions in this RAWP prior to receipt at the Site.

Material from industrial sites, spill sites, other environmental remediation sites, or other potentially contaminated sites will not be imported to the Site.

The Final Engineering Report will include the following certification by the Remedial Engineer: "I certify that all import of soils from off-Site, including source evaluation, approval and sampling, has been performed in a manner that is consistent with the methodology defined in the Remedial Action Work Plan".

All imported soils will meet NYSDEC approved backfill or cover soil quality objectives for Site D. Non-compliant soils will not be imported onto Site D without prior approval by NYSDEC. Nothing in the approved Remedial Action Work Plan or its approval by NYSDEC should be construed as an approval for this purpose.

Soils that meet 'exempt' fill requirements under 6 NYCRR Part 360, but do not meet backfill or cover soil objectives for Site D, will not be imported onto Site D without prior approval by NYSDEC. Nothing in this Remedial Action Work Plan should be construed as an approval for this purpose.

Solid waste will not be imported onto Site D.

Trucks entering Site D with imported soils will be securely covered with tight fitting covers.

5.4.10 Contingency Plan

If underground tanks or other previously unidentified contaminant sources are found during on-site remedial excavation or development related construction, sampling will be performed on product, sediment and surrounding soils, etc. Chemical analytical work will be for full scan parameters (TAL metals; TCL volatiles and semi-volatiles, TCL pesticides and PCBs). These

analyses will not be limited to STARS parameters where tanks are identified without prior approval by NYSDEC. Analyses will not be otherwise limited without NYSDEC approval.

Identification of unknown or unexpected contaminated media identified by screening during invasive site work will be promptly communicated by phone to NYSDEC's Project Manager. These findings will be also included in daily and periodic electronic media reports.

5.4.11 Community Air Monitoring Plan

The CAMP is provided as Appendix C.

Exceedances observed in the CAMP will be reported to NYSDEC and NYSDOH Project Managers and included in the Daily Report.

5.4.12 Odor, Dust, and Nuisance Control Plan

Dust will be controlled by spraying a water mist over the work area if perimeter action levels established in the CAMP are exceeded. The water mist will be generated by connecting a misting device to a hose, which will be connected to any potable water source. The degree to which these measures will be used will depend on particulate levels in ambient air at the Site D perimeter as determined through implementation of the CAMP.

As necessary, a foam unit to suppress vapors and odors that are generated during the soil excavations will be employed. The foam unit, such as a Rusmar PFU-400, includes a self-contained 400-gallon tank for mixing foam concentrate. Foam will be applied, if warranted, to stockpiled soil and excavation sidewalls in an effort to maintain work zone and perimeter air monitoring criteria established in the HASP and CAMP. Tarps will also be employed to suppress vapor and odors from stockpiled soil in the staging area.

The Final Engineering Report will include the following certification by the Remedial Engineer: "I certify that all invasive work during the remediation and all invasive development work were conducted in accordance with dust and odor suppression methodology defined in the Remedial Action Work Plan."

5.4.12.1 Odor Control Plan

This odor control plan is capable of controlling emissions of nuisance odors off-site. Specific odor control methods to be used on a routine basis will include backfilling excavations within the hot spot area in a timely manner to the extent practicable, and maintaining covers over stockpiled impacted soils. If nuisance odors are identified, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. NYSDEC and NYSDOH will be notified of all odor events and of all other complaints about the project. Implementation of all odor controls, including the halt of work, will be the responsibility of the Volunteer's Remediation Engineer, who is responsible for certifying the Final Engineering Report.

All necessary means will be employed to prevent on- and off-site nuisances. At a minimum, procedures will include: (a) limiting the area of open excavations; (b) shrouding open excavations with tarps and other covers; and (c) using foams to cover exposed odorous soils. If odors develop and cannot be otherwise controlled, additional means to eliminate odor nuisances will include: (d) direct load-out of soils to trucks for off-site disposal; (e) use of chemical odorants in spray or misting systems; and, (f) use of staff to monitor odors in surrounding neighborhoods.

Where odor nuisances have developed during remedial work and cannot be corrected, or where the release of nuisance odors cannot otherwise be avoided due to on-site conditions or close proximity to sensitive receptors, odor control will be achieved by sheltering excavation and handling areas under tented containment structures equipped with appropriate air venting/filtering systems.

5.4.12.2 Dust Control Plan

A dust suppression plan that addresses dust management during invasive on-site work will include, at a minimum, the items listed below:

- Dust suppression will be achieved through the use of a dedicated on-site water truck for road wetting. The truck will be equipped with a water cannon capable of spraying water directly onto off-road areas including excavations and stockpiles.
- Clearing and grubbing of larger sites will be done in stages to limit the area of exposed, unvegetated soils vulnerable to dust production.

- Gravel will be used on roadways to provide a clean and dust-free road surface.
- On-site roads will be limited in total area to minimize the area required for water truck sprinkling.

5.4.12.3 Other Nuisances

A plan for rodent control will be developed and utilized by the contractor prior to and during Site D clearing and grubbing, and during all remedial work.

A plan will be developed and utilized by the contractor for all remedial work and will conform, at a minimum, to NYCDEP noise control standards.

6.0 GROUNDWATER TREATMENT

The proposed groundwater remediation is to perform ISCO injections in the Site D courtyard and in the vicinity of monitoring wells MW-18, MW-20, MW-D2, and MW-D2I, as shown on Plate 7. Two temporary injection points are expected to be installed in the courtyard, south (upgradient) of the excavations. Three temporary injection points are expected to be installed at each monitoring well except for MW-D2 and MW-D2I, which are near each other and thus are considered as one location for this purpose. The injections are anticipated to be spaced approximately 15 feet apart to provide overlapping areal coverage. The locations will be confirmed in the field, or adjusted as needed to avoid utilities or other obstructions. The oxidant is expected to be introduced from approximately 10 to 25 ft bls to target the CVOC impacted interval. The concentration of oxidant per vertical foot will be determined by the ISCO Contractor using current site data and oxidant demand calculations. Specialized mixing heads designed with redundant safety features including check valves, pressure gauges, and flow control ball valves or similar equipment constructed of materials compatible with the oxidant will be used to perform the injections. The ISCO Contractor will inject at a flow rate that allows the oxidant to be introduced to the subsurface at low back pressures.

The proposed oxidant is a patented, modified Fenton's reagent enhanced to produce extra free radicals (MFR+XFR) used by In-Situ Oxidative Technologies, Inc. (ISOTEC) in Lawrenceville, New Jersey. The MFR combines proprietary chelated iron complex catalysts, mobility control agents, oxidizes, and stabilizers. The XFR utilizes sodium persulfate activated via various methods to produce sulfate free radicals. The activators include a proprietary chelated iron catalyst, alkali (e.g., sodium hydroxide), heat, hydrogen peroxide or combinations of each. Between 400 to 600 gallons of 10% MFR+XFR are expected to be introduced at each injection point.

Based on the extent of the groundwater CVOC plume, contaminated groundwater exists beneath Gerry Street. It is not practical to perform ISCO injections on Gerry Street due to sewers, multiple other utilities, and disruption to traffic on a heavily used road in the neighborhood. The contaminated groundwater will be addressed indirectly by the ISCO injections conducted at monitoring well MW-20.

The final locations of the injection points will be recorded using a GPS device and included in the FER.

The groundwater remediation portion of the Remedial Action is estimated to require two to three weeks to complete. Pending contractor availability, groundwater remediation activities would be performed concurrent with soil remediation activities. A contingency round of ISCO injections may be necessary after reviewing and evaluating data collected during groundwater performance monitoring.

6.1 Post-Remediation Groundwater Monitoring

Following the completion of the remedial action, a groundwater monitoring program will be implemented at Site D to monitor the effectiveness of the remedy. Specific details describing the duration of the program, the number and location of monitoring wells, and proposed analyses will be presented as part of the Site Management Plan (SMP).

Access to monitoring wells on Site B will no longer be available following redevelopment of that site. To support the post-remediation groundwater monitoring program, three new monitoring wells (MW-21, MW-22, and MW-23) are proposed to be installed in the sidewalk on the north side of Gerry Street (Plate 7). The monitoring wells will be installed using the hollow-stem auger drilling method. The monitoring wells will be constructed of 2-inch diameter, schedule 40, flush-joint internally-threaded polyvinyl chloride (PVC) well casings and well screens. The well screen will be 0.020-inch slot size, set from 10 to 25 ft bbls. The annular space between the well screen and the borehole will be backfilled with No. 2 sand from the bottom of the well to approximately two (2) feet above the well screen. A one to two feet thick bentonite pellet seal will be placed on top of the sand pack, and the balance of the annular space will be backfilled with cement grout to ground surface. The monitoring wells will be completed with a J-plug and an 8-inch, boltdown flush mount protective casing. The monitoring wells will be developed to ensure hydraulic connectivity with the aquifer after installation has been completed.

ISCO performance monitoring will be conducted for two months following the injections. The monitoring well network will consist of MW-D2, MW-D2I, MW-10, MW-12, MW-18, MW-19, MW-20, MW-21, MW-22, and MW-23. Field parameters (e.g., pH, oxidation-

reduction potential, and dissolved oxygen) will be measured at each monitoring well prior to (i.e., baseline), during, and once every two weeks for two months following ISCO injections. When the field parameters indicate groundwater conditions have nearly returned to baseline, as determined by the Remedial Engineer, groundwater samples will be collected and analyzed for VOCs, chloride, and iron (total and ferrous) by a NYSDOH ELAP certified laboratory, and for persulfate by a field titration test kit or at ISOTEC's laboratory. Groundwater sampling will be completed utilizing the USEPA's low-flow (minimal drawdown) procedures.

It is anticipated that post-remediation groundwater monitoring results will demonstrate that there has been a bulk reduction in groundwater contamination at Site D to asymptotic levels. If the results of this monitoring program indicate that residual groundwater contamination at Site D has not reached asymptotic levels, performance of an additional round of ISCO injections may be proposed. ISCO injections will be conducted until the remedial objectives for Site D has been achieved, or until it is determined that additional remedial action is technically impractical or not feasible.

The sampling and analysis described will be conducted in accordance with the QAPP included as Appendix B and in accordance with NYSDEC ASP (Category B deliverables).

7.0 RESIDUAL CONTAMINATION TO REMAIN ON-SITE

Since residual contaminated soil and groundwater/soil vapor will exist beneath Site D after the remedy is complete, Engineering and Institutional Controls (ECs and ICs) are required to protect human health and the environment. These ECs and ICs are described hereafter. Long-term management of EC/ICs and of residual contamination will be executed under a site-specific Site Management Plan (SMP) that will be developed and included in the FER.

ECs will be implemented to protect public health and the environment by appropriately managing residual contamination. The Controlled Property (Site D) will have one EC system: a composite cover system consisting of concrete cover, concrete building slabs, and clean backfill.

The FER will report residual contamination on Site D in tabular and map form. This will include presentation of exceedances of this Track 4 site.

8.0 ENGINEERING CONTROLS: COMPOSITE COVER SYSTEM

Exposure to residual contaminated soils will be prevented by an engineered, composite cover system, most of which already exists on the site. This composite cover system will be comprised of concrete cover, concrete building slabs, and in areas that are not paved or under a building slab a minimum of two feet of clean backfill consisting of:

- on-site materials meeting the Part 375 Protection of Groundwater Criteria for VOCs and Restricted Residential Use Criteria for non-VOCs; or
- off-site materials meeting the lower of the Part 375 Protection of Groundwater or Restricted Residential Use Criteria.

Excavated areas in Site D will be backfilled with the aforementioned off-site, clean materials and NYSDEC-approved on-site excavated materials. In the Site D courtyard, the concrete will be restored to match the existing concrete cover. Although no landscaped areas are currently proposed, any exposed surface soils will be covered by a soil cover consisting of a minimum of two feet of clean soil, meeting the SCOs for cover material set forth in 6 NYCRR Part 375-6.7(d) for Restricted Residential Use. The soil cover would be placed over a demarcation layer, with the upper six inches of soil of sufficient quality to maintain vegetation. The excavated area within Building 25A will be backfilled with off-site, clean materials and NYSDEC-approved on-site excavated materials to match the surrounding floor elevation. Since this area is inside an existing building, the soil cover will not include soil of sufficient quality to maintain vegetation.

A Soil Management Plan will be included in the Site Management Plan and will outline the procedures to be followed in the event that the composite cover system and underlying residual contamination are disturbed after the Remedial Action is complete.

Maintenance of this composite cover system will be described in the Site Management Plan in the FER.

9.0 SOIL VAPOR ASSESSMENT/MITIGATION

Prior to the construction of any enclosed structures or reoccupation of existing Site D buildings, a soil vapor intrusion (SVI) evaluation will be performed to determine whether any mitigation measures are necessary to eliminate potential exposure to vapors in the proposed or existing structure. Alternatively, an SVI mitigation system may be installed as an element of the building foundation without first conducting an investigation. This mitigation system will include a vapor barrier and passive sub-slab depressurization system that is capable of being converted to an active system.

10.0 CRITERIA FOR COMPLETION OF REMEDIATION/ TERMINATION OF REMEDIAL SYSTEMS

10.1 Composite Cover System

The composite cover system is a permanent control and the quality and integrity of this system will be inspected at defined, regular intervals in perpetuity.

10.2 Groundwater Monitoring

Groundwater monitoring activities to assess the effectiveness of the remedy and natural attenuation will continue, as determined by NYSDOH and NYSDEC, until residual groundwater concentrations are found to be below NYSDEC standards or have become asymptotic over an extended period. Monitoring will continue until permission to discontinue is granted in writing by NYSDEC and NYSDOH. Monitoring activities are outlined in the Monitoring Plan of the SMP.

11.0 INSTITUTIONAL CONTROLS

After the remedy is complete, Site D will have residual contamination remaining in place. Engineering Controls (ECs) for the residual contamination have been incorporated into the remedy to render the overall site remedy protective of public health and the environment. Two elements have been designed to ensure continual and proper management of residual contamination in perpetuity: a Deed Restriction and a Site Management Plan. These elements are described in this Section. A site-specific Deed Restriction will be recorded with Kings County to provide an enforceable means of ensuring the continual and proper management of residual contamination and protection of public health and the environment in perpetuity or until released in writing by NYSDEC. It requires that the grantor of the Deed Restriction and the grantor's successors and assigns adhere to all Engineering and Institutional Controls (ECs/ICs) placed on Site D by this NYSDEC-approved remedy. ICs provide restrictions on site usage and mandate operation, maintenance, monitoring and reporting measures for all ECs and ICs. The Site Management Plan (SMP) describes appropriate methods and procedures to ensure compliance with all ECs and ICs that are required by the Deed Restriction. Once the SMP has been approved by the NYSDEC, compliance with the SMP is required by the grantor of the Deed Restriction and grantor's successors and assigns.

11.1 Deed Restriction

A Deed Restriction, in accordance with DER-10, is required when residual contamination is left on-site after the Remedial Action is complete. If the site will have residual contamination after completion of all Remedial Actions, then a Deed Restriction is required. As part of this remedy, a Deed Restriction approved by NYSDEC will be filed and recorded with the Kings County Clerk. The Deed Restriction will be submitted as part of the Final Engineering Report.

The Deed Restriction renders Site D a Controlled Property. The Deed Restriction must be recorded with the Kings County Clerk before the Certificate of Completion can be issued by NYSDEC. A series of Institutional Controls are required under this remedy to implement and maintain the Engineering Control system, prevent future exposure to residual contamination by controlling disturbances of the subsurface soil and restricting the use of Site D to restricted residential, commercial, or industrial uses only. These Institutional Controls are requirements or restrictions placed on Site D that are listed in, and required by, the Deed Restriction.

Institutional Controls can, generally, be subdivided between controls that support Engineering Controls, and those that place general restrictions on site usage or other requirements. Institutional Controls in both of these groups are closely integrated with the Site Management Plan, which provides all of the methods and procedures to be followed to comply with this remedy.

The Institutional Controls that support Engineering Controls are:

- Compliance with the Deed Restriction by the Grantee and the Grantee's successors and adherence of all elements of the SMP is required;
- All Engineering Controls must be operated and maintained as specified in this SMP;
- A composite cover system consisting of concrete cover, concrete building slabs, and two feet of clean backfill in areas that are not paved or under a building slab must be inspected, certified and maintained as required in the SMP;
- A soil vapor mitigation system that may be installed as part of future development must be inspected, certified, operated and maintained as required by the SMP;
- All Engineering Controls on the Controlled Property must be inspected and certified at a frequency and in a manner defined in the SMP;
- Groundwater and other environmental or public health monitoring must be performed as defined in the SMP;
- Data and information pertinent to Site Management for the Controlled Property must be reported at the frequency and in a manner defined in the SMP;
- On-site environmental monitoring devices, including but not limited to groundwater monitor wells, must be protected and replaced as necessary to ensure proper functioning in the manner specified in the SMP;
- Engineering Controls may not be discontinued without an amendment or extinguishment of the Deed Restriction.

Adherence to these Institutional Controls for the Site is mandated by the Deed Restriction and will be implemented under the Site Management Plan (discussed in the next section). The Controlled Property (Site D) will also have a series of Institutional Controls in the form of site restrictions and requirements. The site restrictions that apply to the Controlled Property are:

- Vegetable gardens and farming on the Controlled Property are prohibited.

- Use of groundwater underlying the Controlled Property is prohibited without treatment rendering it safe for intended purpose.
- All future activities on the Controlled Property that will disturb residual contaminated material are prohibited unless they are conducted in accordance with the soil management provisions in the Site Management Plan.
- The Controlled Property may be used for restricted residential, commercial or industrial uses only, provided the long-term Engineering and Institutional Controls included in the Site Management Plan are employed.
- The Controlled Property may not be used for a higher level of use, such as unrestricted residential use without an amendment or extinguishment of this Deed Restriction.
- Grantor agrees to submit to NYSDEC a written statement that certifies, under penalty of perjury, that: (1) controls employed at the Controlled Property are unchanged from the previous certification or that any changes to the controls were approved by the NYSDEC; and, (2) nothing has occurred that impairs the ability of the controls to protect public health and environment or that constitute a violation or failure to comply with the SMP. NYSDEC retains the right to access such Controlled Property at any time in order to evaluate the continued maintenance of any and all controls. This certification shall be submitted annually, or an alternate period of time that NYSDEC may allow. This annual statement must be certified by an expert that the NYSDEC finds acceptable.

11.2 Site Management Plan

Site Management is the last phase of remediation and begins with the approval of the Final Engineering Report and issuance of the Certificate of Completion (COC) for the Remedial Action. The Site Management Plan is submitted as part of the FER but will be written in a manner that allows its removal and use as a complete and independent document. Site Management continues in perpetuity or until released in writing by NYSDEC. The property owner is responsible to ensure that all Site Management responsibilities defined in the Deed Restriction and the Site Management Plan are performed.

The SMP is intended to provide a detailed description of the procedures required to manage residual contamination left in place at the site following completion of the Remedial Action in accordance with the VCA with the NYSDEC. This includes: (1) development, implementation, and management of all Engineering and Institutional Controls; (2) development and implementation of a Monitoring Plan; and (3) submittal of Site Management Reports, performance of inspections and certification of results, and demonstration of proper communication of site information to NYSDEC.

To address these needs, this SMP will include three plans: (1) an Engineering and Institutional Control Plan for implementation and management of EC/ICs; (2) a Monitoring Plan for implementation of Site Monitoring; and (3) a Site Management Reporting Plan for submittal of data, information, recommendations, and certifications to NYSDEC. The SMP will be prepared in accordance with the requirements of the latest version of NYSDEC DER-10 Technical Guidance for Site Investigation and Remediation, and the guidelines provided by NYSDEC.

Site management activities, reporting, and EC/IC certification will be scheduled on a certification period basis. The certification period will be annually. The Site Management Plan will be based on a calendar year and will be due for submission to NYSDEC by March 1 of the year following the reporting period.

The Site Management Plan in the Final Engineering Report will include a monitoring plan for groundwater at the down-gradient site perimeter to evaluate site-wide performance of the remedy.

No exclusions for handling of residual contaminated soils will be provided in the Site Management Plan (SMP). All handling of residual contaminated material will be subject to provisions contained in the SMP.

12.0 FINAL ENGINEERING REPORT

A Final Engineering Report (FER) will be submitted to NYSDEC following implementation of the Remedial Action defined in this RAWP. The FER provides the documentation that the remedial work required under this RAWP has been completed and has been performed in compliance with this plan. The FER will provide a comprehensive account of the locations and characteristics of all material removed from Site D including the surveyed map(s) of all sources. The Final Engineering Report will include as-built drawings for all constructed elements, certifications, manifests, bills of lading as well as the complete Site Management Plan (formerly the Operation and Maintenance Plan). The FER will provide a description of the changes in the Remedial Action from the elements provided in the RAWP and associated design documents. The FER will provide a tabular summary of all performance evaluation sampling results and all material characterization results and other sampling and chemical analysis performed as part of the Remedial Action. The FER will provide test results demonstrating that all mitigation and remedial systems are functioning properly. The FER will be prepared in conformance with DER-10.

Where determined to be necessary by NYSDEC, a Financial Assurance Plan will be required to ensure the sufficiency of revenue to perform long-term operations, maintenance, and monitoring tasks defined in the Site Management Plan and Deed Restriction. This determination will be made by NYSDEC in the context of the Final Engineering Report review.

The Final Remediation Report will include written and photographic documentation of all remedial work performed under this remedy.

The FER will provide a thorough summary of all residual contamination left on Site D after the remedy is complete. Residual contamination includes all contamination that exceeds the Track 4 SCO in 6NYCRR Part 375-6. A table that shows exceedances from Track 4 SCOs for all soil/fill remaining at Site D after the Remedial Action and a map that shows the location and summarizes exceedances from Track 4 SCOs for all soil/fill remaining at Site D after the Remedial Action will be included in the FER.

The FER will provide a thorough summary of all residual contamination that exceeds the SCOs defined for Site D in the RAWP and must provide an explanation for why the material was not removed as part of the Remedial Action. A table that shows residual contamination in excess of Site D SCOs and a map that shows residual contamination in excess of Site D SCOs will be included in the FER.

The Final Engineering Report will include an accounting of the destination of all material removed from Site D, including excavated contaminated soil, historic fill, solid waste, hazardous waste, non-regulated material, and fluids. Documentation associated with disposal of all material must also include records and approvals for receipt of the material. It will provide an accounting of the origin and chemical quality of all material imported onto Site D.

Before approval of a FER and issuance of a Certificate of Completion, all project reports must be submitted in digital form on electronic media (PDF).

12.1 Certifications

The following certification will appear in front of the Executive Summary of the Final Engineering Report. The certification will be signed by the Remedial Engineer, Charles J. McGuckin, who is a Professional Engineer registered in New York State. This certification will be appropriately signed and stamped. The certification will include the following statements:

I _____ certify that I am currently a NYS registered professional engineer, I had primary direct responsibility for the implementation of the subject construction program, and I certify that the Remedial Work Plan (or Remedial Design or Plans and Specifications) was implemented and that all construction activities were completed in substantial conformance with the DER-approved Remedial Work Plan (or Remedial Design or Plans and Specifications).

If the Remedial Action Work Plan (or Remedial Design or Plans and Specifications) identifies time frames to be achieved by the remedial program, the certification must include: The data submitted to DER demonstrates that the remediation requirements set forth in the Remedial Work Plan (or Remedial Design or Plans and Specifications) and all applicable statutes and regulations have been or will be achieved in accordance with the time frames, if any, established in the work plan (or Remedial Design or Plans and Specifications).

If the remedial program requires ICs or ECs, the certification must include: All use restrictions, institutional controls, engineering controls and/or any operation and maintenance requirements applicable to the 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.

If the remedial program requires applicable SMP, the certification must include: *AA Site Management Plan has been submitted for the continual and proper operation, maintenance, and monitoring of any engineering controls employed at the site including the proper maintenance of any remaining monitoring wells, and that such plan has been approved by DER.*

If the remedial program requires financial assurance, the certification must include: *Any financial assurance mechanisms required by DEC pursuant to Environmental Conservation Law have been executed.*

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.

13.0 SCHEDULE

A schedule of the work elements of the Remedial Action and deliverables is provided as Table 5.

Remedial Action Work Plan

TABLES

1. VOC Exceedances of Protection of Groundwater Criteria
2. SVOC Exceedances of Restricted Residential Use Criteria
3. Metal Exceedances of Restricted Residential Use Criteria
4. Summary of Permits
5. Proposed Schedule of Remedial Action and Deliverables

**Table 1. VOC Exceedances of Protection of Groundwater Criteria
Pfizer Inc Site B and Site D OU-1 RAWP, Brooklyn, New York**

Location ID	Depth (ft bls)	VOC	Concentration (mg/kg)
GW-S26	19 – 21	Cis-1,2-DCE VC	0.32 0.05
GW-S27	9 – 11	PCE	2.2
		TCE	2.7
	15 – 17	Cis-1,2-DCE	120
		VC	1.2
	Cis-1,2-DCE		0.29
GWS-OU1-5	8 – 10	PCE	8.6
		TCE	4.2
		Cis-1,2-DCE	6
GWS-OU1-6	9 – 11	VC	0.048
GWS-OU1-7	6 – 10	PCE	6.7
		TCE	0.51
		Cis-1,2-DCE	12
	10 – 13	PCE	1.5
		Cis-1,2-DCE	8.5
		VC	0.16
GWS-OU1-8	10 – 15	Cis-1,2-DCE	4.5
GWS-OU1-11	14 – 15	PCE	280
	15 – 16	PCE	5.7

**Table 2. SVOC Exceedances of Restricted Residential Use Criteria
Pfizer Inc Site B and Site D OU-1 RAWP, Brooklyn, New York**

Location ID	Depth (ft bbls)	SVOC	Concentration (mg/kg)
BSB-13	6 – 7.5	Benzo(a)anthracene	1.1
		Benzo(b)fluoranthene	1.1
BSB-15	7.5 – 10	Benzo(a)anthracene	24
		Benzo(a)pyrene	14
		Benzo(b)fluoranthene	14
		Benzo(k)fluoranthene	4.5
		Chrysene	23
		Dibenzo(a,h)anthracene	2.1
		Indeno(1,2,3-cd)pyrene	4.8
SBB-29	0 – 0.2	Benzo(a)anthracene	75
		Benzo(a)pyrene	54
		Benzo(b)fluoranthene	69
		Chrysene	71
		Dibenzo(a,h)anthracene	25
		Fluoranthene	120
		Indeno(1,2,3-cd)pyrene	43
	0.2 – 2	Phenanthrene	130
		Pyrene	170
		Benzo(a)anthracene	3
		Benzo(a)pyrene	3.4
		Benzo(b)fluoranthene	5.1
		Chrysene	4.8
		Dibenzo(a,h)anthracene	1.3
	5 – 7	Indeno(1,2,3-cd)pyrene	1.4
		Benzo(a)anthracene	1.7
		Benzo(a)pyrene	1.5
		Indeno(1,2,3-cd)pyrene	0.82

**Table 2. SVOC Exceedances of Restricted Residential Use Criteria
Pfizer Inc Site B and Site D OU-1 RAWP, Brooklyn, New York**

Location ID	Depth (ft bls)	SVOC	Concentration (mg/kg)
SBB-30	0.2 – 2	Benzo(a)anthracene	3.2
		Benzo(a)pyrene	3
		Benzo(b)fluoranthene	2.5
		Chrysene	4.2
		Dibenzo(a,h)anthracene	0.51
		Indeno(1,2,3-cd)pyrene	1.9
SBB-32	0 – 0.2	Benzo(a)anthracene	22
		Benzo(a)pyrene	15
		Benzo(b)fluoranthene	13
		Chrysene	18
		Dibenzo(a,h)anthracene	2.9
		Indeno(1,2,3-cd)pyrene	18
	0.2 – 2	Benzo(a)anthracene	31
		Benzo(a)pyrene	39
		Benzo(b)fluoranthene	56
		Benzo(k)fluoranthene	27
		Chrysene	41
		Dibenzo(a,h)anthracene	15
		Indeno(1,2,3-cd)pyrene	14

**Table 2. SVOC Exceedances of Restricted Residential Use Criteria
Pfizer Inc Site B and Site D OU-1 RAWP, Brooklyn, New York**

Location ID	Depth (ft bsls)	SVOC	Concentration (mg/kg)
SBB-33	0 – 0.2	Benzo(a)anthracene	10
		Benzo(a)pyrene	7.1
		Benzo(b)fluoranthene	6.5
		Chrysene	8.4
		Dibenzo(a,h)anthracene	1.7
		Indeno(1,2,3-cd)pyrene	6.6
		Benzo(a)anthracene	4.6
	0.2 – 2	Benzo(a)pyrene	3.3
		Benzo(b)fluoranthene	4.6
		Chrysene	6.4
		Dibenzo(a,h)anthracene	1.6
		Indeno(1,2,3-cd)pyrene	2.6
		Benzo(a)anthracene	2.8
		Benzo(a)pyrene	2.4
SBB-34	5 – 7	Benzo(b)fluoranthene	2.1
		Dibenzo(a,h)anthracene	0.91
		Indeno(1,2,3-cd)pyrene	1.7
	0 – 0.2	Benzo(a)anthracene	4
		Benzo(a)pyrene	4
		Benzo(b)fluoranthene	3.9
		Chrysene	4.4
		Dibenzo(a,h)anthracene	1.3
		Indeno(1,2,3-cd)pyrene	2.6
		Benzo(a)anthracene	6.3
		Benzo(a)pyrene	4.8
		Benzo(b)fluoranthene	5.2
		Benzo(k)fluoranthene	4.1
		Chrysene	5.5
		Dibenzo(a,h)anthracene	1.1
		Indeno(1,2,3-cd)pyrene	4.5

**Table 3. Metal Exceedances of Restricted Residential Use Criteria
Pfizer Inc Site B and Site D OU-1 RAWP, Brooklyn, New York**

Location ID	Depth (ft bls)	Metal	Concentration (mg/kg)
AP-1	7.5 – 8.5	Mercury	2.9
AP-3	8 – 9	Mercury	1.2
AP-32	4 – 5	Lead	460
		Mercury	3
BSB-13	6 – 7.5	Copper	280
		Mercury	2.2
BSB-14	5.5 – 7	Mercury	10
BSB-15	7.5 – 10	Barium	1,000
BSB-16	9 – 11	Mercury	7.4
GWS-OU1-6	9 – 11	Arsenic	25
		Mercury	0.96
SBB-04	0 – 2	Mercury	9.2
	6 – 8	Mercury	1.3
SBB-06	0 – 2	Barium	535
SBB-29	0 – 0.2	Arsenic	307
		Barium	1,250
		Lead	1,770
		Mercury	1.9
		Arsenic	49.7
		Barium	868
	0.2 – 2	Lead	1,530
		Mercury	2
		Lead	631
	5 – 7	Mercury	3.5
SBB-30	0 – 0.2	Barium	1,200
	0.2 – 2	Mercury	1.8
	5 – 7	Mercury	3.3

**Table 3. Metal Exceedances of Restricted Residential Use Criteria
Pfizer Inc Site B and Site D OU-1 RAWP, Brooklyn, New York**

Location ID	Depth (ft bls)	Metal	Concentration (mg/kg)
SBB-32	0 – 0.2	Arsenic	42.8
		Barium	402
		Lead	712
	0.2 – 2	Mercury	61.4
		Barium	1,220
		Lead	1,180
		Mercury	31.4
SBB-33	5 – 7	Mercury	6.1
		Arsenic	16.1
		Barium	519
		Lead	738
		Barium	2,530
		Lead	2,590
SBB-34	0 – 0.2	Barium	708
		Lead	2,020
		Mercury	2.8
	0.2 – 2	Lead	650
		Mercury	3
		Lead	490
		Mercury	1.3

Table 4. Summary of Permits

Pfizer Inc Site B and Site D OU-1 RAWP, Brooklyn, New York

Regulatory Agency	Permit
NYCDOT	Sidewalk Opening Permit (for monitoring well installation)
USEPA	Underground Injection Control Program Form (for ISCO injections)

NYCDOT – New York City Department of Transportation

USEPA – United States Environmental Protection Agency

Table 5. Proposed Schedule of Remedial Action and Deliverables
Pfizer Inc Site B and Site D OU-1 RAWP, Brooklyn, New York

Remedial Action Work Element or Deliverable	Duration (weeks)	Cumulative Duration (weeks)
NYSDEC Approval of Final RAWP (After 30 day public comment period)	0	0
Preparation of Specifications and Contracting Documents	5	5
Bid Review and Award	1-2	7
Obtain Permits	2-4	11
Contractor Mobilization	2	13
Hot Spot Excavation	2-4	17
ISCO Injections	2-3	20
Contractor Demobilization	1	21
Groundwater Performance Monitoring	4-6	27
Contingency ISCO Injections	1-2	29
Preparation and Submission of Draft FER and SMP	12	41

Remedial Action Work Plan

FIGURES

1. Site Location Map
2. Truck Route



QUADRANGLE LOCATION



SOURCE:
USGS; Brooklyn, New York
7.5 Minute Topographic Quadrangle

0 2000'

Title:

SITE LOCATION MAP

SITE B AND SITE D OU-1 RAWP

Prepared for:

PFIZER INC
BROOKLYN, NEW YORK

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting
& Management

Compiled by: W.K. Date: 15SEPT14
Prepared by: G.M. Scale: AS SHOWN
Project Mgr.: W.K. Project No.: 0047.0044Y040
File: 0047.0044Y605R.01.CDR

FIGURE
1



LEGEND

- INBOUND ROUTE
- OUTBOUND ROUTE

0 2000'

Title:

TRUCK ROUTE

SITE B AND SITE D OU-1 RAWP

Prepared for:

PFIZER INC
BROOKLYN, NEW YORK

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting
& Management

Compiled by: W.K.	Date: 15SEPT14
Prepared by: G.M.	Scale: AS SHOWN
Project Mgr.: W.K.	Project No.: 0047.0044Y040
File: 0047.0044Y605R.01.CDR	

FIGURE
2

Remedial Action Work Plan

APPENDICES

- A. Site Specific Health and Safety Plan
- B. Quality Assurance Project Plan
- C. Community Air Monitoring Plan
- D. Professional Profile of Remedial Engineer

Remedial Action Work Plan

APPENDIX A

**Site Specific
Health and Safety Plan**

February 11, 2015

SITE SPECIFIC HEALTH AND SAFETY PLAN

**Pfizer Inc Site B and Site D
Williamsburg
Brooklyn, New York**

Prepared for:

**PFIZER INC
60-66 Gerry Street
Brooklyn, New York 11206**

ROUX ASSOCIATES, INC.

Environmental Consulting & Management

ROUX

209 Shafter Street, Islandia, New York 11749 ◆ 631-232-2600

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3. Typical Decontamination Layout – Level C Protection
4. Typical Decontamination Layout – Level D Protection

APPENDICES

- A. Health and Safety Briefing/Tailgate Meeting Form
- B. Job Safety Analysis Forms
- C. Health and Safety Field Change Request
- D. Occupational Health Clinic and Hospital Directions
- E. Acord Automobile Loss Notice Form
- F. Health and Safety Lessons Learned/Accident Report Forms
- G. Medical Data Sheet

1.0 INTRODUCTION

This site-specific Health and Safety Plan (HASP) has been prepared in accordance with 29 CFR 1910.120 Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER), and Roux Associates, Inc. (Roux Associates) Standard Operating Procedures. This HASP addresses all activities associated with the Scope of Work detailed in the Remedial Action Work Plan (RAWP) for Operable Unit 1 (OU-1) of Pfizer Inc's Site B and Site D.

1.1 HASP Implementation

The designated Site Health and Safety Officer (SHSO) will implement the HASP during work at the site. Each day before the start of work, a Health and Safety meeting shall be held, which will address safety hazards at the site. The attendees and topics discussed during the Health and Safety meeting shall be recorded (Appendix A). Job Safety Analysis (JSA) forms (Appendix B) that concentrate on the relevant work being performed shall also be reviewed. Compliance with this HASP is required for all Roux Associates employees and third parties who enter Site B and Site D. Assistance in implementing this HASP can be obtained from Roux Associates' Office Health and Safety Manager (OHSM). The content of this HASP may undergo revision based upon additional information made available. Any changes proposed must be reviewed and approved by Roux Associates' Corporate Health and Safety Manager (CHSM) or his designee (Appendix C).

The following lists personnel to contact regarding implementation of the HASP.

Responsibility	Name/Affiliation	Telephone / Cell Number
Roux Associates' Project Manager (PM)	Wai Kwan, Ph.D., P.E. Roux Associates, Inc.	631-232-2600 (office) 917-902-1108 (cell)
Pfizer Inc's Project Manager	Matthew Basso, CHMM Pfizer Inc	908-901-7096 (office) 862-596-3423 (cell)
Corporate Health and Safety Manager	Joseph Gentile, CIH Roux Associates, Inc.	856-423-8800 (office) 610-844-6911 (cell)
Office Health and Safety Manager	Ray Fitzpatrick Roux Associates, Inc.	631-630-2347 (office) 631-484-1168 (cell)
Site Health and Safety Officer	TO BE ANNOUNCED Roux Associates, Inc.	631-232-2600 (office)
Site Manager (SM)	TO BE ANNOUNCED Roux Associates, Inc.	631-232-2600 (office)

2.0 EMERGENCY INFORMATION

Multiple emergency services may be obtained from 911. More specific numbers for local services are listed below.

Type	Name	Telephone Numbers
Police	New York City Police Department	718-963-5311 or 911
Fire	New York City Fire Department	718-636-1700 or 911
Hospital (Emergency)	Woodhull Medical Center	718-963-8000 or 911
Occupational Health Clinic (Non-Emergency)	Health Source Medical Service	631-435-0110 631-435-4394
National Response Center (Release or Spill)		800-424-8802
Poison Control Center		800-222-1222
Site Health and Safety Officer	TO BE ANNOUNCED Roux Associates, Inc.	631-232-2600 (office)
Roux Associates' Corporate Health and Safety Manager	Joseph Gentile, CIH Roux Associates, Inc.	856-423-8800 (office) 610-844-6911 (cell)
Roux Associates' Office Health and Safety Manager	Ray Fitzpatrick Roux Associates, Inc.	631-630-2347 (office) 631-484-1168 (cell)
Roux Associates' Project Manager	Wai Kwan, Ph.D., P.E. Roux Associates, Inc.	631-232-2600 (office) 631-831-9403 (cell)
Pfizer Inc's Project Manager	Matthew Basso, CHMM Pfizer Inc	908-901-7096 (office) 862-596-3423 (cell)

The route to Woodhull Medical Center is shown in Figure 1. Written directions to the Occupational Health Clinic located in Islandia, New York and Woodhull Medical Center are provided in Appendix D.

3.0 HEALTH AND SAFETY PERSONNEL DESIGNATIONS

Roux Associates has designated health and safety personnel to be responsible for the implementation of this HASP for Roux Associates employees, and to provide assistance to the contractor for health and safety related issues.

Personnel Designation	Responsibilities
Corporate Health and Safety Manager (CHSM) and Office Health and Safety Manager (OHSM)	Assists in implementation and modification of the HASP.
Project Manager (PM)	Provides adequate resources for field health and safety personnel. Ensures that field personnel are trained and aware of Site B and Site D conditions. Schedules adequate personnel and equipment to perform job safely.
Site Health and Safety Officer (SHSO) / Site B and Site D Emergency Coordinator	Conducts safety briefings and worker awareness meetings. Ensures compliance with HASP. Notifies PM and OHSM of accidents/incidents. Coordinates health and safety activities.
	Makes contact with local emergency groups prior to beginning work onsite. Responsible for evacuation, emergency treatment, and emergency transport of personnel.
Field Crew Personnel	Report unsafe or hazardous conditions to SHSO. Understand the information contained in this HASP.
Site Manager	Coordinates site activities.

4.0 SITE B AND SITE D HISTORY AND PHYSICAL DESCRIPTION

This section provides a brief summary of the history and physical description of Site B and Site D. Additional details are provided in Section 1.1 of the RAWP.

4.1 Site Locations and Descriptions

Site B and Site D are both located in Williamsburg, Brooklyn, New York, as shown in Figure 1 of the RAWP. Site B is known by the street addresses of 59-71 Gerry Street and 73-87 Gerry Street, and is located between Harrison and Throop Avenues. Site D, also known as the former Arlington Press, Inc. (Arlington Press) facility, is known by the street addresses of 191 Harrison Avenue and 60-66 Gerry Street, and is located between Gerry and Bartlett Streets.

4.1.1 Site B

Site B is known by the street addresses of 59-71 Gerry Street and 73-87 Gerry Street, and is located between Harrison and Throop Avenues. Site B is identified as Block 2266, Lots 45 through 50, 52, and part of Lot 1 in the Kings County Tax Map. YGS Inc. (a/k/a Congregation YGS) owns the western portion of Site B, which was formerly leased by Pfizer. Oholie Shloma bought the eastern (formerly Pfizer-owned) portion of Site B from Pfizer in June 2012 (now known as Oholie Shloma Site B). The western portion of Site B is situated on approximately 0.34 acres, and the eastern portion of Site B is situated on approximately 0.46 acres. Site B is bordered on the north by a poultry market and vacant land, three multi-family residences, and a former auto body garage and yard; on the south by Gerry Street; on the east by a vacant lot; and on the west by Harrison Avenue. A five-story, private high school for girls is under construction on the western portion of Site B. The eastern portion of Site B is vacant.

4.1.2 Site D

Site D is known by the street addresses of 191 Harrison Avenue and 60-66 Gerry Street, is located between Gerry and Bartlett Streets, and shares its western property boundary with Harrison Avenue. Site D is identified as Block 2269, Lot 1 in the Kings County Tax Map, and is situated on approximately 0.68 acres. Pfizer owns Site D. Arlington Press, a company that specialized in labels and package inserts for the pharmaceutical industry, had leased the five interconnected buildings that comprise Site D from 1987 to the end of 2007. No other entity has occupied the vacated buildings since then. The buildings surround three sides of a five-story condemned

apartment building that abuts Site D to the south, and fronts on Bartlett Street. Site D is bounded on the West by Harrison Avenue, on the East by a vacant lot, on the North by Gerry Street, and on the South by Bartlett Street. Pfizer does not own, and has never owned, the condemned apartment building or the adjacent vacant lot.

4.1.3 Description of Operable Units

There are three OUs associated with Site B and Site D:

- OU-1 – consists of the Pfizer Site D property;
- OU-2 – consists of the western portion of Site B located at 59-71 Gerry Street and Lot 52, which is the western most lot of the eastern portion of Site B; and
- OU-3 – consists of the remainder of the eastern portion of Site B, Lots 45 through 50.

5.0 HAZARD ASSESSMENT

The potential hazards associated with the anticipated remedial activities include chemical and physical hazards. There is little potential for encountering biological hazards due to the nature of the work location and the activities to be conducted.

5.1 Chemical Hazards

Previous investigations have shown the presence of various dissolved volatile organic compounds at Site B and Site D. The toxicological, physical, and chemical properties of these potential contaminants are presented in Table 1. This table includes action levels (permissible exposure levels) that will establish the level of protection. The potential for encountering these contaminants exists during intrusive activities such as drilling and excavation/earth moving activities. However, during the performance of the remedial action, Safety Data Sheets (SDSs) for applicable products will be kept on file with the SHSO and will be available for review by project personnel upon request.

5.2 Physical Hazards

A variety of physical hazards may be present during Site B and Site D activities. These hazards are similar to those associated with any construction-type project. These physical hazards are due to motor vehicle and heavy equipment operation, the use of power and hand tools, hazardous working surfaces, and handling and storage of fuels. In the case that a motor vehicle accident occurs, an Acord Automobile Loss Notice form (Appendix E) must be filled out. A hard hat must be worn at all times while working at Site B or Site D. Further Personal Protective Equipment (PPE) requirements are outlined in Section 9.2 of this HASP. Workers must also be aware of electrical hazards, such as overhead power lines, while performing their assigned tasks. These hazards are not unique and are generally familiar to most field personnel. Additional task-specific requirements will be covered during safety briefings.

5.2.1 Flammability/Explosive Hazards

Highly flammable/explosive materials have not been identified to be stored at Site B or Site D. However, if these materials are identified, then prior to performing activities near potentially flammable/explosive materials (i.e., within storage areas), all applicable sections of this HASP

need to be thoroughly understood and adhered to. Any questions or concerns should be directed to the SHSO.

5.2.2 Noise

Noise is a potential hazard associated with the operation of heavy equipment, power tools, pumps, and generators. High noise operations will be evaluated at the discretion of the SHSO. Personnel with 8-hour time-weighted-average (TWA) exposures exceeding 85-dBA must be included in a hearing conservation program in accordance with the regulations as specified in 29 CFR 1910.95.

5.2.3 Heat Stress

Heat stress is a significant potential hazard and can be associated with heavy physical activity and/or the use of PPE in hot weather environments.

Heat cramps are brought on by prolonged exposure to heat. As an individual sweats, water and salts are lost by the body resulting in painful muscle cramps. The signs and symptoms of heat cramps are as follows:

- Severe muscle cramps, usually in the legs and abdomen;
- Exhaustion, often to the point of collapse; and
- Dizziness or periods of faintness.

First aid treatment includes shade, rest, and electrolyte fluid replacement therapy. Normally, the individual should recover within one-half hour. If the individual has not recovered within 30 minutes and the temperature has not decreased, the individual should be transported to a hospital for medical attention.

Heat exhaustion may occur in a healthy individual who has been exposed to excessive heat while working. The circulatory system of the individual fails as blood collects near the skin in an effort to rid the body of excess heat. The signs and symptoms of heat exhaustion are as follows:

- Rapid and shallow breathing;
- Weak pulse;
- Cold and clammy skin with heavy perspiration;

- Skin appears pale;
- Fatigue and weakness;
- Dizziness; and
- Elevated body temperature.

First aid treatment includes cooling the victim, elevating the feet, and replacing fluids and electrolytes. If the individual has not recovered within 30 minutes and the temperature has not decreased, the individual should be transported to the hospital for medical attention.

Heat stroke occurs when an individual is exposed to excessive heat and stops sweating. This condition is classified as a **MEDICAL EMERGENCY**, requiring immediate cooling of the victim and transport to a medical facility. The signs and symptoms of heat stroke are as follows:

- Dry, hot, red skin;
- Body temperature approaching or above 105°F;
- Large (dilated) pupils; and
- Loss of consciousness - the individual may go into a coma.

First aid treatment requires immediate cooling and transportation to a medical facility.

Heat stress (heat cramps, heat exhaustion, and heat stroke) is a significant hazard if any type of PPE (semipermeable or impermeable) that prevents evaporative cooling is worn in hot weather environments. Local weather conditions may require restricted work schedules in order to adequately protect personnel. The use of work/rest cycles (including working in the cooler periods of the day or evening) and training on the signs and symptoms of heat stress should help prevent heat-related illnesses from occurring. Work/rest cycles will depend on the workload required to perform each task, type of protective equipment, temperature, and humidity. In general, when the temperature exceeds 88°F, a 15-minute rest cycle will be initiated once every two hours. In addition, potable water and fluids containing electrolytes (e.g., Gatorade) will be available to replace lost body fluids.

5.2.4 Cold Stress

Cold stress is a danger at low temperatures and when the wind-chill factor is low. Prevention of cold-related illnesses is a function of whole-body protection. Adequate insulating clothing must be used when the air temperature is below 40°F. In addition, reduced work periods followed by rest in a warm area may be necessary in extreme conditions. Training on the signs and symptoms of cold stress should prevent cold-related illnesses from occurring. The signs and symptoms of cold stress include the following:

- Severe shivering;
- Abnormal behavior;
- Slowing;
- Weakness;
- Stumbling or repeated falling;
- Inability to walk;
- Collapse; and/or
- Unconsciousness.

First aid requires removing the victim from the cold environment and seeking medical attention immediately. Also, prevent further body heat loss by covering the victim lightly with blankets. Do not cover the victim's face. If the victim is still conscious, administer hot drinks, and encourage activity, such as walking wrapped in a blanket.

5.2.5 Other Physical Hazards

The following provides a list of other physical hazards that may be encountered during performance of the work:

- Heavy equipment and motor vehicle traffic. Workers shall wear fluorescent vests in high traffic areas and utilize traffic cones, barricades, and caution tape to protect work areas, as necessary.
- Slip, trip, fall hazards associated with uneven terrain, obstacles, and slippery or icy surfaces.
- Sharp edges.

- Pinch points.
- Overhead hazards (wear hard hats, as applicable).
- Flying objects and airborne particulate hazards. Wear safety glasses, goggles, or face shields, when appropriate.

5.2.6 Electrical Hazards

Portable pumps, generators, and other power tools require proper grounding and/or a ground fault circuit interrupter (GFCI) before operation. Personnel should never attempt to move an operating pump or generator. Overhead and underground utilities will also be marked out and avoided when drilling.

5.2.7 Biological Hazards

Biological hazards include the possibility of animal bites by potentially rabid stray or wild animals, ticks or other insect bites, and bee and wasp stings.

5.2.7.1 Insect Stings

Stings from insects are often painful, may cause swelling, and can be fatal if a severe allergic reaction, such as anaphylactic shock, occurs. If a sting occurs, the stinger should be scraped out of the skin, opposite of the sting direction. The area should be washed with soap and water, followed by an ice pack. Personnel allergic to bee and/or wasp stings shall alert their PM, SHSO and coworkers immediately, and provide/self-administer medicine and antidotes to treat allergic reactions immediately as prescribed by their personal physician, or if the victim has a history of allergic reaction, he/she should be taken to the Woodhull Hospital.

5.2.7.2 Tick Injury Prevention Program

Ticks may carry Lyme disease, Rocky Mountain spotted fever or other diseases. As such, Roux Associates has instituted a program to prevent tick bites and to provide prompt, adequate, and appropriate notifications and treatment in the event of a work-related tick bite. This SOP applies to all Roux Associates employees and their subcontractors and is additionally addressed by applicable JSAs.

5.2.7.2.1 Project Planning

Pre-planning is the first step in tick avoidance. Where possible, plan the work to avoid tick-infested areas.

- Avoid brushy, overgrown grassy and wooded habitats, particularly in spring and early summer when nymphal ticks feed.
- Remove leaves, tall grass, and brush from areas surrounding work areas (to include residential sites), thereby reducing tick, deer, and rodent habitat.
- Consider having a licensed applicator apply tick-toxic chemicals (e.g., Damminix, Dursban, Sevin, etc.) to surrounding work or residential areas to suppress the tick population.
- Consider performing work during dormant (sub-freezing) seasons; or not during maximum season (spring and early summer) unless it is not practical or rescheduling may introduce other hazards.

5.2.7.2.2 Tick Injury Prevention Measures

Where avoidance of tick habitat or clearing of the area is not possible, follow Roux Associates' Tick Prevention SOP which includes the use of PPE and other measures to avoid tick bites. These include:

- Using Permethrin on clothes to kill ticks on contact;
- Wearing light-colored clothing so that ticks can be more easily seen and removed before attachment occurs;
- Wearing long-sleeved shirts and tucking in (or taping) pant legs into socks or boots to prevent ticks from reaching the skin;
- Wearing high boots or closed shoes that cover the entire foot;
- Wearing a hat; and
- Spraying insect repellents containing n,n-diethyl-m-toluamide (DEET) on exposed skin, excluding the face, in accordance with United States Environmental Protection Agency (USEPA) guidelines.

Tick prevention measures as described above must be implemented prior to entering a potentially tick-infested area. This usually means that the PPE needs to be in place and properly worn before stepping off of a paved or concrete area onto a grassy or wooded area. Pant legs need to be tucked into socks. Where Tyvek is used, the pant legs need to be taped at the ankles.

Insect repellent should be applied in accordance with the manufacturer's instructions. In the event of sensitive ecosystems ensure that the application does not need to be applied at a certain distance from the habitat.

The PPE needs to remain on with the tucking or taping of pant legs, all closures fastened, etc., until leaving the potentially tick-infested area. Upon leaving the area, remove the PPE and bag it to prevent ticks from traveling and subsequently attaching themselves to your skin.

Workers are to inspect themselves and co-workers frequently to see if any ticks are on their clothing and remove them as soon as they are identified. If an embedded tick is found, it should be promptly removed with tweezers. This should be done by grasping the tick firmly and as close to the skin as possible. Then, with a steady motion, pull the tick's body away from the skin. Cleanse the area with an antiseptic. DO NOT use petroleum jelly, a hot match, nail polish or other products to remove the tick. **Preserve the tick for analysis (i.e., by placing in a zip lock bag, envelope, or jar). The tick will be analyzed to determine if it contains the bacteria capable of causing Lyme disease.** After returning home, it is also important to do another thorough examination while showering as a further check that no ticks were missed in previous inspections. Also, it is recommended that any work clothes be washed and dried at high temperatures.

5.2.7.2.3 Responding to Known or Suspected Tick Bites

Any discovery of a tick embedded in the skin where the tick contact may have occurred at work will require (in addition to project management) immediate contact of the Office Manager, OHSM, and CHSM.

Medical practitioners consulted by Roux Associates recommend not administering an antibiotic until AFTER symptoms such as rash, flu-like symptoms, fever, joint or muscle aches, nausea or vomiting develop which could take a few days. Therefore, for tick bites determined to be work related, **antibiotics should not be prescribed or administered until AFTER the results of the tick testing are reviewed and until after any characteristic symptoms develop.**

5.2.7.2.4 Tick Incident Investigation and Reporting

Investigation and reporting of a work-related tick bite will follow established incident investigation and reporting procedures. The Roux Associates Accident Report Form (Appendix F) will be used for documenting the situation.

5.2.7.3 Animals and Animal Wastes

There is potential for various wildlife to reside within the structures, including, but not limited to, pigeons, bats, mice, rats, squirrels, raccoons, stray dogs, and feral cats. Certain animals can represent significant sources (vectors) of disease transmission. Precautions to avoid or minimize potential contact with (biting) animals (such as some of the above listed) or animal waste and/or dead animals should be considered prior to all field activities. Rats, squirrels, raccoons, feral cats, and other wild animals can inflict painful bites which can also cause disease (as in the case of rabid animals). Site personnel should avoid contact with any of the above.

If contact occurs, be sure to clean the area thoroughly with soap and water as soon as possible. If a bite occurs, the area should be cleaned thoroughly immediately with soap and water and medical attention should be sought.

5.2.7.4 Blood Borne Pathogens

The majority of the occupational tasks on-site will not involve a significant risk of exposure to blood, blood components, or body fluids. The highest risk of acquiring any blood borne pathogen for employees on-site will be following an injury. When administering first aid care, there are potential hazards associated with blood borne pathogens that cause diseases such as Human Immunodeficiency Virus (HIV), Hepatitis B (HBV), Hepatitis A (HAV), Hepatitis C (HCV), or the Herpes Simplex Virus (HSV). An employee who has not received the appropriate certification and blood borne pathogens training should never perform first aid and/or cardiopulmonary resuscitation (CPR).

In order to minimize any potential pathogen exposure, all employees should use the hand washing facilities on a regular basis. The decontamination area will provide an adequate supply of water, soap, and single use towels for hand washing. Additionally, the following universal precautions should be followed to prevent further potential risk:

- Direct skin or mucous membrane contact with blood should be avoided.
- Open skin cuts or sores should be covered to prevent contamination from infectious agents.
- Body parts should be washed immediately after contact with blood or body fluids that might contain blood, even when gloves or other barriers have been used.
- Gloves and disposable materials used to clean spilled blood shall be properly disposed of in an approved hazardous waste container.
- First aid responders shall wear latex or thin mil nitrile gloves when performing any procedure risking contact with blood or body substances.
- Safety glasses will be worn to protect the eyes from splashing or aerosolization of body fluids.
- A CPR mask will be worn when performing CPR to avoid mouth-to-mouth contact.
- Cut-resistant work gloves will be worn to minimize the risk of injury to the hands and finger when working on all equipment with sharp or rough edges.
- Broken glass or possible contaminated material shall be avoided with unprotected hands.

5.2.7.5 Mold

A collection of moisture inside on-site structures may lead to the growth of mold within the structures.

Although mold affects individuals differently and to different degrees, the following are some of the most common adverse health effects:

- Respiratory problems – wheezing, difficulty breathing;
- Nasal and sinus congestion;
- Eyes – burning, watery, reddened, blurry vision, light sensitivity;
- Dry, hacking cough;
- Sore throat;

- Nose and throat irritation;
- Shortness of breath and lung disease;
- Chronic fatigue;
- Skin irritation;
- Central nervous system (headaches, loss of memory, and mood changes);
- Aches and pains;
- Fever;
- Headaches;
- Diarrhea; and
- Immune suppression.

Decisions about removing individuals from an affected area must be based on the results of a medical evaluation, and be made on a case-by-case basis.

Workers that discover the visible presence of mold in excess of ten square feet need to notify the SHSO for consultation. If a worker smells mold and feels that he/she is experiencing symptoms of exposure, he/she should retreat and report the symptoms to the SHSO.

5.2.7.6 Other Biohazards

Other biological hazards include mosquitoes which generally live in the vicinity of brush, trees, and stagnant water. Some areas have mosquitoes that carry viruses (for example, West Nile virus, or Eastern Equine Encephalitis). Another category of biohazards include plants such as poison ivy, poison oak, and poison sumac. If exposed to these plants, personnel will wash skin thoroughly with soap and water or post-contact cleansers.

5.2.8 Carbon Monoxide Hazards

Carbon monoxide (CO) is a colorless, odorless, and toxic gas, which is predominately produced by incomplete combustion of carbon-containing materials. Incomplete combustion occurs when insufficient oxygen is used in the fuel (hydrocarbon) burning process. Common sources of CO

may include: motor vehicle exhausts, fuel burning¹ furnaces, coal burning power plants, small gasoline engines including electric generators, demolition equipment, chain saws, lawn mowers and power washers, marine engines, fuel powered forklifts, propane or kerosene-powered heaters, and fuel burning water heaters.

Exposure to CO impedes the blood's ability to carry oxygen to body tissues and vital organs. When CO is inhaled, it combines with hemoglobin (an iron-protein component of red blood cells), producing carboxyhemoglobin, which greatly diminishes hemoglobin's oxygen-carrying capacity. **Hemoglobin's binding affinity for CO is 300 times greater than its affinity for oxygen.** As a result, small amounts of CO can dramatically reduce hemoglobin's ability to transport oxygen.

Common symptoms of CO exposure are headache, nausea, rapid breathing (i.e., shortness of breath), weakness, exhaustion, dizziness, and confusion (i.e., light headedness). Hypoxia (severe oxygen deficiency) due to acute CO poisoning may result in reversible neurological effects, or it may result in long-term (and possibly delayed) irreversible neurological (brain damage) or cardiological (heart damage) effects.

CO exposure can be dangerous during pregnancy for both the mother and the developing fetus. Please contact CDC-INFO (800-232-4636) if you have any questions regarding CO exposure during pregnancy.

At work sites where carbon-containing fuels are used, such as in internal combustion engines and generators, the exhausts from these units can contain significant concentrations of CO. In situations where the exhausts create exposure to CO, the exhausts of these units should be extended via appropriate hoses/piping to well ventilated exterior areas (i.e., outside and downwind of structures). Where the concentrations of CO exceed the following "action levels", notify the Project Manager and immediately implement the corresponding actions to mitigate exposure.

¹ Fuel burning may include natural gas, propane, fuel oil, kerosene, gasoline, coal or other carbon-based items.

Action Levels Table (CO)

Carbon Monoxide (CO) Action Levels²	
Concentration of CO in Air	Action
< 25 ppm	Inspect exhaust system for leaks or other sources of CO. Monitor initially and every 15 minutes during use of CO-generating equipment.
25 – 50 ppm	Ventilate area. Monitor continuously and record measurements. Contact PM
> 50 ppm	Stop work activities. Ventilate area.

² Based upon The American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Value (TLV) of 25 ppm as an 8-hour time-weighted average (TWA) [ACGIH 1994, p. 15] and OSHA's Permissible Exposure Limit (PEL) of 50 ppm as an 8-hour TWA concentration [29 CFR Table Z-1].

6.0 TRAINING REQUIREMENTS

The HAZWOPER Rule (29 CFR 1910.120) requires that all personnel be trained to recognize onsite hazards, understand the provisions of this HASP, and be made aware of the responsible health and safety personnel. This section discusses the means to meet these requirements.

6.1 Basic Training

All Site B and Site D personnel who will perform work in areas where the potential for toxic exposure exists will be health and safety-trained prior to performing work onsite, per OSHA 29 CFR 1910.120(e). Training records will be submitted to and maintained by the SHSO onsite, as described in Section 6.4.

6.2 Site-Specific Training

Health and safety-related training that will specifically address the activities, procedures, monitoring and equipment for site operations will be provided to all personnel and visitors by the SHSO. It will include site facility layout, hazards, emergency services, and will detail all provisions contained within this HASP. This training will also allow field workers to clarify anything they do not understand, and to reinforce their responsibilities regarding safety and operations for their particular activity. Site-specific training will be documented and kept as part of the project records.

6.3 Safety Briefings

Project personnel will be given briefings by the SHSO on an as-needed basis to further assist them in conducting their activities safely. Safety briefings will be held when new operations are to be conducted, whenever changes in work practices must be implemented due to new information made available, before work is begun at each work location. Safety briefings will be documented daily using the form provided in Attachment A, and will be kept by the SHSO as part of the project records. At the conclusion of the safety briefing, all personnel performing work at Site B or Site D will be required to review the HASP and sign the appropriate waiver.

6.4 Record Keeping Requirements

All record keeping requirements mandated by 29 CFR 1910.120 will be strictly followed. Specifically, all personnel training records, medical fit for duty papers, and respirator fit test forms

(if necessary) will be required before work can begin and maintained onsite during the length of the project. These records along with injury/incident reports, medical examination records and exposure monitoring records become a permanent part of the project records (Appendices F and G). Each subcontractor will maintain the above-mentioned records for his employees.

7.0 MONITORING PROCEDURES FOR SITE B AND SITE D OPERATIONS

This section describes the monitoring procedures for Site B and Site D operations.

7.1 Air Monitoring During Site Operations

The SHSO will monitor and record air monitoring measurements as required for onsite activities (Section 7.2 below) and during confined space entry (Section 8.8). All monitoring equipment will be calibrated to the manufacturer's specifications each day prior to use, and documented in site field books.

7.2 Onsite Activities

Activities requiring air monitoring include any site activity which will, or will possibly, result in exposure(s) to hazardous or toxic chemicals or physical agents at or above the permissible exposure limit (PEL), or to flammable or oxygen deficient atmospheres. The following procedures will be followed for any intrusive activities.

Air monitoring will be performed to establish the concentrations of volatile organic compounds during invasive activities using the following instrument(s):

- Photoionization detector (PID);
- Colorimetric indicator tubes (e.g., Dräeger or Sensidyne); and
- Activated charcoal sampling devices, if necessary.

The PID and colorimetric indicator tubes will be used to provide direct readings of organic vapor concentrations during intrusive activities to determine that personnel protection is adequate.

A combustible gas/O₂ meter will be used to monitor the potential for oxygen deficient atmospheres and for explosive concentrations of organic vapors during intrusive operations, if necessary, and during all confined space work. Monitoring will be performed according to the action levels for oxygen and combustible gases provided in Section 9.2.2.

7.2.1 Level D Intrusive Activities

Level D intrusive activities will initially include all intrusive site activities. These activities will begin utilizing Level D protection as described in Section 9.2.2, with upgrading as necessary to assure adequate personnel protection.

The SHSO will monitor the breathing zone with the PID in continuous operating mode and with the alarm activated. The alarm will be set at 5 parts per million (ppm), which is below the PEL for all constituents of concern, except tetrachloroethene (a/k/a tetrachloroethylene, perchloroethylene, PERC) and benzene. If the PID indicates the 5 ppm concentration has been exceeded for a sustained time period, the SHSO will order cessation of the activity and the exclusion zone cleared of all personnel until the PID indicates a reading less than 5 ppm, or until the nature of the hazard has been more thoroughly evaluated.

Colorimetric indicator tubes will be used, if necessary, to establish the concentrations of tetrachloroethene and benzene. The colorimetric indicator tubes may not be chemical-specific for these compounds but will be conservatively biased high and the readings will be assumed to be benzene, which will enable the SHSO to make an immediate decision on the appropriate level of protection. Tetrachloroethene and benzene may also be monitored initially in the breathing zone, using activated charcoal sampling devices. If any detections of benzene are noted based on the colorimetric indicator tube readings, the SHSO will order cessation of the activity until: 1) the direct air screening concentrations are non-detectable by the colorimetric indicator tubes; or 2) all potentially exposed personnel have donned Level B respiratory protection as described in Section 9.2.2 and PID readings are less than 5 ppm; or 3) until the nature of the hazard has been more thoroughly evaluated and it is determined that the measured compound(s) was not tetrachloroethene or benzene.

To confirm the adequacy of respiratory protection, personnel monitoring utilizing activated charcoal sampling devices may be performed to measure the airborne concentrations of benzene and possibly other organic compounds (as necessary) at the beginning of new activities and periodically during intrusive activities. These samples would be sent to an American Industrial Hygiene Association (AIHA) accredited laboratory for analysis using the approved National Institute of Occupational Safety and Health (NIOSH) analytical methods.

7.2.2 Level C Intrusive Activities

Level C intrusive activities will initially include only those activities which require upgrading from Level D. Level C protection will be as described in Section 9.2.2, with upgrading, as necessary, to Level B to assure adequate personnel protection. Downgrading to Level D protection will also be possible if monitoring demonstrates no inhalation hazard exists for this activity.

The SHSO will monitor the breathing zone with the PID in continuous operating mode and with the alarm activated. The alarm will be set at 5 ppm, which is below the PEL for all constituents of concern except benzene. If the PID indicates the 5 ppm concentration has been exceeded, the SHSO will initiate measurements utilizing the colorimetric indicator tubes for benzene.

If the PID readings exceed 25 ppm total organic vapor, or the benzene colorimetric indicator tubes detect benzene, the SHSO will order cessation of the activity until: 1) the PID indicates a reading less than 25 ppm, and is not detectable based upon the colorimetric indicator tube readings, 2) all potentially exposed personnel have donned Level B respiratory protection or, 3) the nature of the hazard has been more thoroughly evaluated and it is determined that the measured concentrations do not pose a potential exposure in excess of the PEL utilizing the Level C protection.

To confirm the adequacy of respiratory protection, personnel monitoring utilizing activated charcoal sampling devices may be performed to measure the airborne concentrations of benzene and possibly other organic compounds (as necessary) at the beginning of new activities and periodically during intrusive activities. These samples would be sent to an AIHA accredited laboratory for analysis using the approved NIOSH analytical methods.

7.2.3 Level B Intrusive Activities

Level B intrusive activities will initially include only those activities which require upgrading from Level C or D, and only those activities required to bring work to a safe stoppage. No work is currently planned utilizing Level B protection, and this HASP will require amendment at such time as Level B work becomes necessary (except for safe work stoppage activities).

When Level B protection is utilized, the SHSO will monitor the breathing zone with the PID in continuous operating mode and with the alarm activated. The alarm will be set at 100 ppm. If the PID indicates the 100 ppm concentration is exceeded, the SHSO will order cessation of the activity until: 1) the PID readings are below 100 ppm, or 2) until the nature of the hazard has been more thoroughly evaluated and it is determined that the measured concentrations do not pose a potential exposure in excess of the PEL utilizing the Level B protection.

To confirm the adequacy of respiratory protection, personnel monitoring utilizing activated charcoal sampling devices may be performed to measure the airborne concentrations of benzene and possibly other organic compounds (as necessary) whenever Level B protection is utilized.

7.3 Non-Intrusive Activities

Non-intrusive activities may result in exposure(s) to hazardous or toxic chemicals or physical agents at or above the PEL, or to flammable or oxygen deficient atmospheres. Based upon the current understanding of site conditions, personnel monitoring may be performed using colorimetric indicator tubes or activated charcoal sampling devices on the first day of non-intrusive activities, and periodically thereafter, if the PID readings indicate a more accurate assessment is warranted.

7.4 Medical Surveillance Requirements

Medical surveillance specifies any special medical monitoring and examination requirements as well as stipulates that all Roux Associates' personnel and subcontractors contracted directly by Roux Associates are required to pass the medical surveillance examination or equivalent for hazardous waste work required by 29 CFR 1910.120.

The examination will be taken annually, at a minimum, and upon termination of employment with the company. Additional medical testing may be required by the CHSM or OHSM in consultation with the company physician and the SHSO if an overt exposure or accident occurs, or if other site conditions warrant further medical surveillance.

8.0 NON-MONITORING SAFETY REQUIREMENTS

This section describes non-monitoring, safety-related procedures for Site B and Site D operations.

8.1 Site Walk-Throughs

Safety considerations during site walk-throughs are important since this activity will usually precede all other field operations. Air monitoring will be performed as indicated in Section 7.2 and will be used to assist in prescribing levels of protection for future site operations, designating site layout and identifying areas of particular hazard, if any.

8.2 Vehicular Traffic Safety Procedures

Vehicular traffic safety will be implemented as described below. A vehicular traffic area is any area where a vehicle may legally travel including, but not limited to, a roadway, roadway shoulder, driveway, or parking area.

The principal exposures to vehicular traffic at Site B and Site D will occur on Site B and on Gerry Street.

Onsite Traffic Safety Procedures

When performing activities on or adjacent to roads, including activities at monitoring wells, the following traffic safety procedures must be followed.

- Fluorescent, reflective, Class 3 vests and hard hats, as well as any other applicable PPE specified in the HASP, must be worn at all times.
- The worker's vehicle should be positioned, to the fullest extent possible, to form a barrier between the worker(s) and oncoming traffic. In addition, each work vehicle will be equipped with a minimum of four high visibility traffic cones. All traffic cones will be placed as necessary to alert traffic of ongoing activities.
- In high volume traffic areas or areas with unpredictable traffic patterns, a traffic watchman or police detail should be utilized. The traffic watchman must be equipped with a warning flag and remain alert and focused on traffic conditions at all times. The need for a traffic watchman or police detail should be discussed with the Project Manager and client prior to deployment.
- Notify the local police of the work location, dates of work, and the anticipated work times when work is to be conducted in a public roadway.

- Additional requirements of local transportation, highway, public safety, and police departments must also be followed when work is performed in a public roadway.
- Any time work is initiated or there is a change in the type of work or location of work, the SHSO should consider the potential traffic safety hazards. If appropriate, implement protective measures in addition to those described above.
- Daily safety briefings should include a discussion of traffic safety as it relates to the activities planned for that day.
- All Roux Associates' subcontractors performing work at Site B or Site D must also adhere to the above safety procedures.

Vehicular traffic in these work areas varies from light and infrequent to very heavy. Traffic consists of car and large-commercial truck traffic typically moving at speeds of 25 to 30 miles per hour (mph) and frequently at speeds approaching 40 mph. Note that the local speed limit is 30 mph. Vehicle speed in work areas is typically low but may be hazardous due to vision limitations caused by miscellaneous obstructions. During activities within all of these work areas, project staff should generally park their vehicles curbside. Curbside parking is dependent on the local public parking rules. Within parking lots, vehicles utilize designated parking spaces.

The following procedures shall be followed to mitigate vehicular traffic hazards posed at the work areas at Site B and Site D during any activities within a roadway, roadway shoulder or any active parking area unless the area is secured (fenced and gated without any vehicle movement potential).

- Double parking shall not be permitted.
- All workers shall wear hardhats and reflective orange vests.
- Workers shall use caution when crossing any road.
- Workers should take care to avoid sudden movements across the road.
- Workers shall position vehicles and equipment to minimize exposure to traffic and to facilitate safe access and egress from vehicles while loading and unloading equipment and/or materials.
- Traffic cones shall be deployed around work areas while workers are present.
- Traffic cones shall be placed at strategic locations to warn approaching traffic.

- All vehicles shall be parked as close to the work area as possible to use the vehicle as a barrier against oncoming traffic.
- When performing activities on a roadway or on the shoulder of any roadway, a minimum of two people must be present. One person will serve as a “traffic watchman” whose sole responsibility is to monitor vehicular traffic conditions and alert worker(s) of potential traffic hazards. The “traffic watchman” must be alert at all times and focused on traffic conditions. At no time should the “traffic watchman” engage in activities other than monitoring traffic conditions.

8.3 Construction Activities

A variety of physical hazards may be present during any construction-type project. Personnel should be aware of safety issues associated with noise, cold, hot work such as welding, cutting and burning, heavy lifting, rough terrain, heavy equipment operation, ladders, scaffolding, excavating and trenching, underground and overhead utilities, electrical hazards, and the hazards associated with hand and power tools. These hazards are not unique and are generally familiar to most construction personnel.

Excavation and drilling (i.e., intrusive activities) are anticipated to be performed during the remediation. The SHSO will conduct air monitoring activities as described in the RAWP.

8.4 Heavy Equipment Safety

The SHSO will be present onsite during all invasive operations, and will provide health and safety monitoring to ensure that appropriate levels of protection and safety procedures are utilized.

Hazardous and non-hazardous waste sites utilize all of the mechanical equipment used on any major construction site. Typical machinery to be found includes pumps, compressors, generators, portable lighting systems, pneumatic tools (drum openers), hydraulic drum crushers, pug mills, forklifts, trucks, dozers, and backhoes. From a safety standpoint, it is always important to be continually aware of the equipment around you. It poses a serious hazard if not operated properly, or if personnel near machinery cannot be seen by operators. In particular, the following heavy equipment hazards are common at Site B and need to be considered from a safety standpoint.

Roux Associates SOP 1.13R1 outlines Roux Associates’ policies and procedures regarding Heavy Equipment Exclusion Zone (HEEZ) set up and use. The objective of the Exclusion Zone Policy is

to establish the minimum clearance distance that must be maintained between workers and heavy equipment while equipment is in operation (i.e., engaged or moving). The intent is to have no personnel or other equipment entering the Exclusion Zone while the equipment is in operation/moving to ensure that Roux Associates and Subcontractor employees are not unnecessarily exposed to the hazards of the equipment. Interaction/contact with heavy equipment contractors – heavy equipment (i.e., backhoes, bulldozers, etc.) operators may not be aware of your presence. Be sure that the operator is aware of your presence before approaching any heavy equipment. When possible, inform operators of your planned activities in the area prior to them beginning their activities.

Each piece of potentially hazardous equipment (i.e., power tools,) will be inspected for proper and safe operation prior to its use.

- All mechanical and rigging equipment will be inspected by the operators prior to beginning this work effort, and at least daily thereafter to ensure proper operating capability. Defective equipment must be repaired or replaced prior to continued use/operation.
- Inspect all cables, sheaves, slings, chains, hooks, and eyes prior to use.
- Secure equipment firmly or be sure it is supported.
- Be sure all power lines are inactivated, removed, or at a safe distance.
- Always use proper loading for capacity at lifting radius.
- Keep all equipment lubricated and maintained.
- Employ signal persons whenever needed.
- Make certain that signals are understood and observed.

8.5 Heavy Equipment Decontamination

If a steam cleaner will be utilized to decontaminate equipment, personnel should exercise caution as the high pressure steam can cause severe burns. Protective gloves, face shields, hard hats, steel-toed boots, and Tyvek suits or rain gear will be worn when using steam cleaners.

8.6 Overhead/Underground Power Lines

The positioning or operation of heavy equipment in the vicinity of utility services will not be initiated until the activities have been coordinated with the SM. Operation of equipment adjacent

to or under overhead power lines, in such a manner that encroaches on authorized clearances, will not take place unless one of the following is satisfied:

- Power has been shut off and positive steps are taken to prevent the lines from being energized;
- The equipment does not have the ability to move laterally or horizontally within the minimum clearance specified in the table below, from energized power lines;
- The equipment has been positioned and blocked to allow no part, including cables, to come within the minimum clearance specified in the table below; or
- Excavation operations are not initiated within 2.5 feet of the verified position of underground power lines.

**Minimum Required Clearances for
Energized Overhead Power Lines**

Nominal System Voltage of Power Line (KV)	Minimum Required Clearance (feet)
0 – 50	10
51 – 100	12
101 – 200	15
201 – 300	20
301 – 500	25
501 – 750	35
751 – 1,000	45

1 kilovolt (KV) = 1,000 volts

8.7 Excavation and Backfill Operations

The SHSO will be present onsite during all Roux Associates' contracted excavation and backfill operations and will provide health and safety monitoring to ensure that appropriate levels of protection and safety procedures are utilized. The proximity of chemical, water, sewer, and electrical lines will be identified by the SHSO before any subsurface activity or sampling is attempted.

The following safe work practices will be followed during this task.

- The proximity of chemical, water, sewer, and electrical lines will be identified prior to any subsurface activity beginning.

- While excavating, stay out of the reach of the backhoe arm's swing by standing at the end of the excavation, not near the sides (sides have the potential to cave in).

Maximum Allowable Slopes

Soil or Rock Type	Maximum Allowable Slopes (H:V) ¹ for Excavations Less Than 20 Feet Deep ³	
Stable Rock	Vertical	(90°)
Type A ² (Stable – Clay, Silty Clay, Passes Ribbon Test)	3/4 : 1	(53°)
Type B (Cohesive – Angular Gravel, Silt, Silty Loam)	1 : 1	(45°)
Type C (Unstable – Sandy, Gravel, Loose)	1½ : 1	(34°)

OSHA (29 CFR 1926.652, Subpart P, Appendices A and B)

Notes:

- ¹ Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.
- ² A short-term maximum allowable slope of 1/2H: 1V (63°) is allowed in excavations in Type A soil that are 12 feet (3.67 meters) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet (3.67 meters) in depth shall be 3/4H : 1V (53°).
- ³ Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.

If the SHSO or a competent person determines that sloping or benching is inadequate to ensure the protection and safety of the workers in the excavation or trench, other forms of protective systems (i.e., trench shield [box]) may be utilized. The trench box can be either pre-manufactured or custom-built in accordance with 29 CFR 1926.652(c)(3) or (c)(4).

Proper stockpiling, containment, and disposal practices will be utilized in regard to the potential amount of waste generated during operations. The location of safety equipment and evacuation procedures will be established prior to initiation of operations according to this HASP. The use of hard hats, eye protection, ear protection, and steel-toed boots will be required during excavation or other heavy equipment operations.

8.8 Confined Space Entry

Confined space is defined as having limited or restricted means of entry or exit, is large enough for an employee to enter and perform assigned work, and is not designed for continuous occupancy by

the employee. These spaces include, but are not limited to, underground vaults, tanks, storage bins, pits and diked areas, vessels, and silos.

If scope of work requires personnel to enter a confined space during the conduct of this project, a permit is required and should meet the definition of confined space, which has one or more of the following characteristics:

- Contains or has the potential to contain a hazardous atmosphere;
- Contains a material that has the potential for engulfing an entrant;
- Has an internal configuration that might cause an entrant to be trapped or asphyxiated by inwardly converging walls or by a floor that slopes downward and tapers to a smaller cross section; and/or
- Contains any other recognized serious safety or health hazards.

Routine confined space entry at Site B and Site D is not required but, if necessary, all personnel performing this activity are required to have OSHA confined space entry training (29 CFR 1910.146).

Any remaining spaces at Site B or Site D that require entry are to be evaluated prior to entry and discussed with the SHSO to determine the entry requirements for that space (i.e., non-permit or permit required).

8.9 Hot/Cold Welding

Roux Associates shall not perform welding unless specific clearance has been obtained from the PM and/or the SM. Any contractors or Roux Associates' personnel performing welding must adhere to the procedures outlined below.

Welding equipment shall be chosen for safe application to the work and shall be installed properly. Employees designated to operate welding equipment shall be properly instructed and qualified to operate it. Mechanical ventilation shall be provided when welding or cutting:

- Where there is less than 10,000 cubic feet per welder; and
- Where the overhead height is less than 16 feet.

Proper shielding and eye protection shall be worn to prevent exposure of personnel to welding hazards. Proper precautions (isolating welding and cutting, removing fire hazards from vicinity, etc.) for fire prevention shall be taken in areas where welding or other “hot work” is being done. The SHSO will be responsible for securing these permits.

All welding and cutting operations carried out in confined spaces shall be adequately ventilated to prevent the accumulation of toxic materials or possible oxygen deficiency. In general, oxygen shall never be used for ventilation. In such circumstances where it is impossible to provide ventilation, OSHA requires airline respirators or hose masks approved by the National Institute for Occupational Safety and Health (NIOSH) for this purpose to be utilized. In areas immediately dangerous to life, NIOSH approved powered air purifying respirators (PAPR) or self-contained breathing apparatus (SCBA) shall be used.

8.10 Communications

- Telephones -- A telephone will be available for communication with emergency support services/facilities.
- Hand Signals -- To be employed by personnel required to use Level C or B respiratory protection. They shall be known by the entire field team before operations commence and covered during site-specific training.

Hand Signals

SIGNAL	MEANING
Hand gripping throat	Out of air, can't breath
Grip partner's wrist	Leave area immediately
Hands on top of head	Need assistance
Thumbs up	I'm alright, okay
Thumbs down	No, negative

8.11 Additional Safe Work Practices

Refer to the SHSO for specific concerns on each individual site task. The safety rules listed below.

- Inform SM of planned activities and evaluate the degree of health and safety protection required for each task.

- Practice contamination avoidance; avoid any skin contact with potentially contaminated materials (i.e., surface or ground water, soil, etc.).
- Hard hat and eye protection will be worn when inside the excavation exclusion zone.
- Do not carry gum, cigarettes, food, or drink of any kind into contaminated areas.
- Wash hands before handling food and drink and other activities that could cause hand-to-mouth transfer of contaminants.
- Appropriate foot, hearing, and hand protection will be worn by those directly involved in the work efforts when warranted.
- No facial hair that interferes with the face to face piece seal of respirators will be allowed.
- Personnel not involved in the operations, excavating, or monitoring activities will remain a safe distance from the equipment.
- Do not climb over/under obstacles.
- Be alert to your own physical condition.
- Watch your buddy for signs of fatigue, exposure, heat or cold stress, etc.
- No work will be conducted without adequate light.
- Report all accidents, no matter how minor, immediately to the SHSO.
- **KNOW YOUR HEALTH AND SAFETY PLAN.**

9.0 ZONES, PROTECTION, AND COMMUNICATIONS

These safety requirements are for activities not typically associated with the normal facility operations at Site B or Site D, but which may be required for any work that has the potential to spread contamination.

9.1 Site Zones

A three zone approach to site operations to control the potential spread of contamination may be employed. The three zones are:

- The Exclusion Zone;
- The Contamination Reduction Zone; and
- The Support Zone.

The establishment of work zones will ensure that: personnel are properly protected against the potential hazards in the area where they are working; work activities and potential contamination are limited to the specific areas; and personnel can be easily located and evacuated in an emergency.

The establishment of work zones and the levels of protection required within the zones will be determined on a case by case basis. The SHSO and PM will determine the need for work zones, and based upon site-specific knowledge and data; determine the levels of protection within the established zones. The following sections provide general specifications for the three work zones.

9.1.1 Exclusion Zone

The area(s) which contain, or are suspected to contain, hazardous materials or activities will be considered the Exclusion Zone (EZ). The SHSO may establish more than one restricted area within the EZ when different levels of protection may be employed or different hazards exist. No personnel are allowed in the EZ without:

- The proper personal protective equipment;
- Medical authorization; and
- Training certification.

During excavation, drilling and sampling activities, the EZ is defined as the excavation and a 10-foot radius around the excavation boundary, or drilling or sampling locations. For the purposes of this project, the EZ(s) will be delineated once the work sites have been determined.

9.1.2 Contamination Reduction Zone

A Contamination Reduction Zone (CRZ) will be established between the Exclusion Zone and the Support Zone. The CRZ will contain the contamination reduction corridor (CRC) and is designed to reduce the probability that the uncontaminated clean areas will become contaminated or affected by other site hazards. It is the area where decontamination of personnel and equipment takes place and serves to limit the physical transfer of hazardous substances into clean areas. The CRZ is to be used for general site entry and egress including access for heavy equipment for remediation activities. The CRZ will also contain safety and emergency equipment. No personnel are allowed in the CRZ without:

- The proper personal protective equipment;
- Medical authorization; and
- Training certification.

9.1.3 Support Zone

The Support Zone (SZ) is considered the uncontaminated area and will be separated from the CRZ by the “Contamination Control Line.” The SZ will contain the support facility, which will provide for team communications and emergency response. Appropriate sanitary facilities and safety and support equipment will be located in this zone. The majority of site operations as well as site access of authorized persons will be controlled from this location. The support facility will be located up-wind of site operations, if possible, and may be used as a potential evacuation point. No potentially contaminated personnel or materials are allowed in this zone.

9.1.4 Buddy System

Select field activities conducted in contaminated, hazardous, and remote areas of the site may require the use of the buddy system. Instances when the buddy system should be employed include, but are not limited to, activities performed in or near water body (e.g., surface-water sampling, etc.), excavation activities, drilling activities and confined space entry (permit required

and non-permit required). Prior to commencing with field tasks in a potentially hazardous area, the need for using the buddy system should be evaluated. If required, a buddy should be able to:

- Provide his/her partner with assistance;
- Observe his/her partner for signs of chemical or heat/cold exposure;
- Periodically check the integrity of his/her partner's protective clothing; and
- Notify the SHSO or others if emergency help is needed.

9.2 Personal Protection

This section describes the levels of protection, which will be required by onsite personnel during site activities.

9.2.1 General

The level of protection to be worn by field personnel and visitors will be defined and controlled by the SHSO and the PM. Where more than one hazard area is indicated, further definition shall be provided by review of site hazards, conditions, and operational requirements and by monitoring at the particular operation being conducted.

Intrusive activities (e.g., drilling, excavation activities, etc.) include any site activity which will, or potentially will, result in exposure(s) to hazardous or toxic chemicals or physical agents at or above the PEL, or to flammable or oxygen deficient atmospheres. Prior to commencing with any field activity, the potential for such conditions should be evaluated to determine air monitoring requirements. General procedures for air monitoring are described below.

During intrusive activities, continuous monitoring will be performed using the PID for relative concentrations of volatile organic compounds, and Dräeger tubes for initial and periodic measurements of benzene. Personnel monitoring utilizing activated charcoal tubes may also be performed in areas where high benzene concentrations were present during previous investigations.

The use of Dräeger tubes for benzene will allow the SHSO to make an immediate decision on the adequacy of protection against this compound. Should the PID or Dräeger tubes indicate that the action level for benzene has been exceeded, work will cease in this area until:

- Workers have donned a pressure-demand, self-contained breathing apparatus (Level B); or
- The concentration levels for benzene are below the Dräeger tube detection levels.

Based upon the results of intrusive activities in these worst case areas, the level of personnel protection will be established for the remainder of the site based upon previous sampling results. Protection may be upgraded or downgraded by the SHSO in conjunction with the PM based upon the PID instrument and Dräeger tube results.

All non-intrusive activities which preclude contact with contaminated media will be performed in Level D protection without continuous monitoring, unless periodic PID monitoring indicates additional monitoring is warranted. However, initial monitoring may be necessary utilizing the PID and the Dräger tubes and/or personnel monitoring (charcoal tubes).

9.2.2 Respiratory Protection and Clothing

Three levels of protective equipment are discussed below including Level D, Level C, and Level B.

Level D Protection

1. Personal Protective Equipment:

- Boots/shoes, leather or chemical-resistant, steel toe and shank;
- Boots (outer), chemical-resistant (disposable)*;
- Chemical resistant gloves – nitriles*;
- Chemical resistant clothing (e.g., Tyveks)*; or Tychem Fabrics, for additional information call (800) 558-9329 for specific fabrics and chemicals;
- Safety glasses or chemical splash goggles;
- Hard hat;
- Hearing protection; and
- Reflective traffic safety vest.

* Optional for activities except when handling petroleum product (i.e., well bailing) and materials (e.g., soil, sorbent products, etc.) exhibiting high degrees of petroleum contamination, or when performing other activities that warrant this equipment.

2. Criteria for Selection:

- Non-intrusive activities and intrusive activities in areas where the potential airborne hazards are substantially characterized and do not pose a threat of exposure in excess of one-half the PEL; and
- PID instrument (such as the MultiRAE 3000 or other comparable instrument) readings in the breathing zone are less than 5 ppm and benzene is not detectable utilizing colorimetric indicator tubes (e.g., Dräger tubes). Work functions preclude splashes, immersion, or potential for unexpected inhalation of any chemicals.

Notes: 1. Benzene may also be monitored initially and periodically in the breathing zone utilizing activated charcoal sampling devices.

2. Modifications of Level D will be used to increase or decrease the level of skin protection during activities which increase or preclude, respectively, the degree of contact with chemical hazards. Modifications for increased protection may include the use of chemical resistant coveralls (e.g., Tyveks) and chemical resistant gloves. Chemical resistant coveralls, gloves and boots will be used when handling petroleum products is required (i.e., well bailing). Any modifications of Level D will require approval of the SHSO and PM.

Level C Protection

1. Personal Protective Equipment:

- Full-face, air-purifying, cartridge-equipped respirator (Mine Safety and Health Administration/National Institute of Occupational Safety and Health [MSHA/ NIOSH] specifically approved for protection from organic vapors per OSHA 1910.1028);
- Chemical-resistant clothing (coverall; hooded, two-piece chemical splash suit; chemical-resistant hood and apron; disposable chemical-resistant coveralls);
- Cotton coveralls;
- Gloves (outer), chemical-resistant, nitriles;
- Gloves (inner), chemical-resistant, latex;
- Boots (inner), chemical-resistant, steel toe and shank;
- Boots (outer), chemical-resistant (disposable);
- Safety glasses or chemical splash goggles;
- Hard hat (face shield*);
- Hearing protection; and
- Escape mask*.

* Optional, or mandatory if required as referenced by the task-specific JSA

2. Criteria for Selection:

Meeting any of these criteria warrants use of Level C protection.

- Airborne hazards are known to be present but are unlikely to exceed protection factors provided by air purifying respirators;
- Continuous total organic vapor readings in the breathing zone register between 5 ppm and 25 ppm on a PID; tetrachloroethene and benzene readings utilizing colorimetric indicator tubes (e.g., Dräger or Sensidyne) are undetectable;
- Measured air concentrations of known organic vapors will be reduced by the respirator to at or below one half the permissible exposure limit, and the individual and combined compound concentrations are within the service limit of the respirator cartridge;
- Atmospheric contaminant concentrations do not exceed Immediately Dangerous to Life and Health (IDLH) concentrations;
- Atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect the small area of skin left unprotected by chemical-resistant clothing; and
- Job functions have been determined not to require self-contained breathing apparatus.

Notes:

1. Benzene may also be monitored initially and periodically in the breathing zone utilizing activated charcoal sampling devices.
2. Modifications of Level C will be used to increase or decrease the level of skin protection during activities which increase or preclude, respectively, the degree of contact with chemical hazards. Modifications for increased protection may include the use of chemical resistant coveralls (e.g., Tyveks) and chemical resistant gloves. Any modifications to Level C will require approval of the SHSO and PM.

Level B Protection

1. Personal Protection Equipment:

- Pressure-demand, self-contained breathing apparatus (MSHA/NIOSH approved);
- Chemical-resistant clothing (overall and long-sleeved jacket; coveralls; hooded, one or two-piece chemical-splash suit; disposable chemical-resistant coveralls);
- Cotton coveralls;
- Gloves (outer), chemical-resistant, nitriles;
- Gloves (inner), chemical-resistant, latex;
- Boots (inner), chemical-resistant, steel toe and shank;
- Boots (outer), chemical-resistant, (disposable);
- Hard hat (face shield);

- Hearing protection; and
- 2-way radio communications (intrinsically safe).

2. Criteria for Selection:

Meeting any one of these criteria warrants use of Level B protection:

- PID instrument readings in the breathing zone are greater than 25 ppm and less than 500 ppm of tetrachloroethene or benzene is detectable utilizing colorimetric indicator tubes (e.g., Dräger or Sensidyne);
- Airborne hazards are known to be present, but are not identified or quantified;
- The type(s) and atmospheric concentration(s) of toxic substance(s) have been identified and require the highest level of respiratory protection, but a lower level of skin and eye protection. These would be atmospheres:
 - With IDLH concentrations;
 - Exceeding limits of protection afforded by a full-face, air-purifying respirator; or
 - Containing substances requiring supplied-air PPE, but substances and/or concentrations do not represent a serious skin hazard.
- The atmosphere contains less than 19.5% oxygen;
- Site operations make it highly unlikely that the small, unprotected arc of the head or neck will be contacted by splashes of extremely hazardous substances; and
- If work is performed in an enclosed space.

Action Levels for Respiratory Protection

Organic Vapor Concentrations			
PID ¹	Tetrachloroethene ²	Benzene ²	Action ³
< 5 ppm	Non-detect	Non-detect	No Action
5 ppm - < 25 ppm	Non-detect	Non-detect	Level C
5 ppm - < 25 ppm	Detected	Detected	Level B
25 ppm - < 100 ppm	Non-detect	Non-detect	Level B
25 ppm - < 100 ppm	Detected	Detected	Level B

¹ Based on relative response/sensitivity of PID to benzene.

² Colorimetric indicator tube readings.

³ Measured air concentrations of known organic vapors will be reduced by the respirator to at or below one half the permissible exposure limit, and the individual and combined compound concentrations are within the service limit of the respirator cartridge.

Action Levels for Oxygen Levels and Combustible Gases

Combustible Gases ¹	
2.0 - 10.0% LEL	Continue monitoring
10.0 - 19.0% LEL	Notify SHSO
20.0% LEL or greater	Potential explosion hazard Interrupt task/Evacuate area
Oxygen ¹	
20.8% O ₂	Oxygen level normal
< 20.8 O ₂ - > 19.5% O ₂	Oxygen deficient - Notify SHSO
< 19.5% O ₂	Oxygen deficient Interrupt task/Evacuate area

¹ Action levels based on USEPA Standard Operating Safety Guides; Table 5-1, Atmospheric Hazard Action Guides.

9.2.3 Safety Equipment

Basic emergency and first aid equipment will be available at the work vehicle, Support Zone and/or the CRZ as appropriate. This shall include first aid kit, emergency eyewash, fire extinguishers, and other safety-related equipment.

Field personnel will be notified of the locations of emergency and first aid equipment prior to commencing with field activities.

9.3 Decontamination Procedures

A steam cleaner will be utilized to decontaminate heavy equipment used in drilling. Personnel should exercise caution when using a steam cleaner. The high pressure steam can cause burns. Protective gloves, face shields, hard hats, steel-toed boots, and Tyvek suits or rain gear will be worn when using steam cleaners.

9.3.1 Contamination Prevention

Adequate contamination prevention should minimize worker exposure and help ensure valid sample results by precluding cross-contamination. Procedures for contamination avoidance include the following.

Personnel

- Do not walk through areas of obvious or known contamination;
- Do not handle contaminated materials directly;
- Make sure all PPE has no cuts or tears prior to donning;
- Fasten all closures on suits, covering with tape, if necessary;
- Take particular care to protect any skin injuries;
- Stay upwind of airborne contaminants;
- Do not carry cigarettes, gum, etc., into contaminated areas; and
- Use disposables to cover non-disposable equipment when contact is probable.

Sampling/Monitoring

- When required by the SHSO, cover instruments with clear plastic, leaving opening for sampling and exhaust ports; and
- Bag sample containers prior to the placement of sample material.

Heavy Equipment

- Care should be taken to limit the amount of contamination that comes in contact with heavy equipment;
- If contaminated tools are to be placed on non-contaminated equipment for transport to the decontamination pad, plastic should be used to keep the equipment clean; and
- Excavated soils should be contained and kept out of the way of workers.

9.3.2 Decontamination

All personnel and equipment exiting the Work Zone shall be thoroughly decontaminated. Figures 2, 3, and 4 illustrate decontamination procedures for Levels B, C, and D, respectively. Safety briefings shall explain the decontamination procedures for personnel and portable

equipment for the various levels of protection. Heavy equipment will be decontaminated with a steam cleaner.

9.3.3 Disposal Procedures

All discarded materials, waste materials, or other objects shall be handled in such a way as to preclude the potential for spreading contamination, creating a sanitary hazard, or causing litter to be left at Site B or Site D. All potentially contaminated materials (e.g., soil, clothing, gloves, etc.) will be bagged or drummed, as necessary, and segregated for disposal. All contaminated materials shall be disposed of in accordance with appropriate regulations. All non-contaminated materials shall be collected and bagged for appropriate disposal as normal domestic waste. All waste disposal operations conducted by Roux Associates will be monitored by the SHSO and carried out under the appropriate level of personal protection.

9.4 Waste Disposal

All waste disposal operations shall be monitored by the SHSO and performed using the appropriate level of personal protection. Personnel shall wear the prescribed clothing, especially eye protection and chemical resistant gloves, when handling or drumming waste materials. Contamination avoidance shall be practiced at all times.

10.0 EMERGENCY PLAN

As a result of the hazards onsite and the conditions under which operations are conducted, the possibility of an emergency exists. An emergency plan is required by 29 CFR 1910.120 to be available for use and is included below. A copy of this plan shall be posted in the Support Zone at each work site.

10.1 Site B and Site D Emergency Coordinator(s)

The SHSO shall act as the Site B and Site D Emergency Coordinator to make contact with the local fire, police, and other emergency units prior to beginning work onsite. In these contacts, the SHSO will inform the emergency units about the nature and duration of work expected at Site B or Site D and the type of contaminants and possible health or safety effects of emergencies involving these contaminants.

The SHSO or his designee shall implement this emergency plan whenever conditions at Site B or Site D warrant such action. The coordinator(s) will be responsible for assuring the evacuation, emergency treatment, emergency transport of personnel as necessary, and notification of emergency response units and the appropriate management staff.

10.2 Evacuation

In the event of an emergency situation, such as fire, explosion, significant release of particulates, etc., an air horn, or other appropriate device will be sounded by the SHSO for approximately ten seconds indicating the initiation of evacuation procedures. All persons in both the restricted and non-restricted areas will evacuate and assemble near the Support Zone or other safe area as identified in advance by the SHSO. Under no circumstances will incoming personnel or visitors be allowed to proceed into the evacuated area once the emergency signal has been given. The SHSO must see that access for emergency equipment is provided and that all combustible apparatus has been shut down once the alarm has been sounded. Once the safety of all personnel is established, the fire department and other emergency response groups will be notified by telephone of the emergency. The hospital route will be posted onsite (Figure 1). Any other evacuation routes will be specified by the appropriate emergency personnel.

10.3 Potential or Actual Fire or Explosion

If the potential for a fire exists or if an actual fire or explosion occurs, the following procedure will be implemented:

- immediately evacuate the Work Zone as described above (Section 10.2); and
- notify fire department and security.

10.4 Environmental Incident (Release or Spread of Contamination)

The SHSO shall instruct a person onsite to immediately contact police and fire authorities to inform them of the possible or immediate need for nearby evacuation. If a significant release (above the reportable quantity as described in 40 CFR 302) has occurred, the National Response Center and other appropriate groups should be contacted. Those groups will alert National or Regional Response Teams as necessary. The personnel listed below shall be notified as necessary.

Type	Name	Telephone Numbers
Police	New York City Police Department	718-963-5311 or 911
Fire	New York City Fire Department	718-636-1700 or 911
Hospital (Emergency)	Woodhull Medical Center	718-963-8000 or 911
Occupational Health Clinic (Non-Emergency)	Health Source Medical Service	631-435-0110 631-435-4394
National Response Center (Release or Spill)		800-424-8802
Poison Control Center		800-222-1222
Site Health and Safety Officer	TO BE ANNOUNCED Roux Associates, Inc.	631-232-2600 (office)
Roux Associates' Corporate Health and Safety Manager	Joseph Gentile, CIH Roux Associates, Inc.	856-423-8800 (office) 610-844-6911 (cell)
Roux Associates' Office Health and Safety Manager	Ray Fitzpatrick Roux Associates, Inc.	631-630-2347 (office) 631-484-1168 (cell)
Roux Associates' Project Manager	Wai Kwan, Ph.D., P.E. Roux Associates, Inc.	631-232-2600 (office) 917-902-1108 (cell)
Pfizer Inc's Project Manager	Matthew Basso, CHMM Pfizer Inc	908-901-7096 (office) 862-596-3423 (cell)

10.5 Personal Injury

Emergency first aid shall be applied onsite as deemed necessary to stabilize the patient. Notify the emergency units as deemed necessary.

10.6 Overt Personnel Exposure

If an overt exposure to toxic materials should occur, the exposed person shall be treated onsite as follows:

Skin Contact:	Wash/rinse affected area thoroughly with copious amounts of soap and water, and then provide appropriate medical attention. An eyewash and/or emergency shower or drench system will be provided onsite at the CRZ and/or support zone, as appropriate. Eyes should be rinsed for at least fifteen (15) minutes upon chemical contamination.
Inhalation:	Move to fresh air and/or if necessary, decontaminate and transport to the hospital.
Ingestion:	Decontaminate and transport to emergency medical facility.
Puncture Wound or Laceration:	Decontaminate and transport to emergency medical facility. SHSO will provide medical data sheets to medical personnel as requested. The onsite first aid kit will include sterile materials to control bleeding en route to the hospital.

10.7 Adverse Weather Conditions

In the event of adverse weather conditions, the SHSO will determine if work can continue without sacrificing the health and safety of field workers. Some of the items to be considered prior to determining if work should continue are:

- Heavy rainfall;
- Potential for heat stress;
- Potential for cold stress and cold-related injuries;
- Limited visibility;
- Potential for electrical storms;
- Potential for malfunction of health and safety monitoring equipment or gear; and
- Potential for accidents.

11.0 AUTHORIZATIONS

Personnel authorized to enter Site B and Site D while operations are being conducted must be approved by the SHSO and the Project Manager. This document will be completed when the subcontractors have assigned trained personnel for Site B and Site D. Authorization will require completion of appropriate training courses, medical examination requirements as specified by 29 CFR 1910.120, and review and sign-off of this HASP.

The following Roux Associates personnel are authorized to perform work onsite:

1. Joseph Gentile
2. Charles McGuckin
3. Wai Kwan
4. Jordanna Kendrot
5. Ray Fitzpatrick
6. TO BE ANNOUNCED

Pfizer Inc personnel authorized to enter Site B and Site D are:

1. Matthew Basso
2. TO BE ANNOUNCED

12.0 FIELD TEAM REVIEW

Each person entering Site B and Site D and each field member shall sign this section after site-specific training is completed and before being permitted to work onsite.

I have read and understand this site-Specific Health and Safety Plan. I will comply with the provision contained therein.

Site Task: _____

13.0 APPROVAL PAGE

The Approval Page must be attached and signed by the SHSO, OHSM, Project Manager, and Project Principal.

By their signature, the undersigned certify that this HASP is approved and will be utilized by Roux Associates, Inc. personnel at Site B and Site D, Brooklyn, New York.

Site Health and Safety Officer

Date

Office Health and Safety Manager

Date

Project Manager

Date

Project Principal

Date

Health and Safety Plan

TABLE

Toxicological, Physical and Chemical Properties of
Compounds Potentially Present at Site B and Site D
Pfizer Inc, Brooklyn, New York

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at Pfizer Site B and Site D

Compound	CAS #	TLV	IDLH	PEL	Routes of Exposure	Toxic Properties	Target Organs	Physical/Chemical Properties
Benzene	71-43-2	1.6 mg/m ³ 0.5 ppm	Ca (ND)	1 ppm	Dermal; inhalation; ingestion	CNS depression Hematopoietic depression Dermatitis	CNS blood skin eyes resp system bone marrow	Liquid (solid below 42°F) BP: 80.093°C flammable LEL: 1.4% UEL: 8.0%
Carbon Monoxide	630-08-0	25 ppm	1,200 ppm	50 ppm	Inhalation	Carboxyhemogloemia	Blood	Colorless, odorless gas
Chromium (VI)	7440-47-3	0.05 mg/m ³ (water soluble) 0.01 mg/m ³ (insoluble)	(ND)	None	Dermal; inhalation; ingestion	Nasal and lung tumors Sensory irritant	lungs eyes skin	Red, rhombic crystals
Diesel Fuel	68334-30-5	100 mg/m ³	NA	NA	Dermal; inhalation	Resp irritation Dizziness, nausea Skin disorders Liver disorders	lungs CNS skin liver	Light amber liquid Fl.Pt = >100°F LEL = 0.6% UEL = 7.0%
Ethylbenzene	100-41-4	434 mg/m ³ 100 ppm (may lower to 20 ppm)	800 ppm (10% LEL)	435 mg/m ³ 100 ppm	Dermal; inhalation; ingestion	Sensory irritant CNS depressant Narcosis Hematological disorders	eyes skin CNS respiratory system blood	Liquid aromatic odor BP: 277°F Fl.P: 59°F LEL: 1.2% UEL: 7.0%
Fuel Oil	68476-33-5	NA	None	NA	Dermal; inhalation; ingestion	Skin cancer Liver damage Blood disorders	skin liver bone marrow	Dark liquid LEL = 1.0% UEL = 3.0% Fl.Pt = >140°F
Gasoline	8006-61-9	300 ppm 890 mg/m ³ carcinogen	carcinogen	900 mg/m ³ 300 ppm	Dermal; inhalation; ingestion	CNS depression Sensory irritant Dermatitis Pulmonary Edema	CNS eyes skin resp system	Liquid, aromatic Fl.Pt = -50°F

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at Pfizer Site B and Site D

Kerosene	8008-20-6	200 mg/m ³	NA	NA	Dermal; inhalation	Eye/skin irritation Resp. irritation Dizziness, nausea	eyes skin resp. system CNS	yellow to white oily liquid Fl.Pt = >100-162°F LEL = 0.7% UEL = 5.0%
Lead	7439-92-1	0.05 mg/m ³	700 100 mg/m ³	0.05 mg/m ³	Dermal; inhalation; ingestion	Abdominal pain CNS depressant Anemia Nephropathy Reproductive effects	GI tract CNS blood kidneys	Metal - soft gray BP: 3164°F
Mercury vapor (Elemental)	7439-97-6	0.025 (skin)	28 mg/m ³	0.05 (skin)	Dermal; inhalation; ingestion	Tremor Insomnia Chest pain GI disturbance Eye irritant Skin irritant	skin resp system CNS kidneys eyes	Silver, white, odorless liquid BP = 674°F
Petroleum hydrocarbons (Petroleum distillates)	8002-05-9	N/A	1,100 ppm	2,000 mg/m ³ 500 ppm	Dermal; inhalation; ingestion	CNS depressant Respiratory irritant Dried/cracked skin	CNS respiratory tract skin	Colorless liquid BP: 86-460°F UEL: 5.9% LEL: 1.1% flammable
Slop Oil	68477-26-9	NA	NA	NA	Dermal	Eye irritation Skin irritation	eyes skin	Dark liquid Fl.Pt = >300°F LEL = 0.6% UEL = 7.0%
Tetrachloroethene	127-18-4	TWA 25 ppm STEL 100 ppm (STEL) listed as A3, animal carcinogen	Ca [150 ppm]	TWA 100 ppm C 200 ppm (for 5-min. in any 3-hour period), with a maximum peak of 300 ppm	Dermal; inhalation; ingestion	Irritation eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, incoordination; headache, drowsiness; skin erythema (skin redness); liver damage; [potential occupational carcinogen]	Eyes, skin, respiratory system, liver, kidneys, central nervous system	Colorless liquid with a mild, chloroform-like odor. BP: 250°F Noncombustible Liquid

Table 1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at Pfizer Site B and Site D

Toluene	108-88-3	75 mg/m ³ 20 ppm	500 ppm	200 ppm	Dermal; inhalation; ingestion	CNS depression Liver damage Kidney damage Defatting of skin	CNS liver kidney skin	Liquid benzene odor BP: 110.4°C flammable LEL: 1.2% UEL: 7.1%
Xylene(s)	1330-20-7	434 mg/m ³ 100 ppm	900 ppm	435 mg/m ³ 100 ppm	Dermal; inhalation; ingestion	Sensory irritant Blood dyscrasia Bronchitis CNS depression	CNS eyes skin GI tract blood liver kidneys	Liquid Aromatic odor BP: 138.5° flammable LEL: 1.1% UEL: 7.0%

Notes:

Ca – Carcinogen
TLV – Threshold Limit Value, as 8-hr. time-weighted averages (ACGIH)
IDLH – Immediately Dangerous to Life and Health (OSHA)
PEL – Permissive Exposure Level (OSHA)
PPM – Parts per million
mg/m³ – milligrams per cubic meter
Fl. Pt. – Flash point
LEL – Lower Explosive Level
UEL – Upper Explosive Level
BP – Boiling Point
NA – Not Available
ND – Not Determined

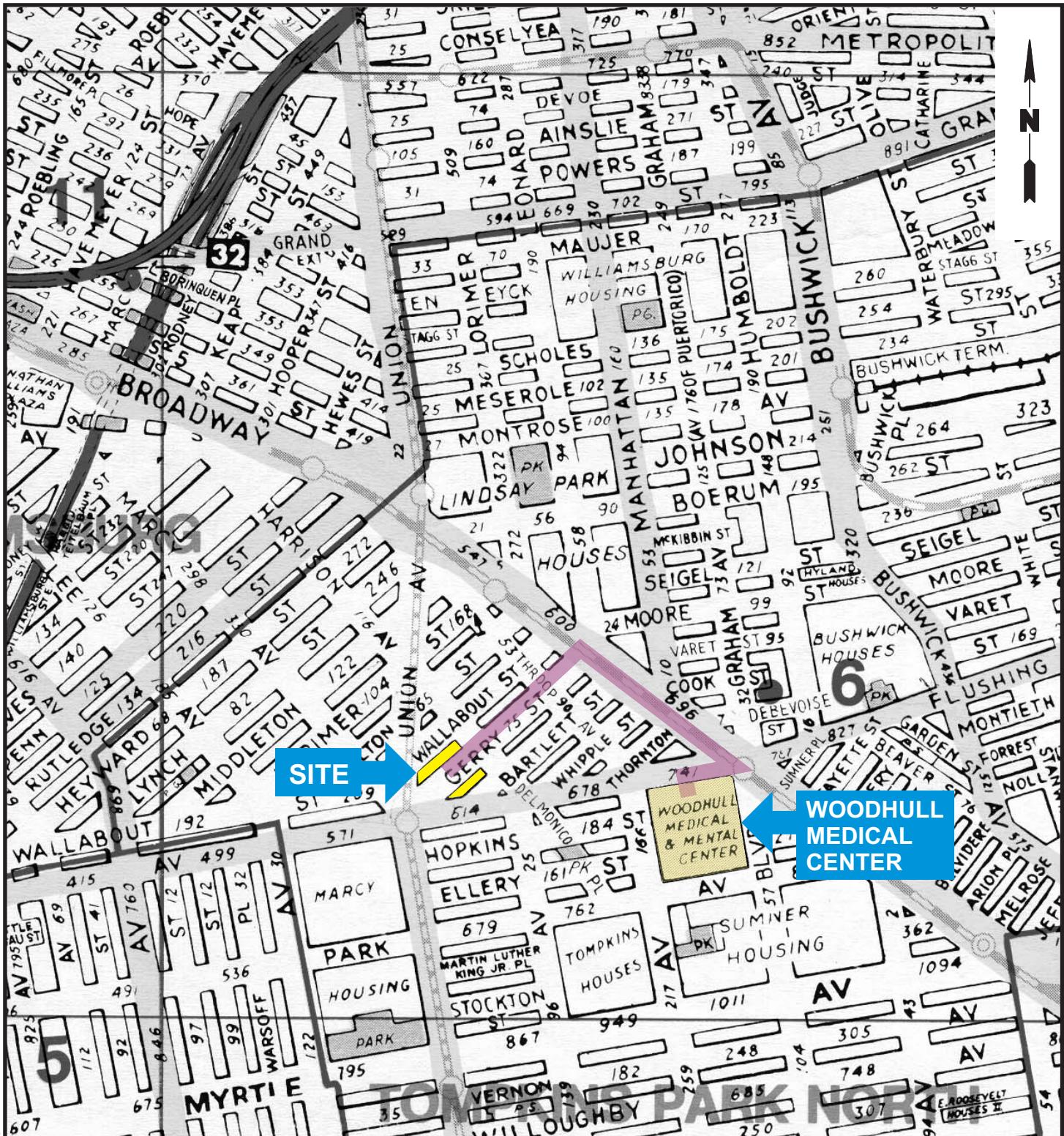
References:

2010 TLVs® and BEIs®. American Conference of Governmental Industrial Hygienists.
Hawley's Condensed Chemical Dictionary, Sax, N. Van Nostrand and Reinhold Company, 11th Edition, 1987.
Occupational Safety and Health Administration, 1993. General Industry Air Contaminant Standard (2a CFR 1910.1000).
Proctor, N.H., J.P. Hughes and M.L. Fischman, 1989. Chemical Hazards of the Workplace. Van Nostrand Reinhold. New York.
Sax, N.I. and R.J. Lewis, 1989. Dangerous Properties of Industrial Materials. 7th Edition. Van Nostrand Reinhold. New York.
U.S. Department of Health and Human Services, 1997. NIOSH Pocket Guide to Chemical Hazards.

Health and Safety Plan

FIGURES

1. Hospital Route from Pfizer Site B and Site D
2. Typical Decontamination Layout – Level B Protection
3. Typical Decontamination Layout – Level C Protection
4. Typical Decontamination Layout – Level D Protection



ROUTE TO HOSPITAL

DIRECTIONS TO WOODHULL MEDICAL CENTER:

GO DOWN GERRY STREET AND TURN RIGHT ON BROADWAY. TAKE BROADWAY APPROXIMATELY FOUR BLOCKS, WOODHULL MEDICAL CENTER IS ON THE RIGHT HAND SIDE.

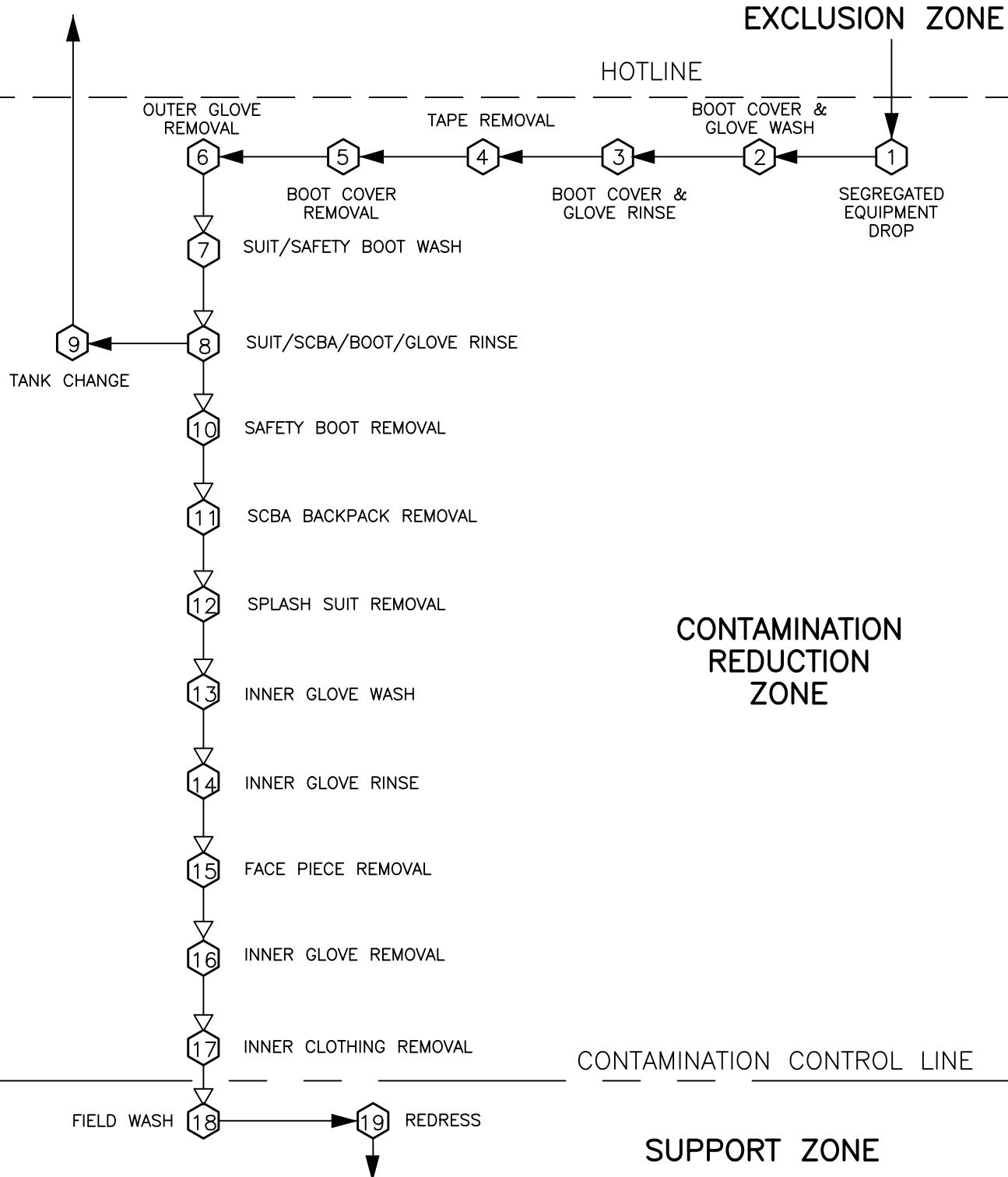
Title:

ROUTE TO WOODHULL MEDICAL CENTER

SITE B AND SITE D OU-1
HEALTH AND SAFETY PLAN

Prepared for:

PFIZER INC
BROOKLYN, NEW YORK



Title: **TYPICAL DECONTAMINATION LAYOUT
LEVEL B PROTECTION**

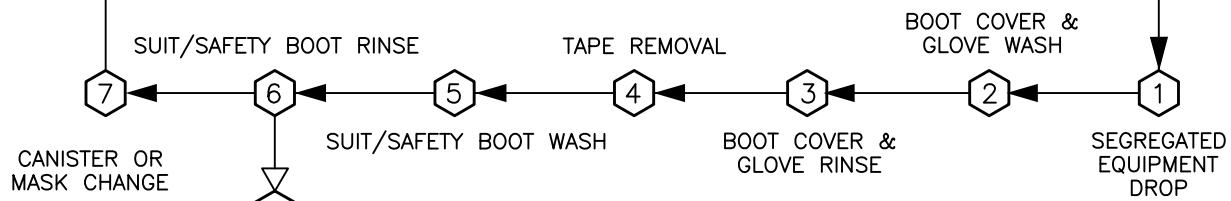
SITE B AND SITE D OU-1
HEALTH AND SAFETY PLAN

Prepared For: **PFIZER INC
BROOKLYN, NEW YORK**

ROUX ROUX ASSOCIATES, INC. Environmental Consulting and Management	Compiled by: W.K. Date: 02NOV11	FIGURE 2
	Prepared by: J.A.D. Scale: NOT TO SCALE	
	Project Mgr: W.K. Project: 0047.0044Y036	
	File: 0047.0044Y524R.08.DWG	

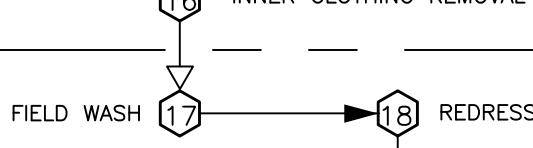
EXCLUSION ZONE

HOTLINE

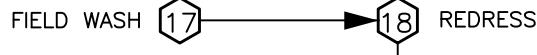


CONTAMINATION REDUCTION ZONE

CONTAMINATION CONTROL LINE



SUPPORT ZONE



Title:

TYPICAL DECONTAMINATION LAYOUT LEVEL C PROTECTION

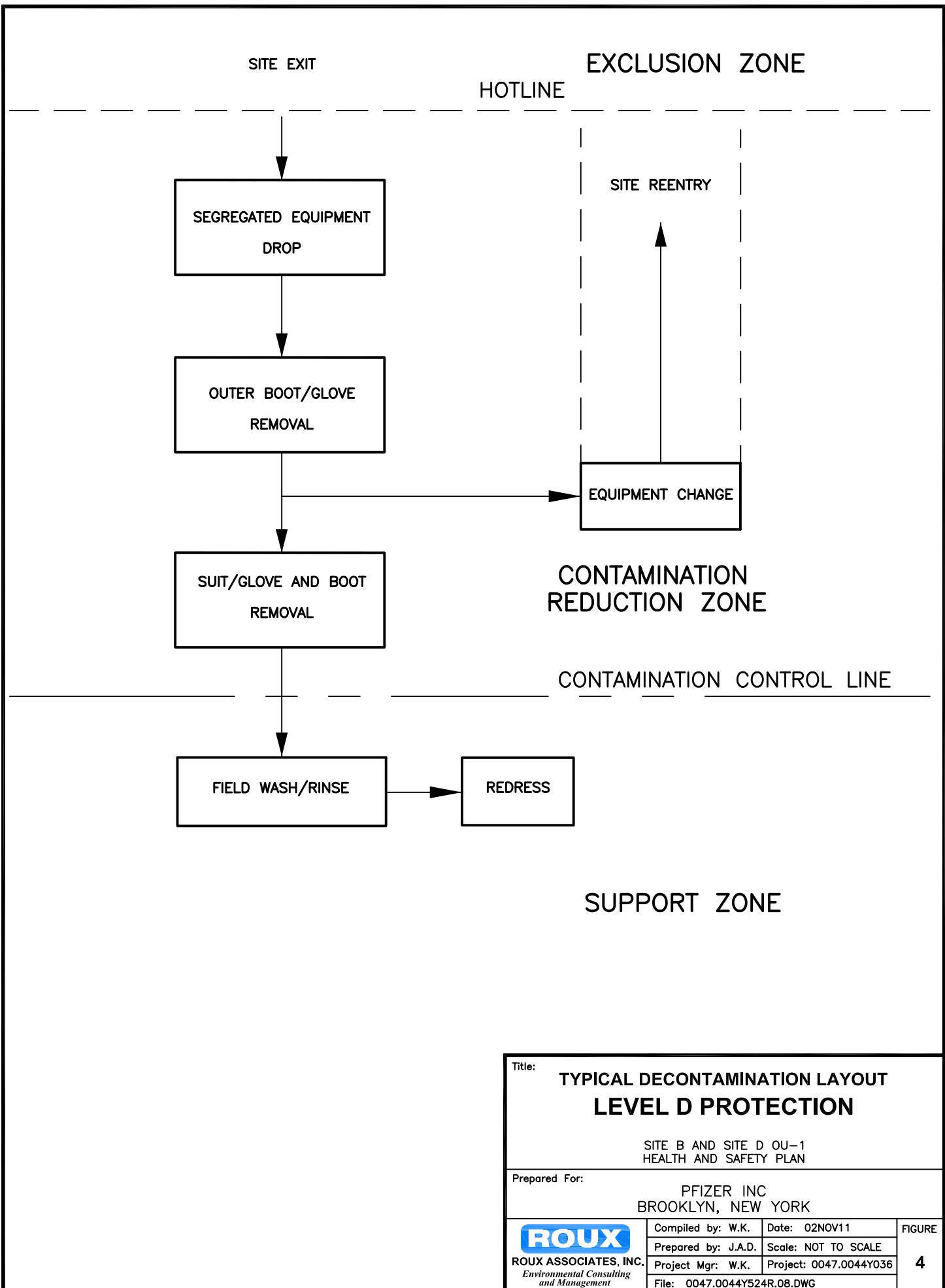
SITE B AND SITE D OU-1
HEALTH AND SAFETY PLAN

Prepared For:

PFIZER INC
BROOKLYN, NEW YORK

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting
and Management

Compiled by: W.K.	Date: 02NOV11	FIGURE 3
Prepared by: J.A.D.	Scale: NOT TO SCALE	
Project Mgr: W.K.	Project: 0047.0044Y036	
File: 0047.0044Y524R.08.DWG		



Health and Safety Plan

APPENDICES

- A. Health and Safety Briefing/Tailgate Meeting Form
- B. Job Safety Analysis Forms
- C. Health and Safety Field Change Request
- D. Occupational Health Clinic and Hospital Directions
- E. Acord Automobile Loss Notice Form
- F. Health and Safety Lessons Learned/Accident Report Forms
- G. Medical Data Sheet

Health and Safety Plan

APPENDIX A

Health and Safety Briefing/ Tailgate Meeting Form

HEALTH AND SAFETY BRIEFING / TAILGATE MEETING FORM

Site Name / Location _____

Date: _____ Weather Forecast: _____

Names of Personnel Attending Briefing

Planned Work

Items Discussed

Work Permit Type and
Applicable Restrictions:

Signatures of Attending Personnel

Health and Safety Plan

APPENDIX B

Job Safety Analysis Forms

Pfizer Site B and Site D
JOB SAFETY ANALYSIS FORM (JSA)

COMPANY/ PROJECT NAME or ID/ LOCATION (City, State) Pfizer Site B and Site D, Brooklyn, NY		DATE	<input checked="" type="checkbox"/> NEW <input type="checkbox"/> REVISED	PAGE 1 of _____ Roux Control No.: _____
WORK ACTIVITY (Description):				
DEVELOPMENT TEAM	POSITION / TITLE	REVIEWED BY:	POSITION / TITLE	
MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT (SEE CRITICAL ACTIONS FOR TASK-SPECIFIC REQUIREMENTS)				
<input type="checkbox"/> REFLECTIVE VEST <input type="checkbox"/> HARD HAT <input type="checkbox"/> LIFELINE / HARNESS <input type="checkbox"/> SAFETY GLASSES	<input type="checkbox"/> GOGGLES <input type="checkbox"/> FACE SHIELD <input type="checkbox"/> HEARING PROTECTION <input type="checkbox"/> SAFETY SHOES _____	<input type="checkbox"/> AIR PURIFYING RESPIRATOR <input type="checkbox"/> SUPPLIED RESPIRATOR <input type="checkbox"/> PPE CLOTHING _____	<input type="checkbox"/> GLOVES <input type="checkbox"/> OTHER _____	
¹JOB STEPS	²POTENTIAL HAZARDS	³CRITICAL ACTIONS TO MITIGATE HAZARDS		
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				

¹ Each Job or Operation consists of a set of steps. Be sure to list all the steps in the sequence that they are performed. Specify the equipment or other details to set the basis for the associated hazards in Column 2

² A hazard is a potential danger. What can go wrong? How can someone get hurt? Consider, but do not limit, the analysis to: **Contact** - victim is struck by or strikes an object; **Caught** - victim is caught on, caught in or caught between objects; **Fall** - victim falls to ground or lower level (includes slips and trips); **Exertion** - excessive strain or stress / ergonomics / lifting techniques; **Exposure** - inhalation/skin hazards. Specify the hazards and do not limit the description to a single word such as "Caught"

³ Aligning with the first two columns, describe what actions or procedures are necessary to eliminate or minimize the hazards. Be clear, concise and specific. Use objective, observable and quantified terms. Avoid subjective general statements such as, "be careful" or "use as appropriate".

Health and Safety Plan

APPENDIX C

Health and Safety Field Change Request

HEALTH AND SAFETY FIELD CHANGE REQUEST FORM

SITE SAFETY REVIEW – CHANGES AND OVERALL EVALUATION (To Be Completed For Each Field Change In Plan)

Was the Safety Plan followed as presented? Yes No

Describe, in detail, all changes to the Safety Plan:

Reasons for changes:

Follow-Up, Review and Evaluation Prepared by _____ Date _____

Discipline _____

Approved by: Site Manager _____ Date _____

Site Safety Officer _____ Date _____

Approved by: Office Health & Safety Manager _____ Date _____

Evaluation of Site Safety Plan:

Was the Safety Plan adequate? Yes No

What changes would you recommend?

Health and Safety Plan

APPENDIX D

Occupational Health Clinic and Hospital Directions

APPENDIX D

Emergency Information and Directions to the Occupational Health Clinic and Hospital from Pfizer Site B and Site D, Gerry Street, Brooklyn, New York

EMERGENCY CONTACTS:

Type	Name	Telephone Numbers
Police	New York City Police Department	(718) 963-5311 or 911
Fire	New York City Fire Department	(718) 636-1700 or 911
Hospital	Woodhull Medical Center	(718) 963-8000 or 911
Occupational Health Clinic	Health Source Medical Service	(631) 435-0110 (631) 758-3100
State Poison Control Centers	New York	(800) 222-1222
Emergency Response		911
Ambulance		911
Roux Associates' Corporate Health and Safety Manager	Joseph Gentile, CIH Roux Associates, Inc.	(856) 423-8800 (office) (610) 844-6911 (cell)
Roux Associates' Project Manager	Wai Kwan, Ph.D., P.E. Roux Associates, Inc.	(631) 232-2600 (office) (917) 902-1108 (cell)

DIRECTIONS TO THE OCCUPATIONAL HEALTH CLINIC (OHC)

Health Source Medical Service

3001 Expressway Drive North, Suite 200C
Islandia, New York 11749
Contact: Shannon Olweck

Email: shannonolweck@healthsourceli.com

Phone: (631) 435-0110 and (631) 435-4394

Hours: Monday – Wednesday: 9 AM to 5 PM
Thursday: 9 AM to 7 PM
Friday: 9 AM to 5 PM

Alternative Clinic

Health Source Medical Service
1743 North Ocean Avenue
Medford, New York 11763
Contact: Carol Mancine or "Wendy"

Email: carolmancine@healthsourceli.com

Phone: (631) 758-3100

Hours: Mon, Tues, and Thurs: 9 AM to 6:30 PM
Wednesday and Friday: 9 AM to 4 PM
Saturday: 9 AM to 3 PM

DIRECTIONS FROM THE SITE TO THE OHC ARE LOCATED BELOW:

1. Head northeast on Gerry Street toward Throop Avenue 0.1 mi
2. Turn right onto Broadway 0.2 mi
3. Turn left onto Flushing Avenue 2.7 mi
4. Continue onto Grand Avenue 0.3 mi
5. Slight right onto Borden Avenue 0.4 mi
6. Take the I-495 E/L I Expressway ramp on the left to Eastern L I 0.6 mi
7. Slight left onto I-495 E 38.0 mi
8. Take exit 57 toward NY-454/Commack/Patchogue 0.1 mi
9. Merge onto Express Dr S/Long Island Expressway South Service Road 394 ft
10. Turn left onto Long Island Motor Parkway 0.4 mi
11. Turn right onto NY-454 E 0.3 mi
12. Take 1st right onto Long Island Expressway N Service Rd 0.2 mi

Destination will be on right

The approximate driving time from the site to the OHC is **1 hour 3 minutes** (43.4 miles).

DIRECTIONS TO THE HOSPITAL

The nearest Hospital to the site is:

Woodhull Medical Center
760 Broadway
Brooklyn, New York
(718) 963-8000 or 911

**DIRECTIONS FROM THE SITE TO THE HOSPITAL ARE LOCATED BELOW
(Map depicting route provided as Figure 1)**

1. Head northeast on Gerry Street toward Throop Avenue 0.1 mi
2. Turn right onto Broadway Destination will be on the right 0.2 mi

The approximate driving time from the site to the hospital is **2 minutes** (0.4 miles).

Health and Safety Plan

APPENDIX E

Acord Automobile Loss Notice Form



AUTOMOBILE LOSS NOTICE

DATE (MM/DD/YYYY)

AGENCY		INSURED LOCATION CODE	DATE OF LOSS AND TIME	
The Treiber Group AJ Gallagher Risk Mgmt Svcs 377 Oak Street Garden City, NY 11530				AM PM
CONTACT NAME: Teresa Garzia		CARRIER		NAIC CODE
PHONE (A/C, No, Ext): 516.622.2418		Great Divide Insurance Company		25224
FAX (A/C, No): 516.622.2618		POLICY NUMBER		
E-MAIL ADDRESS: teresa_garzia@ajg.com		BAP1549799-11		
CODE:	SUBCODE:	POLICY TYPE		
AGENCY CUSTOMER ID: ROUXASSO		Commercial Automobile		

INSURED

NAME OF INSURED (First, Middle, Last)			INSURED'S MAILING ADDRESS	
Roux Associates, Inc.			Susan Sullivan, General Counsel, Roux Associates, Inc. 209 Shafter Street Islandia, NY 11749	
DATE OF BIRTH	FEIN (if applicable)	MARITAL STATUS / CIVIL UNION (if applicable)		
	11-2579482			
PRIMARY PHONE #	<input type="checkbox"/> HOME <input checked="" type="checkbox"/> BUS <input type="checkbox"/> CELL	SECONDARY PHONE #	<input type="checkbox"/> HOME <input type="checkbox"/> BUS <input type="checkbox"/> CELL	PRIMARY E-MAIL ADDRESS: LegalDept@rouxinc.com
631.232.2600			SECONDARY E-MAIL ADDRESS: Fax Notice of Loss to: 631.232.1525	

CONTACT

NAME OF CONTACT (First, Middle, Last)			CONTACT'S MAILING ADDRESS	
Susan Sullivan, General Counsel			Susan Sullivan, General Counsel, Roux Associates, Inc. 209 Shafter Street Islandia, NY 11749	
PRIMARY PHONE #	<input type="checkbox"/> HOME <input checked="" type="checkbox"/> BUS <input type="checkbox"/> CELL	SECONDARY PHONE #	<input type="checkbox"/> HOME <input type="checkbox"/> BUS <input type="checkbox"/> CELL	PRIMARY E-MAIL ADDRESS: LegalDept@rouxinc.com
631.232.2600			SECONDARY E-MAIL ADDRESS: Fax Notice of Loss to: 631.232.1525	
WHEN TO CONTACT				

LOSS

LOCATION OF LOSS		POLICE OR FIRE DEPARTMENT CONTACTED	
STREET:			
CITY, STATE, ZIP:		REPORT NUMBER	
COUNTRY:			
DESCRIBE LOCATION OF LOSS IF NOT AT SPECIFIC STREET ADDRESS:			
DESCRIPTION OF ACCIDENT (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)			

INSURED VEHICLE

VEH #	YEAR	MAKE:	BODY TYPE:	PLATE NUMBER	STATE	
		MODEL:	V.I.N.:			
OWNER'S NAME AND ADDRESS <input type="checkbox"/> (Check if same as insured)				PRIMARY PHONE # <input type="checkbox"/> HOME <input type="checkbox"/> BUS <input type="checkbox"/> CELL	SECONDARY PHONE # <input type="checkbox"/> HOME <input type="checkbox"/> BUS <input type="checkbox"/> CELL	
				PRIMARY E-MAIL ADDRESS:		
				SECONDARY E-MAIL ADDRESS:		
DRIVER'S NAME AND ADDRESS <input type="checkbox"/> (Check if same as owner)				PRIMARY PHONE # <input type="checkbox"/> HOME <input type="checkbox"/> BUS <input type="checkbox"/> CELL	SECONDARY PHONE # <input type="checkbox"/> HOME <input type="checkbox"/> BUS <input type="checkbox"/> CELL	
				PRIMARY E-MAIL ADDRESS:		
				SECONDARY E-MAIL ADDRESS:		
RELATION TO INSURED (Employee, family, etc.)		DATE OF BIRTH	DRIVER'S LICENSE NUMBER	STATE	PURPOSE OF USE	USED WITH PERMISSION? (Y/N) <input type="checkbox"/>

DESCRIBE DAMAGE

1. WAS A STANDARD CHILD PASSENGER RESTRAINT SYSTEM (CHILD SEAT) INSTALLED IN THE VEHICLE AT THE TIME OF THE ACCIDENT?		Y / N
2. WAS THE CHILD PASSENGER RESTRAINT SYSTEM (CHILD SEAT) IN USE BY A CHILD DURING THE TIME OF THE ACCIDENT?		Y / N
3. DID THE CHILD PASSENGER RESTRAINT SYSTEM (CHILD SEAT) SUSTAIN A LOSS AT THE TIME OF THE ACCIDENT?		Y / N
ESTIMATE AMOUNT:	WHERE CAN VEHICLE BE SEEN?:	WHEN CAN VEHICLE BE SEEN?:
OTHER INSURANCE ON VEHICLE - CARRIER:		POLICY NUMBER:

OTHER VEHICLE / PROPERTY DAMAGED

NON - VEHICLE?

AGENCY CUSTOMER ID: ROUXASSO

VEH #	YEAR	MAKE: MODEL:	BODY TYPE: V.I.N.:	PLATE NUMBER		STATE	
DESCRIBE PROPERTY (Other Than Vehicle)						OTHER VEH/PROP INS? (Y/N) <input type="checkbox"/>	
CARRIER OR AGENCY NAME		NAIC CODE	POLICY NUMBER				
OWNER'S NAME AND ADDRESS		PRIMARY PHONE # <input type="checkbox"/> HOME <input type="checkbox"/> BUS <input type="checkbox"/> CELL		SECONDARY PHONE # <input type="checkbox"/> HOME <input type="checkbox"/> BUS <input type="checkbox"/> CELL			
		PRIMARY E-MAIL ADDRESS:					
DRIVER'S NAME AND ADDRESS <input type="checkbox"/> (Check if same as owner)		PRIMARY PHONE # <input type="checkbox"/> HOME <input type="checkbox"/> BUS <input type="checkbox"/> CELL		SECONDARY PHONE # <input type="checkbox"/> HOME <input type="checkbox"/> BUS <input type="checkbox"/> CELL			
		PRIMARY E-MAIL ADDRESS:					
		SECONDARY E-MAIL ADDRESS:					
DESCRIBE DAMAGE							
ESTIMATE AMOUNT	WHERE CAN DAMAGE BE SEEN?						

INJURED

NAME & ADDRESS	PHONE (A/C, No)	PED	INS VEH	OTH VEH	AGE	EXTENT OF INJURY
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>		

WITNESSES OR PASSENGERS

NAME & ADDRESS	PHONE (A/C, No)	INS VEH	OTH VEH	OTHER (Specify)
		<input type="checkbox"/>	<input type="checkbox"/>	
		<input type="checkbox"/>	<input type="checkbox"/>	
		<input type="checkbox"/>	<input type="checkbox"/>	

REPORTED BY

REPORTED TO

REMARKS (ACORD 101, Additional Remarks Schedule, may be attached if more space is required)

APPLICABLE IN ALASKA

A person who knowingly and with intent to injure, defraud, or deceive an insurance company files a claim containing false, incomplete, or misleading information may be prosecuted under state law.

APPLICABLE IN ARIZONA

For your protection, Arizona law requires the following statement to appear on this form. Any person who knowingly presents a false or fraudulent claim for payment of a loss is subject to criminal and civil penalties.

**APPLICABLE IN ARKANSAS, DELAWARE, KENTUCKY, LOUISIANA, MAINE, MICHIGAN, NEW JERSEY,
NEW MEXICO, NORTH DAKOTA, PENNSYLVANIA, RHODE ISLAND, SOUTH DAKOTA, TENNESSEE,
TEXAS, VIRGINIA, AND WEST VIRGINIA**

Any person who knowingly and with intent to defraud any insurance company or another person, files a statement of claim containing any materially false information, or conceals for the purpose of misleading, information concerning any fact, material thereto, commits a fraudulent insurance act, which is a crime, subject to criminal prosecution and civil penalties. In LA, ME, TN, and VA, insurance benefits may also be denied.

APPLICABLE IN CALIFORNIA

For your protection, California law requires the following to appear on this form: Any person who knowingly presents a false or fraudulent claim for payment of a loss is guilty of a crime and may be subject to fines and confinement in state prison.

APPLICABLE IN COLORADO

It is unlawful to knowingly provide false, incomplete, or misleading facts or information to an insurance company for the purpose of defrauding or attempting to defraud the company. Penalties may include imprisonment, fines, denial of insurance, and civil damages. Any insurance company or agent of an insurance company who knowingly provides false, incomplete, or misleading facts or information to a policy holder or claimant for the purpose of defrauding or attempting to defraud the policy holder or claimant with regard to a settlement or award payable from insurance proceeds shall be reported to the Colorado Division of Insurance within the Department of Regulatory Agencies.

APPLICABLE IN THE DISTRICT OF COLUMBIA

Warning: It is a crime to provide false or misleading information to an insurer for the purpose of defrauding the insurer or any other person. Penalties include imprisonment and/or fines. In addition, an insurer may deny insurance benefits, if false information materially related to a claim was provided by the applicant.

APPLICABLE IN FLORIDA

Pursuant to S. 817.234, Florida Statutes, any person who, with the intent to injure, defraud, or deceive any insurer or insured, prepares, presents, or causes to be presented a proof of loss or estimate of cost or repair of damaged property in support of a claim under an insurance policy knowing that the proof of loss or estimate of claim or repairs contains any false, incomplete, or misleading information concerning any fact or thing material to the claim commits a felony of the third degree, punishable as provided in S. 775.082, S. 775.083, or S. 775.084, Florida Statutes.

APPLICABLE IN HAWAII

For your protection, Hawaii law requires you to be informed that presenting a fraudulent claim for payment of a loss or benefit is a crime punishable by fines or imprisonment, or both.

APPLICABLE IN IDAHO

Any person who knowingly and with the intent to injure, defraud, or deceive any insurance company files a statement of claim containing any false, incomplete or misleading information is guilty of a felony.

APPLICABLE IN INDIANA

A person who knowingly and with intent to defraud an insurer files a statement of claim containing any false, incomplete, or misleading information commits a felony.

APPLICABLE IN KANSAS

Any person who, knowingly and with intent to defraud, presents, causes to be presented or prepares with knowledge or belief that it will be presented to or by an insurer, purported insurer, broker or any agent thereof, any written statement as part of, or in support of, an application for the issuance of, or the rating of an insurance policy for personal or commercial insurance, or a claim for payment or other benefit pursuant to an insurance policy for commercial or personal insurance which such person knows to contain materially false information concerning any fact material thereto; or conceals, for the purpose of misleading, information concerning any fact material thereto commits a fraudulent insurance act.

APPLICABLE IN MARYLAND

Any person who knowingly and [or]* willfully presents a false or fraudulent claim for payment of a loss or benefit or who knowingly and [or]* willfully presents false information in an application for insurance is guilty of a crime and may be subject to fines and confinement in prison. * [or] effective 01-01-2013

APPLICABLE IN MINNESOTA

A person who files a claim with intent to defraud or helps commit a fraud against an insurer is guilty of a crime.

APPLICABLE IN NEVADA

Pursuant to NRS 686A.291, any person who knowingly and willfully files a statement of claim that contains any false, incomplete or misleading information concerning a material fact is guilty of a felony.

APPLICABLE IN NEW HAMPSHIRE

Any person who, with purpose to injure, defraud or deceive any insurance company, files a statement of claim containing any false, incomplete or misleading information is subject to prosecution and punishment for insurance fraud, as provided in RSA 638:20.

APPLICABLE IN NEW YORK

Any person who knowingly and with intent to defraud any insurance company or other person files an application for commercial insurance or a statement of claim for any commercial or personal insurance benefits containing any materially false information, or conceals for the purpose of misleading, information concerning any fact material thereto, and any person who in connection with such application or claim knowingly makes or knowingly assists, abets, solicits or conspires with another to make a false report of the theft, destruction, damage or conversion of any motor vehicle to a law enforcement agency, the Department of Motor Vehicles or an insurance company, commits a fraudulent insurance act, which is a crime, and shall also be subject to a civil penalty not to exceed five thousand dollars and the value of the subject motor vehicle or stated claim for each violation.

APPLICABLE IN OHIO

Any person who, with intent to defraud or knowing that he/she is facilitating a fraud against an insurer, submits an application or files a claim containing a false or deceptive statement is guilty of insurance fraud.

APPLICABLE IN OKLAHOMA

WARNING: Any person who knowingly and with intent to injure, defraud or deceive any insurer, makes any claim for the proceeds of an insurance policy containing any false, incomplete or misleading information is guilty of a felony.

APPLICABLE IN WASHINGTON

It is a crime to knowingly provide false, incomplete, or misleading information to an insurance company for the purpose of defrauding the company. Penalties include imprisonment, fines and denial of insurance benefits.

Health and Safety Plan

APPENDIX F

Health and Safety Lessons Learned/ Accident Report Forms

ACCIDENT REPORT

Joe Gentile, Corporate Health and Safety Manager

Cell: (610) 844-6911; Office: (856) 423-8800; Office FAX: (856) 423-3220; Home: (484) 373-0953

PART 1: ADMINISTRATIVE INFORMATION

Project #: _____ Project Name: _____ Project Location (street address/city/state): _____	Immediate Verbal Notifications Given To: Corporate Health & Safety <input type="checkbox"/> Yes <input type="checkbox"/> No Office Health & Safety <input type="checkbox"/> Yes <input type="checkbox"/> No Office Manager <input type="checkbox"/> Yes <input type="checkbox"/> No Project Principal <input type="checkbox"/> Yes <input type="checkbox"/> No Project Manager <input type="checkbox"/> Yes <input type="checkbox"/> No Client Contact <input type="checkbox"/> Yes <input type="checkbox"/> No	REPORT STATUS (time due): <input type="checkbox"/> Initial (24 hr) <input type="checkbox"/> Final (5-10 days) Date: _____ Date: _____
Client Corporate Name / Contact / Address / Phone #: _____ _____ _____ _____ _____ _____	Accident Report Delivered To: Corporate Health & Safety <input type="checkbox"/> Yes <input type="checkbox"/> No Office Health & Safety <input type="checkbox"/> Yes <input type="checkbox"/> No Office Manager <input type="checkbox"/> Yes <input type="checkbox"/> No Project Principal <input type="checkbox"/> Yes <input type="checkbox"/> No Project Manager <input type="checkbox"/> Yes <input type="checkbox"/> No	
OSHA CASE # Assigned by Corporate Health & Safety if Applicable: _____	REPORT TYPE: <input type="checkbox"/> Loss <input type="checkbox"/> Near Loss Estimated Costs: \$ _____	
DATE OF INCIDENT: _____ TIME INCIDENT OCCURRED: <input type="checkbox"/> AM <input type="checkbox"/> PM	INCIDENT LOCATION – City, State, and Country (If outside U.S.A.)	

INCIDENT TYPES: (Select most appropriate if Loss occurred.)

From lists below, please select the option that best categories the incident. When selecting an injury or illness, also indicate the severity level.

<input type="checkbox"/> INJURY	<input type="checkbox"/> ILLNESS	OTHER INCIDENT TYPES	
-----Severity Level-----		<input type="checkbox"/> Spill / Release <input type="checkbox"/> Misdirected Waste <input type="checkbox"/> Consent Order <input type="checkbox"/> NOV	
<input type="checkbox"/> Fatality	<input type="checkbox"/> First Aid	Material involved: _____	
<input type="checkbox"/> Restricted Work	<input type="checkbox"/> Lost Time	Quantity (U.S. Gallons): _____	
ACTIVITY TYPE (Check most appropriate one.)		INJURY TYPE (Check all applicable.)	BODY PART AFFECTED (Check all applicable.)
<input type="checkbox"/> Decommissioning	<input type="checkbox"/> Geoprobe	<input type="checkbox"/> Abrasion	<input type="checkbox"/> Respiratory <input type="checkbox"/> Shoulder <input type="checkbox"/> Face
<input type="checkbox"/> Demolition	<input type="checkbox"/> Motor Vehicle	<input type="checkbox"/> Occupational Illness	<input type="checkbox"/> Neck <input type="checkbox"/> Arm <input type="checkbox"/> Leg
<input type="checkbox"/> Dewatering	<input type="checkbox"/> Operations/	<input type="checkbox"/> Amputation	<input type="checkbox"/> Puncture <input type="checkbox"/> Wrist <input type="checkbox"/> Knee
<input type="checkbox"/> Drilling	Maintenance	<input type="checkbox"/> Burn	<input type="checkbox"/> Chest <input type="checkbox"/> Hand/Fingers <input type="checkbox"/> Ankle
<input type="checkbox"/> Excavation	<input type="checkbox"/> Pump/Pilot Test	<input type="checkbox"/> Cold/Heat Stress	<input type="checkbox"/> Repetitive Motion <input type="checkbox"/> Groin <input type="checkbox"/> Eye <input type="checkbox"/> Foot/Toes
<input type="checkbox"/> Gauging	<input type="checkbox"/> Rigging/Lifting	<input type="checkbox"/> Inflammation	<input type="checkbox"/> Sprain/Strain <input type="checkbox"/> Back <input type="checkbox"/> Head <input type="checkbox"/> Other
		<input type="checkbox"/> Laceration	<input type="checkbox"/> Other _____

I. PERSON(S) DIRECTLY / INDIRECTLY INVOLVED IN INCIDENT (Attach additional information as necessary/applicable.)

Name/Phone # of Each Person Directly/Indirectly Involved in Incident:	Designate: Roux/Remedial Employee Roux/Remedial Subcontractor Client Employee Client Contractor Third Party	As applicable, Current Occupation; Yrs in Current Occupation; Current Position; and Yrs in Current Position:	As applicable, Employer Name; Address; and Phone #:	As applicable, Supervisor Name; and Phone #:
1)				
2)				

II. PERSONS INJURED IN INCIDENT (Attach additional information as necessary/applicable.)

Name/Phone # of Each Person Injured in Incident:	Designate: Roux/Remedial Employee Roux/Remedial Subcontractor Client Employee Client Contractor Third Party	As applicable, Current Occupation; Yrs in Current Occupation; Current Position; and Yrs in Current Position:	As applicable, Employer Name; Address; and Phone #:	As applicable, Supervisor Name; and Phone #:	Description of Injury:
1)					
2)					

III. PROPERTY DAMAGED IN INCIDENT (Attach additional information as necessary/applicable.)

Property Damaged:	Property Location:	Owner Name, Address & Phone #:	Description of Damage:	Estimated Cost:
1)				\$ _____

2)				\$		
IV. WITNESSES TO INCIDENT (Attach additional information as necessary/applicable.)						
Witness Name:		Address:		Phone #:		
1)						
2)						
PART 2: WHAT HAPPENED AND INCIDENT DETAILS						
PROVIDE FACTUAL DESCRIPTION OF INCIDENT (e.g., describe loss/near loss, injury, response / treatment).						
I. AUTHORITIES/GOVERNMENTAL AGENCIES NOTIFIED (Attach additional information as necessary/applicable.)						
Authority/Agency Notified:		Name/Phone #/Fax # of Person Notified:	Address of Person Notified:	Date & Time of Notification:		
				Exact Information Reported/Provided:		
II. PUBLIC RESPONSES TO INCIDENT (if applicable)						
Response/Inquiry By: (check one)	Entity Name:	Name/Phone # of Respondent/Inquirer:	Address of Entity/Person:	Date & Time of Response/Inquiry:		
<input type="checkbox"/> Newspaper <input type="checkbox"/> Television <input type="checkbox"/> Community Group <input type="checkbox"/> Neighbors <input type="checkbox"/> Other						
Describe Response/Inquiry:						
Roux/Remedial Response:						
(Check all that apply.) (Attach photos, drawings, etc. to help illustrate the incident.)						
ATTACHED INFORMATION: <input type="checkbox"/> Photo <input type="checkbox"/> Sketches <input type="checkbox"/> Vehicle Acord Form <input type="checkbox"/> Police Report <input type="checkbox"/> Other						
Name(s) of person(s) who prepared Initial and Final Report:		Title(s):		Phone number(s):		
PART 3: INVESTIGATION TEAM ANALYSIS						
CONCLUSION: WHY IT HAPPENED (LIST CAUSAL FACTORS AND CORRESPONDING ROOT CAUSES)						
(Root Causes: Lack of knowledge or skill, Doing the task according to procedures or acceptable practices takes more time or effort, Short-cuts or not following acceptable practices is reinforced or tolerated, Not following procedures or acceptable practices did not result in an accident, Lack of or inadequate procedures, Inadequate communications of expectations regarding procedures or acceptable practices, Inadequate tools or equipment, External Factors)						
ROOT CAUSE(S) AND SOLUTION(S): HOW TO PREVENT INCIDENT FROM RECURRING						
CAUSAL FACTOR	ROOT CAUSE	#	SOLUTION(S) [Must Match Root Cause(s)]	PERSON RESPONSIBLE	AGREED DUE DATE	ACTUAL COMPLETION DATE
			Solution(s)			
		1				
		2				
		3				
INVESTIGATION TEAM:						
PRINT NAME		JOB POSITION		DATE	SIGNATURE	

Health and Safety Plan

APPENDIX G

Medical Data Sheet

MEDICAL DATA SHEET

This form must be completed by all on-site personnel prior to the commencement of activities, and shall be kept by the Site Health and Safety Officer during site activities. This form must be delivered to any attending physician when medical assistance is needed.

(This form should be typed or printed legibly.)

Site: _____

Name: _____ Home Telephone: _____
(Area Code/Telephone Number)

Address: _____

Date of Birth: _____ Height: _____ Weight: _____

Emergency Contact: _____ Telephone: _____
(Area Code/Telephone Number)

Drug Allergies or Other Allergies: _____

Previous Illnesses or Exposures to Hazardous Substances: _____

Current Medication (Prescription and Non-Prescription): _____

Medical Restrictions: _____

Name, Address and Telephone Number of Person Physician: _____

Remedial Action Work Plan

APPENDIX B

Quality Assurance Project Plan

February 13, 2015

QUALITY ASSURANCE PROJECT PLAN

**Pfizer Inc Site B and Site D
Williamsburg
Brooklyn, New York**

Prepared for:

**PFIZER INC
60-66 Gerry Street
Brooklyn, New York 11206**

**Remedial Engineering, P.C.
*Environmental Engineers***

and ROUX ASSOCIATES, INC.

209 Shafter Street, Islandia, New York 11749 ♦ 631-232-2600

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- B. Roux Associates' Standard Operating Procedures

1.0 INTRODUCTION

Roux Associates, Inc. (Roux Associates) and Remedial Engineering, P.C. (Remedial Engineering) have developed this Quality Assurance Project Plan (QAPP) to describe in detail the field sampling and quality assurance/quality control (QA/QC) methods to be used during the remediation of Operable Unit 1 (OU-1) of Pfizer Inc's (Pfizer's) Site B and Site D. OU-1 consists of Site D, known by the street addresses of 191 Harrison Avenue and 60-66 Gerry Street and located between Gerry and Bartlett Streets. Pfizer entered into a Voluntary Cleanup Agreement (VCA) with the New York State Department of Environmental Conservation (NYSDEC) on September 19, 2003, subsequently amended on March 22, 2011 and September 19, 2012, to perform remedial action at Site B and Site D. The remedial tasks covered by this QAPP are waste characterization sampling, confirmation soil sampling, and backfill sampling.

The goals of the sampling program are to characterize soil and groundwater for offsite disposal; to confirm the removal of soils above the clean-up criteria, to the extent practicable; and to confirm the acceptability of offsite clean backfill. Deviations from expected conditions will be noted, and appropriate corrective measures will be taken to maintain quality in the sample collection and analysis program.

This QAPP was prepared in accordance with the NYSDEC's May 2010 *DER-10 Technical Guidance for Site Investigation and Remediation* (DER-10) and provides guidelines and procedures to be followed by field personnel during performance of sampling required during the remediation of Site D. Information contained in this QAPP relates to:

- sampling objectives and scope (Section 2);
- project organization (Section 3);
- sample media, sampling locations, analytical suites, sampling frequencies, and analytical laboratory (Section 4);
- sample handling, sample analysis, and QA/QC (Section 5); and
- site control procedures and decontamination (Section 6).

2.0 SAMPLING OBJECTIVES AND SCOPE

The sampling program is designed to meet the data quality objectives (DQOs) set forth in the DER-10. Specifically, analytical parameters selected for each sample, as described in Section 4, are comprehensive, and are intended to meet the following objectives:

- Analyze samples of stockpiled soil/fill designated for offsite disposal for parameters required by the selected disposal facility;
- Analyze construction water samples for parameters required by the selected offsite disposal facility;
- Analyze post-excavation soil/fill samples to confirm levels of volatile organic compounds (VOCs) meet the criteria for protection of groundwater presented in Table 6.8 (b) of Title 6 of New York Codes, Rules and Regulations (6 NYCRR) Part 375 (Part 375); and
- Analyze onsite and offsite backfill samples for parameters required to evaluate its suitability for use as backfill in Site D (i.e., meet the Part 375 Protection of Groundwater for VOCs and Restricted Residential Criteria for non-VOCs).

A discussion of the DQOs and QA/QC is provided in Section 5.

The scope of the sampling program is described in Section 5 of the Remedial Action Work Plan (RAWP) for OU-1.

3.0 PROJECT ORGANIZATION

The overall management structure and a general summary of the responsibilities of project team members are presented below. Professional profiles are provided in Appendix A.

Project Manager

The Project Manager, Wai Kwan, Ph.D., P.E., is responsible for defining project objectives, and bears ultimate responsibility for the successful completion of the work. This individual will provide overall management for the implementation of the scope of work and will coordinate all field activities. The Project Manager is also responsible for data review/interpretation and report preparation.

Field Team Leader

The Field Team Leader, Ms. Jordanna Kendrot, bears the responsibility for the successful execution of the field program, as scoped in the RAWP. This individual will direct the activities of the technical staff in the field, as well as all subcontractors. The Field Team Leader will also assist in the interpretation of data and in report preparation. The Field Team Leader reports to the Project Manager.

Quality Assurance Officer

The Quality Assurance Officer, Robert Kovacs, provides technical quality assurance assistance; prepares, reviews, and approves the QAPP; oversees any contractor quality assurance activities to ensure compliance with contract specifications; and monitors field investigations, if necessary.

Laboratory Project Manager

The Laboratory Project Manager is responsible for sample container preparation, sample custody in the laboratory, and completion of the required analysis through oversight of the laboratory staff. This individual will ensure that quality assurance procedures are followed and that an acceptable laboratory report is prepared and submitted. The Laboratory Project Manager reports to the Project Manager or the Field Team Leader.

4.0 SAMPLE MEDIA, LOCATIONS, ANALYTICAL SUITES, AND FREQUENCY

The media to be sampled during the implementation of the remediation are soil and groundwater. Sampling locations, analytical suites, and frequency are described in Section 3 of the RAWP and thus will not be reiterated in this QAPP. Duplicate samples, matrix spike, matrix spike duplicates, field blanks, and trip blanks will be collected and analyzed during the course of the investigation for quality control in accordance with the methods and frequency in Section 5 of the RAWP.

4.1 Analytical Laboratory

Laboratory analyses will be performed by a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP) certified laboratory, in accordance with the NYSDEC Analytical Services Protocol (ASP) using United States Environmental Protection Agency (USEPA) SW-846 methods.

5.0 SAMPLE HANDLING AND ANALYSIS

To ensure quality data acquisition and collection of representative samples, there are selective procedures to minimize sample degradation or contamination. These include procedures for preservation of the samples, as well as sample packaging, shipping procedures, and QA/QC. Additional details regarding sampling protocols are described in Roux Associates' Standard Operating Procedures (SOP), which are provided in Appendix B.

5.1 Field Sample Handling

A detailed discussion of types of samples to be collected during each task, as well as the analyses to be performed, can be found in Section 4.0 of this QAPP. The types of containers, volumes, preservation techniques, and QC samples for the aforementioned testing parameters are presented in Tables 1 and 2.

5.2 Sample Custody Documentation

The purpose of documenting sample custody is to ensure that the integrity and handling of the samples is not subject to question. Sample custody will be maintained from the point of sampling through the analysis (and return of unused sample portion, if applicable). Specific procedures regarding sample tracking from the field to the laboratory are described in Roux Associates' SOP for Sample Handling (Appendix B).

Each individual collecting samples is personally responsible for the care and custody of the samples. All sample labels should be pre-printed or filled out using waterproof ink. The technical staff will review all field activities with the Field Team Leader to determine whether proper custody procedures were followed during the field work and to decide if additional samples are required.

All samples being shipped offsite for analysis must be accompanied by a properly completed chain of custody form. The sample numbers will be listed on the chain of custody form. When transferring the possession of samples, individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents transfer of custody of samples from the sampler to another person, to/from a secure storage area, and to the laboratory.

Samples will be packaged for shipment and dispatched to the appropriate laboratory for analysis with a separate signed custody record enclosed in each sample box or cooler. Shipping containers will be locked and/or secured with strapping tape in at least two locations for shipment to the laboratory.

5.3 Sample Shipment

Sample packaging and shipping procedures are based upon USEPA specifications, as well as U.S. Department of Transportation (DOT) regulations. The procedures vary according to potential sample analytes, concentration, and matrix and are designed to provide optimum protection for the samples and the public. Additional information regarding sample handling is provided in Roux Associates' SOP for Sample Handling (Appendix B).

All samples will be shipped within 24 hours of collection and will be preserved appropriately from the time of sample collection. A description of the sample packing and shipping procedures is presented below:

1. Prepare cooler(s) for shipment:
 - tape drain(s) of cooler shut; and
 - place mailing label with laboratory address on top of cooler(s).
2. Arrange sample containers in groups by sample number.
3. Ensure that all bottle labels are completed correctly. Place clear tape over bottle labels to prevent moisture accumulation from causing the label to peel off.
4. Arrange containers in front of assigned coolers.
5. Place packaging material approximately at the bottom of the cooler to act as a cushion for the sample containers.
6. Arrange containers in the cooler so that they are not in contact with the cooler or other samples.
7. Fill remaining spaces with packaging material.
8. Ensure all containers are firmly packed in packaging material.
9. If ice is required to preserve the samples, ice cubes should be repackaged in Zip-lock™ bags and placed on top of the packaging material.

10. Sign chain of custody form (or obtain signature) and indicate the time and date it was relinquished to courier as appropriate.
11. Separate chain of custody forms. Seal proper copies within a large Zip-lock™ bag and tape to inside cover of cooler. Retain copies of all forms.
12. Close lid and latch.
13. Secure each cooler using custody seals.
14. Tape cooler shut on both ends.
15. Relinquish to overnight delivery service as appropriate. Retain air bill receipt for project records. (Note: All samples will be shipped for “NEXT A.M.” delivery).

5.4 Quality Assurance/Quality Control

The primary intended use for the samples that will be collected during the remediation are to characterize soil and groundwater for offsite disposal; to confirm the removal of soils above the clean-up criteria, to the extent practicable; and to confirm the acceptability of offsite backfill.

All sample analyses will be performed in accordance with the NYSDEC ASP using USEPA SW-846 methods. All laboratories retained to perform the sample analyses shall maintain current NYSDOH ELAP CLP certification for each of the analyses listed in Section 4.0.

Waste characterization and backfill characterization laboratory data are to be reported in NYSDEC ASP Category A deliverables. Post-excavation confirmation laboratory data are to be reported in NYSDEC ASP Category B deliverables.

6.0 SITE CONTROL PROCEDURES

Site control procedures have been developed to minimize both the risk of exposure to contamination and the spread of contamination during field activities at the site. In order to accomplish this objective, the QAPP addresses three main considerations:

- the establishment of discrete work zones in the investigative area;
- the decontamination of field equipment; and
- the disposal of all remediation-derived waste.

All personnel who come into designated work areas, including contractors and observers, will be required to adhere strictly to the conditions imposed herein and to the provisions of the consultant's and/or contractor's Site-Specific Health and Safety Plan (HASP).

6.1 Field Work Zones

Field work zones will be limited to areas where sampling is being conducted. Access to these areas will be limited in accordance with the HASP. Control of work zone access will be the responsibility of the individual(s) designated as a Site Health and Safety Manager. At the completion of each working day, all loose equipment (e.g., sampling equipment, coolers, etc.) will be secured. Heavy equipment will remain onsite within an established, secured zone, or be moved to another secure location.

6.2 Decontamination

In an attempt to avoid the spread of contamination, all sampling equipment must be decontaminated at a reasonable frequency in properly designed and located decontamination areas. Temporary decontamination pads will be set up by the contractor, as deemed necessary. Additional details regarding decontamination protocols are described in Roux Associates' SOP, which is provided in Appendix B. The location of the decontamination area(s) will be determined as necessary during the field operations. The decontamination area will be constructed to ensure that all wash water generated during decontamination can be collected. The water will be characterized prior to offsite disposal.

6.3 Waste Handling and Disposal

The remediation-derived waste that will be generated during the remedial activities include:

- Personal Protective Equipment (PPE);
- Contaminated soil/fill; and
- Contaminated groundwater.

Drill cuttings may also be generated during the performance of the remediation. The remediation-derived waste will be consolidated and stored in appropriate bulk containers (drums, etc.). Any full or partially filled drums will be appropriately labeled and after the completion of the work will be disposed of by the appropriate means. Contaminated groundwater and decontamination water will be collected, characterized, and if applicable, disposed of in the City of New York sewer system.

Table 1. Preservation, Holding Times, and Sample Containers, Pfizer Inc, Brooklyn, New York

Sample Matrix	Target Analytes*	Analysis Method	Maximum Hold Time*	Container	Sample Preservation	Minimum Sample Volume
Groundwater	VOCs	8260	12 days preserved	GTLs	HCl to pH < 2; Cool to 4°C	40 mL
	SVOCs	8270	5 days to extract, 40 days from extract to analysis	GTLC	Cool to 4°C	1 liter
	Metals (total & dissolved)	6010/7471	6 months, except mercury (26 days)	P	HNO ₃ to pH < 2	100 mL
	Total Cyanide	9012	12 days preserved	P or GTLC	Cool to 4°C NaOH to pH > 12	50 mL
	PCBs	8082	7 days to extract, 40 days from extract to analysis	GTLC	Cool to 4°C; No light	1 liter
	Pesticides/Herbicides	8081/8151	7 days to extract, 40 days from extract to analysis	GTLC	NaOH or H ₂ SO ₄ to pH 5-9; Cool to 4°C, No light	1 liter
Soil	VOCs	8260	48 hours to laboratory (no preservative)/ 14 days from time of collection	GTLC or Encore	Zero headspace; Cool to 4°C	5 grams
	SVOCs	8270	14 days to extract, 40 days from extract to analysis	GTLC	Cool to 4°C	30 grams
	Metals	6010/7471	6 months, except mercury (26 days)	P	Cool to 4°C	1 gram
	Total Cyanide	9012	14 days from time of collection	P or GTLC	Cool to 4°C	25 grams
	PCBs	8082	14 days to extract, 40 days from extract to analysis	GTLC	Cool to 4°C; No light	30 grams
	Pesticides/Herbicides	8081/8151	14 days to extract, 40 days from extract to analysis	GTLC	NaOH or H ₂ SO ₄ to pH 5-9; Cool to 4°C, No light	50 grams
TCLP	Acid Extractables Base Neutrals Metals Herbicides Pesticides Volatile	1311	14 days from time of collection except metals (6 months) and mercury (26 days)	P or GTLC	Cool to 4°C	Varies According to Target Analyte
RCRA	Ignitability	1020	N/A	GTLC	Cool to 4°C	100 grams
	Reactive Cyanide	7332	N/A	GTLC	Cool to 4°C	100 grams
	Reactive Sulfide	7342	N/A	GTLC	Cool to 4°C	100 grams
	Corrosivity	9045C	N/A	GTLC	Cool to 4°C	50 grams

Notes:

P - Polyethylene

GTLC - Glass with Teflon lined cap

GTLs - Glass with Teflon lined septum

SDG - Sample Delivery Group

* Following Verified Time of Sample Receipt (VTSR), unless otherwise noted

TCLP - Toxicity Characteristic Leaching Procedure

RCRA - Resource Conservation and Recovery Act

Table 2. Quality Assurance Summary Table, Pfizer Inc, Brooklyn, New York

Sample Matrix	Target Analytes	Field QC			Lab QC				
		Duplicate Sample	Trip Blank	Field Blank	Laboratory Control Sample	Matrix Spike/Matrix Spike Duplicate†	Method Blank	Laboratory Duplicate	Surrogate Spike
Groundwater	VOCs	1 per 20	1 per VOC cooler	1 per day	1 per SDG	1 per 20	1 per SDG	1 per SDG	All organic samples
	SVOCs	1 per 20	NA	1 per day	1 per SDG	1 per 20	1 per SDG	1 per SDG	
	Metals (total & dissolved)	1 per 20	NA	1 per day	1 per SDG	1 per 20	1 per SDG	1 per SDG	
	Total Cyanide	1 per 20	NA	1 per day	1 per SDG	1 per 20	1 per SDG	1 per SDG	
	PCBs	1 per 20	NA	1 per day	1 per SDG	1 per 20	1 per SDG	1 per SDG	
	Pesticides/Herbicides	1 per 20	NA	1 per day	1 per SDG	1 per 20	1 per SDG	1 per SDG	
Soil	VOCs	1 per 20	1 per VOC cooler	1 per day	1 per SDG	1 per 20	1 per SDG	1 per SDG	All organic samples
	SVOCs	1 per 20	NA	1 per day	1 per SDG	1 per 20	1 per SDG	1 per SDG	
	Metals	1 per 20	NA	1 per day	1 per SDG	1 per 20	1 per SDG	1 per SDG	
	Total Cyanide	1 per 20	NA	1 per day	1 per SDG	1 per 20	1 per SDG	1 per SDG	
	PCBs	1 per 20	NA	1 per day	1 per SDG	1 per 20	1 per SDG	1 per SDG	
	Pesticides/Herbicides	1 per 20	NA	1 per day	1 per SDG	1 per 20	1 per SDG	1 per SDG	

Notes:

P - Polyethylene

GTL - Glass with Teflon lined cap

GTL - Glass with Teflon lined septum

SDG - Sample Delivery Group

NA - Not Applicable

† To be provided to the lab by the field sampling personnel

Quality Assurance Project Plan

APPENDIX A

Professional Profiles of Project Team

Wai Kwan, Ph.D., P.E.

Senior Engineer

Technical Specialties:

Environmental chemistry, engineered natural systems, PCBs, chlorinated solvents, design of remediation systems utilizing traditional and innovative techniques.

Experience Summary:

Over ten years of experience as a Senior and Project Engineer with Roux Associates, Inc.

Credentials:

Ph.D., Environmental Engineering, Massachusetts Institute of Technology, 2003

M.S., Environmental Engineering, Massachusetts Institute of Technology, 1999

B.S., Chemistry, California Institute of Technology, 1997

B.S., Engineering & Applied Science, California Institute of Technology, 1997

Professional Engineer – New York

Publications / Presentations / Abstracts:

Extricating Membership as a PRP at Hazardous Waste Disposal Sites. Ram, N. M., Kwan, W. P., Gerbig, C. A., and Moore, C., Remediation Journal. Accepted for 2014 publication.

Long-Term Performance of a Phytoremediation Cap. Kwan, W. P., USEPA Engineering Forum, August 2012.

Long-Term Performance of an Integrated CTW/Phyto Cap System. Kwan, W. P., and W. Eifert, 8th International Phytotechnology Society Conference, 2011.

Large-Scale Enhanced Reductive Dechlorination for the Remediation of Chlorinated Volatile Organic Compounds. Kwan, W. P., Senh, S., and Netuschil, G., Proceedings of The Seventh International Conference on Remediation of Chlorinated and Recalcitrant Compounds, Paper F-036, 2010.

Predicting Oxidation Rates of Dissolved Contaminants During In Situ Remediation Using Fenton's Reaction. Kwan, W. P., and B. M. Voelker, Abstracts of Papers of the American Chemical Society, 228(352 ENVR), 2004.

Influence of Electrostatics on the Oxidation Rates of Organic Compounds in Heterogeneous Fenton Systems. Kwan, W. P. and B. M. Voelker, Environmental Science & Technology, 38(12), 2004.

Rates of Hydroxyl Radical Generation and Organic Compound Oxidation in Mineral-Catalyzed Fenton Like Systems. Kwan, W. P. and B. M. Voelker, Environmental Science & Technology, 37(6), 2003.

Decomposition of Hydrogen Peroxide and Organic Compounds in the Presence of Dissolved Iron and Ferrihydrite. Kwan, W. P. and B. M. Voelker, Environmental Science & Technology, 36(7), 2002.

Heterogeneous Fenton-Like Chain Reactions Initiated by Iron Oxides. Kwan, W. P. and B. M. Voelker, Abstracts of Papers of the American Chemical Society, 200(283 ENVR), 2000.

Professional Affiliations:

American Chemical Society

Key Projects:
Engineered Natural Systems (ENS)

- Project Manager and Engineer for the design of a full-scale natural media filtration (NMF) system consisting of two stormwater storage basins (0.4 MM and 1.8 MM gallons) and four NMF cells (two 114,000-gallon aboveground cells and 0.15- and 0.25-acre in-ground cells) at a 172-acre active aluminum manufacturing facility in Lafayette, Indiana. The NMF cells treat up to 1,500 GPM of stormwater runoff and process water impacted by polychlorinated biphenyls (PCBs), dissolved and particulate aluminum, and suspended solids. Researched the fate and transport of PCBs, and assessed the treatability of PCBs in wetlands. Evaluated a compost treatability bench-scale experiment. Designed and coordinated groundwater percolation tests. Used HydroCAD to model treatment capacity for multiple storm events.
- Project Engineer for the design of a passive stormwater management system for a 3,500-acre aluminum manufacturing facility in Point Comfort, Texas. The passive stormwater management system uses sedimentation trenches and swales to manage and convey bauxite-laden runoff. Stormwater runoff is managed by a constructed treatment wetland (CTW) and is consumptively used by a phytotechnology tree plot. Completed a hydrologic analysis using USACE HEC-HMS modeling software. Prepared bid specifications and provided bid support.
- Project Manager and Senior Engineer for the design of a NMF system to reduce PCBs to non-detect levels in stormwater at an aluminum extrusion facility in Cressona, Pennsylvania. The NMF system will treat a first flush volume of 240,000 gallons containing residual PCBs. Conducted a detailed analysis of the site's constituents and runoff volumes during dry weather and wet weather to properly size the pump station and the NMF cell. A Bid Document will be prepared for the construction of the NMF system.
- Project Engineer for the design of a CTW to manage stormwater runoff generated from a scrap metal recycling facility in Sayreville, New Jersey. The CTW was designed to handle and treat runoff with elevated levels of suspended solids prior to discharge to adjacent coastal and freshwater jurisdictional wetlands.
- Evaluated the feasibility of using CTW to treat 110 GPM of groundwater containing elevated levels of cyanide at an aluminum manufacturing facility in Hannibal, Ohio. The CTW was designed to address the site's constituents and winter environment, and was modularized to facilitate the expansion and incorporation of the pilot-scale CTW into the full-scale CTW.

Soil and Groundwater Investigation and Remediation

- Senior and Project Engineer for the remediation of a former petroleum refinery terminal in Buffalo,

Wai Kwan, Ph.D., P.E.

Senior Engineer

New York, under the New York State Department of Environmental Conservation (NYSDEC) Brownfield Cleanup Program. Worked closely with geotechnical consultant and reviewed conceptual and final designs for stabilization of 1,400 linear feet of river embankment using tiered slopes, rip rap, and reinforced bioengineering. Critiqued scanning electron microscopy photographs and energy dispersive x-ray spectroscopy absorption spectra that were used to identify and support the conclusion that multiple, unrelated lead species are present within one operable unit. Evaluated bench scale studies of stabilization/solidification agents. Designed, supervised, and evaluated the performance of multiple options to treat petroleum impacted soils based on results generated from pilot scale field tests. Prepared Alternatives Analysis Report for different operable units to document analysis of engineering options and remedy recommendation. Prepared permit application, Remedial Design and Bid Document for implementation of remedy. Reviewed contractor submittals. Provided oversight and engineering support during remedy construction.

- Project Manager and Engineer for a soil vapor extraction (SVE) and air sparge (AS) system to treat groundwater contaminated with volatile organic compounds (VOCs) and chlorinated VOCs (CVOCs) at a 0.8-acre NYSDEC Voluntary Cleanup Site in Brooklyn, New York. Designed and performed two SVE/AS pilot studies. Designed the full-scale SVE/AS system. Provided oversight during installation of the full-scale SVE/AS system. Prepared the Final Engineering Report and the Site Management Plan. Managing daily operations of the SVE/AS system and groundwater gauging and sampling personnel. Responsible for communications with the NYSDEC and submitting progress reports.
- Designed and oversaw construction of full-scale *in situ* enhanced bioremediation treatment system for groundwater impacted with CVOCs at an 18-acre former electronics manufacturing facility in Taiwan. Evaluated the effectiveness of different substrates for *in situ* treatment from the results of two concurrent 6-month pilot studies, resulting in selection of enhanced bioremediation. The full-scale treatment system consists of over 9,000 feet of piping and 189 molasses injection wells. The technology decreased tetrachloroethene (PCE) concentrations by 99%, trichloroethene (TCE) concentrations by 98%, and total CVOC concentrations by 96%.
- Project Manager and Senior Engineer for the performance of a Corrective Measures Study (CMS) at a 30-acre land parcel undergoing RCRA Corrective Action in Williamsburg, Virginia. The site is a former fibers manufacturing facility, and a RCRA regulated landfill is located within the parcel. The CMS was

conducted to identify, evaluate, and recommend a final remedy to address zinc-impacted groundwater discharging to a tributary. Managed multi-person field crew who installed multiple monitoring wells, gauged and sampled groundwater, and conducted slug tests. Analyzed the CMS data to show more than 96 percent of the zinc loading is attributed to groundwater discharge along approximately 20 percent of the shoreline. Proposed a final remedy consisting of a 6.5-acre phytotechnology cover and 960 linear feet of compost reactive barrier, at a significantly lower cost compared to conventional treatment approaches.

- Project Manager and Senior Engineer for the performance of multiple soil, groundwater, and soil vapor investigations at a NYSDEC Voluntary Cleanup Site in Brooklyn, New York. Prepared reports, work plans and directed field staff in the collection of discrete soil, groundwater, and soil vapor samples to delineate the extent of CVOC contamination in groundwater, soil, and soil vapor. Used membrane interface probe technology as a screening tool to focus subsequent sample collection efforts and to reduce overall investigation costs.
- Field Engineer for the remediation of two 6.25-million gallon process lagoons at a former dye manufacturing facility in Rensselaer, New York. Supervised the excavation, staging, screening, and transport of riprap and soil contaminated with hazardous concentrations of arsenic. Interacted daily with the client and regulatory agency representatives during implementation of the remedial action.
- Prepared a treatability study work plan to evaluate the feasibility of using surfactant-enhanced subsurface remediation technology to enhance free-product recovery at a former petroleum refinery and distribution terminal in Greenpoint, Brooklyn, New York. The effort consisted of corresponding with surfactant vendors, performing literature review, and designing a bench scale treatability study and an implementability assessment for the purpose of enhancing recovery of residual free-product in the regional aquifer that is exhibiting decreases in recovery rates via dual-pump liquid extraction.
- Project Engineer for a multi-element remedial design of a USEPA Superfund Site in Nassau, New York. Prepared response letters, technical drawings, and 95% and 100% remedial design documents in accordance with the Record of Decision and Consent Judgment.
- Field Engineer for the remediation of a NYSDEC Brownfield Site in Staten Island, New York. Supervised the removal of soil and groundwater contaminated with hazardous levels of PCE and TCE released from a defunct dry cleaner. Evaluated the performance of molasses injections to enhance *in situ* bioremediation of impacted groundwater. Prepared the Final Engineering Report to document the remedial action.

Wai Kwan, Ph.D., P.E. Senior Engineer

- Project Manager and Engineer for a feasibility study to mitigate land subsidence at a golf course in Northport, New York. Completed a data review of existing reports from USGS and local municipality, previous soil investigation, and current stormwater drainage design. Directed a field investigation to obtain data in support of the conceptual model for land movement. Concluded that existing stormwater management measures accelerated the rate of land movement. Evaluated potential engineering remedies.
- Evaluated laboratory data packages of post-excavation soil samples generated during the interim remediation of a former storage and loading area of a pharmaceutical company in Brooklyn, New York. Initial site investigations concluded site contamination was limited to petroleum-related compounds. Supplemental site investigations conducted a few years after the conclusion of the interim remediation showed a dissolved CVOC plume was present site-wide. Reviewed chromatograms and concluded that CVOCs were detected – but not reported since the reporting scope was limited to petroleum-related compounds – in many of the post-excavation soil samples, which would have provided earlier indications of the presence of the CVOC plume.

Litigation Support

- Senior Engineer for the analysis of expert reports and preparation of rebuttal for three superfund sites in New York and Massachusetts. The case involved assigning the percentage of PCBs released over time during the operation of the facilities at the three sites for the purpose of remedial costs allocation to various insurance carriers. Reviewed information submitted by opposing experts, conducted independent research to verify methodologies, and provided technical calculations indicating flaws in positions advocated by the opposing experts.
- Senior Engineer for the preparation of an expert report for a fuel oil release in Rochelle Park, New Jersey. The release was from a residential underground storage tank (UST). The expert report opined on the age of the release, the reliability of the estimation method used by the opposing expert, and the accuracy of the age dating of the perforations in the UST.
- Project Engineer for the preparation of an affidavit regarding a cesspool explosion on Long Island, New York. The affidavit was prepared for the defendant's counsel providing technical calculations and opining on the improbability that the defendant's use of a drain cleaner contributed to a flash fire that injured the plaintiff. Also prepared an expert rebuttal affidavit to demonstrate the fallacies in the plaintiff's expert's arguments. The judge dismissed the case after reviewing all admitted information.
- Senior Engineer for the evaluation of expected remedial costs for waste disposal sites as part of a large bankruptcy litigation. Reviewed over 70 site records to

identify potential liabilities and appropriate statute of limitations. Developed present value of remedial investigation and action costs and apportionment ranging from \$160,000 to \$1,200,000.

- Senior Engineer for the evaluation of gas chromatograms from multiple retail gasoline stations in Puerto Rico as part of a class action lawsuit. Responsibilities included reviewing for indicators of methyl tert-butyl ether (MTBE) and determining MTBE concentrations from historic laboratory data packages.

Compliance

- Project Engineer for the evaluation of air emissions data from a steel mill melt shop in Sayreville, New Jersey. Prepared annual emissions statement in accordance with permit requirements using RADIUS software and emissions factors from AP-42 and CEMS data. Evaluated and summarized trends and anomalies observed in over one year's worth of air monitoring data on particulates and metals from monitors set up in the surrounding community.
- Project Engineer for the preparation of Title V emissions statement for two major hospitals in Nassau County, New York. Responsibilities included reviewing annual fuel usage data, calculating air emissions using emissions factors from AP-42, and preparing the emissions statement.
- Project Manager for the coordination, preparation, and submission of PCB TMDL reporting requirements for multiple sites in Virginia. Responsibilities included managing subcontractors, preparing submission forms in accordance with state guidelines, and preparing the first Pollutant Minimization Plan (PMP) in the state for PCBs.

Jordanna Kendrot

Staff Engineer

Technical Specialties:

Remedial construction and soil excavation oversight, management of waste characterization and disposal, environmental site assessments focusing on soil, groundwater, and soil vapor investigations.

Experience Summary:

Over two years of experience: Staff Engineer with Roux Associates, Inc., Islandia, New York.

Credentials:

B.E., Materials Engineering, Stony Brook University, 2011
M.E., Environmental Engineering, Cornell University, 2012
OSHA 40-Hour Health and Safety Course, 2012
OSHA 10-Hour Construction Health and Safety Course, 2013
OSHA 8-Hour Annual Refresher Course
Loss Prevention System (LPS) Awareness, 8-Hour Certified
First Aid and CPR Certified
E.I.T. (Engineer-In-Training) Certification
Transportation Worker Identification Credential (TWIC) Certification
Stormwater Pollution Protection Plan (SWPPP) Certification

Key Projects:

- Field Supervisor for implementation of Remedial Action Work Plan (RAWP) at a former ink ribbon and carbon manufacturer in Glen Cove, New York. RAWP entails removal of toluene-contaminated soil at various final excavation depths within 1.4-acre area and subsequently followed by *In Situ* Chemical Oxidation injections across the excavated area. Intrusive activities included soil and sediment excavation utilizing slide-rail excavation systems in conjunction with trench-box excavation systems and standard sloping/shoring excavation. Responsibilities include waste tracking of non-hazardous and potentially hazardous soil throughout the site, oversight of Geoprobe sampling activities at discrete sample depths, collection of soil and perched groundwater samples from open excavation, and logging soil lithology throughout site and at confirmatory base depths.
- Field manager responsible for implementation of Community Air Monitoring Plan (CAMP) and

SWPPP during a six-month long remedial action soil cap installation at an 8-acre former petroleum distribution terminal along the Hudson River waterfront in the Village of Hastings-on-Hudson, Westchester County, New York. Intrusive activities included soil and sediment excavation, soil stabilization, and up to grade soil grading. In addition to CAMP activities, assisted project engineer and construction manager with contractor oversight, material review, health and safety oversight, and daily reporting before taking over responsibilities after three-month period.

- Field Manager addressing the largest subsurface free-product plume in North America at a former petroleum refinery and terminal in Brooklyn, New York. Responsibilities include construction oversight of subcontractors, implementation of site specific health and safety plan. Tasks include: installation of single and double cased monitoring wells using Sonic and Hollow Stem Auger drilling methods, collection of groundwater samples in accordance with EPA groundwater sampling method via low stress purging and sampling, collection of soil vapor and ambient air sampling with EPA method TO-15, development and review of job safety analysis (JSA) documents.
- Field manager for a long term remediation project for the City of New York. Includes quarterly groundwater sampling and soil vapor sampling as part of an NYSDEC approved work plan, as well as oversight of soil sampling as part of subsurface investigations. Responsible for creation of tables and figures based on investigation results and as part of periodic reports submitted to NYSDEC.
- Staff Engineer/Field Manager for underground storage tank (UST) discovery and removal at multiple sites. Field responsibilities involved subcontractor oversight, collection of end-point soil and groundwater samples, the collection of soil and groundwater samples, tank cleaning and waste management.
- Site Safety Officer for various remedial investigation sites. Responsibilities include preparation of health and safety plans (HASPs), directing onsite safety meetings and ensuring site-specific safety procedures are implemented in accordance with the HASP.

Robert Kovacs

Senior Environmental Scientist

Technical Specialties:

Design, implementation and management of Environmental Site Assessments, Remedial Investigations, and Remedial Actions at industrial, commercial, UST, and property transfer sites; Characterization, Decontamination and Decommissioning of Manufacturing Facilities.

Experience Summary:

Over Thirteen years of experience: Senior, Project, Staff and Staff Assistant Environmental Scientist at Roux Associates, Inc., Islandia, New York; Field Manager/Staff Scientist at Long Island Analytical Laboratories, Holbrook, New York.

Credentials:

B.A., Biological Sciences, University of Delaware, Newark, Delaware, 1999
OSHA 40-Hour Health and Safety Course (29 CFR 1910.120)
OSHA 8-Hour Health and Safety Refresher Course (29 CFR 1910.120)
NJDEP UST Certification Program-Subsurface Evaluator (License No. 239024)

Key Projects:

- Project Manager for the Remedial Investigation (RI) and Remedial Action (RA) implementation associated with a former dry cleaner located in Parsippany-Troy Hills, New Jersey. Soil, groundwater and subsurface vapor were impacted with chlorinated VOCs as a result of the former dry cleaner operations. Responsibilities included the design and management of a Supplemental RI that included the installation of soil borings, monitoring wells and the completion of groundwater vertical profiling. Additionally, under the oversight of the LSRP, I was responsible for the design, implementation and management of an extensive groundwater remediation injection program in which approximately 200,000 pounds of Zero-Valent Iron (ZVI) and 2,500 gallons of Emulsified Vegetable Oil (EVO) were injected into the subsurface using pneumatic fracturing. Initial post-treatment results show over 95 percent reduction in concentrations of chlorinated VOCs in groundwater. Additionally, under the supervision of the LSRP, I was responsible for the design, installation and operation of a Soil Vapor Extraction (SVE) system to address impacted vadose zone soil. The system is currently operating at the Site. Additional project responsibilities included the implementation and management of a vapor intrusion investigation in nearby retail spaces. As part of this project I was responsible for supporting the Site LSRP, and meeting all NJDEP administrative requirements, including obtaining necessary permits, preparation of forms, public notifications, submittal of fees, etc. I also took the lead role in preparing all project reports, including a Supplemental RI Report and Remedial Action Workplan (RAW).

- Project Manager for the removal of (2) waste oil underground storage tanks (USTs), a subsurface oil water separator (OWS) and associated piping at a former vehicle maintenance shop in Parlin, New Jersey. As part of this work it was determined that a historic release occurred from the OWS, triggering a Remedial Investigation (RI) for petroleum-related VOCs and chlorinated VOCs in soil. I was also responsible for the development and implementation of the Remedial Action (RA) for the Site, which included excavation and off-site soil disposal. SESOIL modeling was also utilized to demonstrate groundwater (approximately 100 feet deep) was not impacted by the shallow soil contamination. As part of this project, I supported the Site LSRP and took a lead role in preparing the Site Investigation (SI) Report, RI Report, Remedial Action Workplan (RAW), Remedial Action Report (RAR), Receptor Evaluation, and the Unrestricted Use Response Action Outcome (RAO). I was also responsible for supporting the LSRP in meeting all NJDEP administrative requirements, including obtaining necessary permits, preparation of forms, public notifications, submittal of fees, etc.
- Project Manager for the Remedial Investigation (RI) and Remedial Action (RA) design and implementation at an active electrical substation in Rahway, New Jersey for a national passenger railroad agency. Responsibilities included the management of free-product recovery programs and RI activities associated with delineating PCBs in soil. Further, I was responsible for managing the RA at the Site, which included soil excavation and offsite disposal, and free-product recovery. As part of this project, I supported the Site LSRP and took a lead role in preparing the Supplemental RI Report, Remedial Action Workplan (RAW), Remedial Action Report (RAR), Receptor Evaluation, and the Unrestricted Use Response Action Outcome (RAO). Additionally, I assisted the LSRP in satisfying all NJDEP administrative requirements, including preparation of forms, public notifications, and submittal of fees.
- Project Manager for the implementation of a groundwater remediation injection program to address petroleum contamination at a former service station located in Paterson, New Jersey for a major transit agency. I was also responsible for the implementation of a Preliminary Assessment (PA) and Site Investigation (SI) to further investigate chlorinated VOCs at this Site. As part of this project, I supported the Site LSRP and took a lead role in preparing reports and the Permit-by-Rule Request, as well as assisting in satisfying all NJDEP administrative requirements, including preparation of forms, public notifications, and submittal of fees. I am currently assisting the LSRP in preparing a Supplemental Remedial Investigation (RI) Report for this project.

Robert Kovacs

Senior Environmental Scientist

- Project manager for the investigation of a diesel release at an active railyard in Roxbury Township, New Jersey. This release was caused by a faulty underground pipe located in the locomotive fueling area. The diesel release resulted in a free-product plume, groundwater impacts, and impacts to a subsurface drainage culvert and a nearby lake. Responsibilities included the development and coordination of a field investigation program, coordination of routine gauging and free-product recovery events, correspondence with NJDEP, and preparation of a baseline ecological evaluation (BEE). Additionally, I supported the Site LSRP in meeting all NJDEP administrative requirements.
- Project Manager for the completion of a Remedial Investigation (RI) at an active bus garage located in Fairview, New Jersey for a major transit agency. Responsibilities included the delineation of a free product plume, characterization of soil and groundwater quality, report preparation, and correspondence with the NJDEP. Additionally, I was responsible for implementing free-product Interim Remedial Measure efforts. I am currently finalizing the RI report for the Site, and managing the Remedial Action (RA) design, and supporting the LSRP in meeting all NJDEP administrative requirements.
- Project Manager for the completion of a Remedial Investigation (RI) field program at an active bus garage located in Oradell, New Jersey for a major transit agency. Responsibilities included the preparation of a Remedial Investigation Workplan (RIWP), delineation of a free product plume, and characterization of soil and groundwater quality. Additionally, I was responsible for supporting the LSRP in meeting all NJDEP administrative requirements.
- Project Manager for the completion of a Preliminary Assessment and Site Investigation (PA/SI) at an active ship dry dock facility in Hoboken, New Jersey. I was responsible for the coordination and management of field investigation activities, which included soil, groundwater, and sediment sampling, as well as the preparation of a PA and SI report. This work was completed on behalf of a potential buyer of the property.
- Project Manager for the removal of a waste oil underground storage tank (UST) and associated piping at a former vehicle maintenance shop in Lakewood, New Jersey. Responsibilities included coordinating and managing the UST removal activities as well as post-removal soil sampling. Additionally, I supported the Site LSRP in meeting all NJDEP administrative requirements, including preparation of forms, obtaining permits, and submittal of fees.
- Project manager for the Site Investigation (SI), Remedial Investigation (RI), and vapor intrusion investigation at a former dry cleaner in Ramsey, New Jersey. Responsibilities included managing and coordinating field investigations, preparing remedial cost estimates, and supporting the LSRP in the preparation of reports and satisfying NJDEP Administration requirements.
- Project Manager for a UST removal program at a vacant parcel located in Paterson, New Jersey for a major transit agency. Further work included the completion of a soil and groundwater investigation, installation of monitoring wells, oversight of remedial excavation activities, the completion of aquifer testing, and completion of routine groundwater investigations as part of the NJDEP-approved monitored natural attenuation remedy for the site.
- Project Manager for multiple Remedial Investigations (RIs) and Feasibility Studies (FSs) for several Operable Units at a 130+ acre active railyard located in Queens, New York. Responsibilities include the completion of field investigations to characterize a PCB-contaminated separate-phase hydrocarbon plume, as well as PCB, hydrocarbon and metals impacted soil, groundwater, and sewer infrastructure at this listed state superfund site. Additional work includes the development of multiple Work Plans and RI and FS Reports to characterize soil, groundwater and soil vapor impacts as part multiple Operable Units; interaction with the NYSDEC and NYSDOH; and management of a GIS database containing analytical data for over 1,000 environmental samples.
- Project Manager for the subsurface investigations of several sites spanning multiple city blocks for a major pharmaceutical company in Brooklyn, New York. In part, environmental investigation was as conducted as a component to a property transfer. Responsibilities included development and preparation of investigation work plans, coordination and management of field investigations, including the installation of shallow and deep monitoring wells and soil borings using sonic drilling methods, completion of a geophysical survey, and collection of groundwater samples, and preparation of investigation reports.
- Project Manager for the interior investigation of several former manufacturing buildings, including a 700,000+ square foot facility, in Brooklyn, New York for a major pharmaceutical company. Investigation activities included sampling and characterizing a wide array of building materials impacted with PCBs, lead and mercury. Additional tasks included the preparation of remedial and demolition cost estimates to address impacted building material, asbestos, and lead-based paint as part of multiple different property redevelopment scenarios.
- Project manager for the interior decontamination and decommissioning of a 700,000+ square foot former manufacturing facility, in Brooklyn, New York for a

Robert Kovacs

Senior Environmental Scientist

major pharmaceutical company to allow for future commercial/light industrial reuse. This project included the development of a decontamination and decommissioning work plan, technical support of bidding process, and full time onsite engineering support of the entire project. Decontamination and decommissioning activities included removal/cleaning of hundreds of air handling units and dust collector units impacted with manufacturing dusts and residues, as well as thousands of feet of intricate vacuum, ventilation and dust collection lines. This project also included the removal of concrete impacted with metals, PCBs, and/or VOCs, selective interior demolition, and decontamination of former laboratory, milling, compounding, blending, and packaging areas, as well as asbestos abatement. At the conclusion of this project, a Final Report was prepared, documenting in detail the extensive work completed and that the work plan objectives were achieved.

- Project Manager for the installation of an active sub-slab venting system at a dry cleaner store in Oceanside, New York. This system was required to mitigate elevated chlorinated VOCs present in soil vapor beneath the dry cleaner and neighboring stores. This work was conducted under NYSDEC and NYSDOH oversight. Official regulatory closure of the site was achieved.
- Project Scientist for the investigation and remediation of the interior of a former cable manufacturing facility located in Yonkers, New York. Responsibilities included the completion of several large-scale investigations, including the collection of wipe, soil and building material samples to characterize PCB and lead impacts at this 200,000+ square foot facility. Additional tasks included oversight of the remediation of interior surfaces using several different methods for the removal of PCBs and lead, and remediation of a sub-surface drainage trench and process water system. Further work included assistance in the preparation of a Remedial Investigation report and a Feasibility Study report for submittal to the NYSDEC.
- Project Manager for the demolition of two former manufacturing buildings in Brooklyn, New York for a major pharmaceutical company. Both buildings were impacted with hazardous levels of PCBs, mercury and lead. Responsibilities included in-situ waste characterization of building materials, oversight of hazardous waste removal, completion of waste manifests, and full-time Community Air Monitoring during all demolition activities. Additionally, Roux Associates performed daily inspections and monitoring to ensure the protection of a nearby elementary school, and prepared a completion report at the conclusion of the project.
- Project Manager for the investigation and TSCA remediation of PCB containing paint in a former manufacturing area. This location (approximately 2,000 square feet in area, and two stories in height) was found to contain PCBs in the paint matrix at concentrations as high as 10,000 parts per million. The underlying building material (brick, concrete, and terra cotta) was also found to be impacted with PCBs from the paint. Responsibilities included preparation of a Self-Implementing Notification and Alternative Decontamination Methods and Verification Sampling Work Plan to remediate the PCBs under the TSCA regulatory framework. This project also included providing field oversight of the PCB remediation, completion of the extensive verification sampling program of the underlying porous building material, and collection of confirmation air samples and confirmation wipe samples outside of the exclusion zone to confirm proper function of all critical barriers. Following the successful completion of the project, a Final Report was prepared and submitted to USEPA documenting the entire project in detail.

Quality Assurance Project Plan

APPENDIX B

Roux Associates' Standard Operating Procedures

Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to explain the quality control (QC) measures taken to ensure the integrity of the samples collected and to establish the guidelines for the collection of QC samples. The objective of the QC program is to ensure that water-quality data of known and reliable quality are developed.

Because valid water-chemistry data are integral to a hydrogeologic investigation that characterizes water-quality conditions, the data will be confirmed by QC samples. Without checks on the sampling and analytical procedures, the potential exists for contradictory or incorrect results. The acceptance of water-quality data by regulatory agencies and in litigation-support investigations depends heavily on the proper QC program to justify the results presented. The QC sampling requirements must be determined by the project manager and be clearly defined in the work plan. If data validation (for in-house purposes or for compliance with the United States Environmental Protection Agency [USEPA] regulations) is stipulated as part of the hydrogeologic investigation, QC sampling must be conducted.

2.0 QUALITY CONTROL SAMPLES

2.1 Samples taken for analysis of compounds require the use of quality control samples to monitor sampling activities and laboratory performance. Types of quality control samples may include replicate and/or replicate split, trip blank, field equipment blank, matrix spike and matrix spike duplicate, and fortification. A discussion pertaining to each quality control sample follows:

a. Replicate and Replicate Split - Replicate sample analysis is done to check on the reproducibility of results either within a laboratory or between laboratories. A replicate sample is called a split sample when it is collected with or turned over to a second party (e.g., regulatory agency, consulting firm) for an independent analysis. Replicate samples are aliquots (equal portions) from a sample in a common container.

To collect a replicate sample, water from the bailer or pump will be distributed first to fill one container and then to fill the second container. Adequate water should be available to fill the bottles completely before they are capped. If the water is insufficient to fill all the bottles at once, then incrementally fill each bottle with water from two or more bailer volumes or pump cycles.

For some test substances, water may have to be accumulated in a common container and then decanted slowly into the sample bottles. The work plan should be checked for a description of how replicate samples are to be

collected. Additionally, in the case of wells that recover slowly and produce insufficient water to fill all the replicate sample containers, the containers should be filled incrementally and kept on ice in the cooler in between filling periods.

b. Trip Blank - A trip blank sample is a sample bottle that is filled with "clean" (e.g., distilled/deionized) water in the laboratory, and travels unopened with the sample bottles. (The USEPA now uses the phrase "demonstrated analyte free water.") It is opened in the laboratory and analyzed along with the field samples for the constituent(s) of interest to detect if contamination has occurred during field handling, shipment, or in the laboratory. Trip blanks are primarily used to check for "artificial" contamination of the sample caused by airborne volatile organic compounds (VOCs) but may also be used to check for "artificial" contamination of the sample by a test substance or other analyte(s). One trip blank per cooler containing VOC samples, or test substance of other analyte(s) of interest would accompany each day's samples.

c. Field Equipment Blank - A field equipment blank (field blank) sample is collected to check on the sampling procedures implemented in the field. A field blank is made with "clean" (e.g., distilled/deionized/demonstrated analyte free) water by exposing it to sampling processes (i.e., the clean water must pass through the actual sampling equipment). For example, if samples are being collected with a bailer, the field blank would be made by pouring the clean water into a bailer which has been decontaminated and is ready for sampling, and then pouring from the bailer into the sample containers. If a metals equipment blank is to be made, and the water was filtered, then the sample must be filtered (i.e., exposed to the sampling process). One equipment blank would be incorporated into the sampling program for each day's collection of samples and analyzed for the identical suite of constituents as the sample. In some situations one equipment blank will be required for each type of sampling procedure (e.g., split-spoon, bailer, hand auger).

A special type of field blank may be needed where ambient air quality may be poor. This field blank sample would be taken to determine if airborne contaminants will interfere with constituent identification or quantification. This field blank sample is a sample bottle that is filled and sealed with "clean" (e.g., distilled/deionized/demonstrated analyte free) water in the analytical laboratory, and travels unopened with the sample bottles. It is opened in the field and exposed to the air at a location(s) to check for potential atmospheric interference(s). The field blank is resealed and shipped to the contract laboratory for analysis.

d. Matrix Spike and Matrix Spike Duplicate - Spikes of compounds (e.g., standard compound, test substance, etc.) may be added to samples in the

laboratory to determine if the ground-water matrix is interfering with constituent identification or quantification, as well as a check for systematic errors and lack of sensitivity of analytical equipment. Samples for spikes are collected in the identical manner as for standard analysis, and shipped to the laboratory for spiking. Matrix spike duplicate sample collection, and laboratory spiking and analysis is done to check on the reproducibility of matrix spike results.

e. Fortification - A fortification, which is performed in the field, is used to check on the laboratory's ability to recover the test substance (analyte) added as well as its stability between fortification and analysis.

A field fortification (spike) is prepared by filling the container(s) with field or distilled/deionized/demonstrated analyte free water (as specified by the laboratory) to a predetermined volume (as specified by the laboratory) and adding the spike (supplied by the laboratory). The predetermined volume of water is measured with a clean (decontaminated) graduated cylinder. Field spikes will be prepared following the collection, labeling, and sealing of nonspiked samples in a separate cooler. The spike is kept at a safe distance from the sampling point (e.g., in the hotel room).

2.2 The work plan must be referred to for details regarding the type of QC samples to be collected and the QC sample collection method.

3.0 PROCEDURE

3.1 Implement QC sampling as outlined above, depending on the type of QC sample(s) specified in the work plan.

3.2 Ensure unbiased handling and analysis of replicate and blank QC samples by concealing their identity by means of coding so that the analytical laboratory cannot determine which samples are included for QC purposes. Attempt to use a code that will not cause confusion if additional samples are collected or additional monitoring wells are installed. For example, if there are three existing monitoring wells (MW-1, 2 and 3), do not label the QC blank MW-4. If an additional monitoring well were installed, confusion could result.

3.3 Label matrix spike and field fortification (spike) QC samples so that the analytical laboratory knows which samples are to be spiked in the laboratory and which samples were fortified (spiked) in the field, respectively. In certain situations, the field fortification will be "blind" or undisclosed to the laboratory to independently verify their analytical ability.

3.4 Verify that each sample is placed in an individual "zip-lock" bag, wrapped with "bubble wrap," and placed in its appropriate container (holder) in the cooler, and that the cooler has sufficient ice (wet ice or blue packs) to preserve the samples for transportation to the analytical laboratory. Consult the site work plan to

determine if a particular ice is specified as the preservative for transportation (e.g., the USEPA prefers the use of wet ice because they claim that blue ice will not hold the samples at 4° Centigrade/Celsius).

- 3.5 Document the QC samples on the appropriate field form and in the field notebook. On the chain-of-custody form, replicate and blank QC samples will be labeled using the codes (Number 3.2, above), and matrix spike and field fortification QC samples will be identified as such (Number 3.3, above).
- 3.6 Follow standard shipping procedures for samples (i.e., retain one copy of the chain-of-custody form, secure the cooler with sufficient packing tape and a custody seal, forward the samples via overnight [express] mail or hand deliver to the designated analytical laboratory preferably within 24 hours but no later than 48 hours after sampling). However, check the site work plan for information on the analyte(s), as some have to be analyzed immediately (e.g., CN).

END OF PROCEDURE

Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to provide procedures and standards for record keeping and maintenance, for all field activities conducted by Roux Associates, Inc. (Roux Associates).

Strict quality assurance/quality control (QA/QC) is necessary to properly and accurately document and preserve all project-related information. Quality assurance is implemented to corroborate that quality control procedures are followed. Quality control provides a means to monitor investigation activities (e.g., sampling and laboratory performance) as a check on the quality of the data.

Valid data and information are integral to all aspects of Roux Associates' field activities. These aspects include, but are not necessarily limited to, activities that involve: drilling; sediment, sludge, and soil sampling (lithologic, and soil-quality and analysis); well construction and development; aquifer testing and analysis; water-quality sampling and analysis (surface water and ground water); free-product sampling and analysis; air-quality sampling and analysis; geophysical testing; demolition activities; waste removal operations; engineering installations; etc. The data will be confirmed by QA/QC methods established and set forth in the work plan/scope of work. Without checks on the field and analytical procedures, the potential exists for contradictory results, and associated incomplete or incorrect results from the interpretation of potentially questionable data.

Documentation will be entered in the field notebook and must be transcribed with extreme care, in a clear and concise manner, as the information recorded will become part of the permanent legal record. Because field notes are the legal record of site activities, they must be taken in a standard and consistent manner. If abbreviations are used, then they must first be spelled out for clarity (i.e., to avoid ambiguity and misunderstanding). All entries must be dated and initialed, and the time (military time) of the entry included. Field notebooks and forms must be assigned to an individual project and properly identified (i.e., client name, project number, location and name of site, individual recording information, dates, times, etc.). Change of possession of field notebooks or forms must be documented with the date and time, and initialed by both individuals. Following each day's entries, the field notebook or form must be photocopied in the event that the original documentation is lost or stolen. All field notebooks must have the company name and address legibly printed in indelible ink along with the message "If found, then please forward to Roux Associates, Inc. at the above address - REWARD OFFERED."

Information must be recorded while onsite because it may be difficult to recall details at a later date. Furthermore, information must be documented immediately as it provides unbiased information which will be used for writing the report when the field activities are completed. Project-related documentation is an irreplaceable, important record for

other individuals who may become involved in the project, and provides the project manager with a complete history of project-related activities. Written information must be accompanied by maps, sketches, and photographs where appropriate, especially if these supplemental sources of information assist in the documentation process. A new page must be used in the field notebook for each new day's entries (i.e., unused portions of a previous page must have an "X" placed through it). The end of the day's records must be initialed and dated.

As part of record keeping and QA/QC activities, state and federal regulatory agencies should be contacted to check if special or different protocols are required and/or if particular or unconventional methods are required for the given field activity. Thus, the record keeping and QA/QC activities implemented by Roux Associates are based on technically sound standard practices and incorporate Roux Associates own, extensive experience in conducting hydrogeologic field activities.

2.0 MATERIALS

In order to track investigation activities, specific materials are required. These materials include the following:

- a. A bound, waterproof field notebook.
- b. Appropriate Roux Associates' forms (e.g., daily log, geologic log, monitoring well construction log, well sampling data form, location sketch, chain of custody, telephone conversation record, meeting notes, etc.).
- c. Appropriate labels (e.g., sample, Roux Associates' Custody Seal, etc.)
- d. Work plan/scope of work.
- e. Health and safety plan (HASP).
- f. Appropriate Roux Associates' SOPs.
- g. Black pens, and indelible markers.
- h. Camera and film.

3.0 DOCUMENTATION

- 3.1 Before the Roux Associates personnel leave the field, they must ensure that their field notes include comprehensive descriptions of the hydrogeologic conditions, and all investigation-related activities and results (onsite and offsite). This will safeguard against the inability to reconstruct and comprehend all aspects of the field investigation after its completion, and will serve to facilitate the writing of an accurate report. Properly documented information provides the QA/QC tracking (back-up) required for all Roux Associates' projects. General types of information

that must be recorded (where pertinent to the investigation being conducted) include, but may not necessarily be limited to, the following:

- a. List of Roux Associates personnel on site.
- b. Name, date, and time of arrival on site by Roux Associates personnel, including temporary departures from, and returns to, the site during the work day.
- c. Client and project number.
- d. Name and location of study area.
- e. Date and time of arrival on site by non-Roux Associates personnel (names and affiliation) and equipment (e.g., subcontractors and facility personnel, and drilling equipment, respectively, etc.), including temporary departures from, and returns to, the site during the work day, and departure at the end of the work day.
- f. List of non-Roux Associates personnel on site.
- g. Weather conditions at the beginning of the day as well as any changes in weather that occur during the working day.
- h. Health and safety procedures including level of protection, monitoring of vital signs, frequency of air monitoring, and any change (i.e., downgrade or upgrade) in the level of protection for Roux Associates and other on-site personnel (e.g., subcontractors, facility personnel, etc.).
- i. Health and safety procedures not in compliance with the HASP (for all on-site personnel).
- j. Site reconnaissance information (e.g., topographic features, geologic features, surface-water bodies, seeps, areas of apparent contamination, facility/plant structures, etc.).
- k. Air monitoring results (i.e., photoionization detector [PID], etc. measurements).
- l. Task designation and work progress.
- m. Work-related and site-related discussions with subcontractors, regulatory agency personnel, plant personnel, the general public, and Roux Associates personnel.
- n. Delays, unusual situations, problems and accidents.

- o. Field work not conducted in accordance with the work plan/scope of work, and rationale and justification for any change(s) in field procedures including discussions with personnel regarding the change(s) and who authorized the change(s).
- p. QA/QC procedures not conducted in accordance with the QA/QC procedures established in the work plan/scope of work and rationale and justification for any change(s) in QA/QC procedures including discussions with personnel regarding the change(s) and who authorized the change(s).
- q. Equipment and instrument problems.
- r. Decontamination and calibration procedures.
- s. Activities in and around the site and work area by any and all on-site personnel which may impact field activities.
- t. Sketches, maps, and/or photographs (with dates and times) of the site, structures, equipment, etc. that would facilitate explanations of site conditions.
- u. Contamination evidenced as a result of work-related activities (e.g., visible contaminants [sheen] in drilling fluids or on drilling equipment; sheen on, or staining of, sediments; color of, or separate [nonaqueous] phase on, water from borehole or well; vapors or odors emanating from a borehole or well; etc.); make all observations as objectively as possible (e.g., grey-blue, oil-like sheen; black and orange, rust-like stain; fuel-like odor; etc.) and avoid using nontechnical or negative-sounding terms (e.g., slimy, goopy, foul-smelling).
- v. Date and time of final departure from the site of all personnel at the end of the work day.

3.2 In addition to the general types of information that must be recorded (as presented in Section 3.1), task-specific information must also be properly documented. Task-specific information which is required is provided in each respective task-oriented SOP, and the documentation procedures outlined in each SOP must be followed.

END OF PROCEDURE

Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for sample handling which will allow consistent and accurate results. Valid chemistry data are integral to investigations that characterize media-quality conditions. Thus, this SOP is designed to ensure that once samples are collected, they are preserved, packed and delivered in a manner which will maintain sample integrity to as great an extent as possible. The procedures outlined are applicable to most sampling events and any required modifications must be clearly described in the work plan.

2.0 CONSIDERATIONS

Sample containers, sampling equipment decontamination, quality assurance/quality control (QA/QC), sample preservation, and sample handling are all components of this SOP.

2.1 Sample Containers

Prior to collection of a sample, considerations must be given to the type of container that will be used to store and transport the sample. The type and number of containers selected is usually based on factors such as sample matrix, potential contaminants to be encountered, analytical methods requested, and the laboratory's internal quality assurance requirements. In most cases, the overriding considerations will be the analytical methodology, or the state or federal regulatory requirements because these regulations generally encompass the other factors. The sample container selected is usually based on some combination of the following criteria:

a. Reactivity of Container Material with Sample

Choosing the proper composition of sample containers will help to ensure that the chemical and physical integrity of the sample is maintained. For sampling potentially hazardous material, glass is the recommended container type because it is chemically inert to most substances. Plastic containers are not recommended for most hazardous wastes because the potential exists for contaminants to adsorb to the surface of the plastic or for the plasticizer to leach into the sample.

In some instances, however, the sample characteristics or analytes of interest may dictate that plastic containers be used instead of glass. Because some metals species will adhere to the sides of the glass containers in an aqueous matrix, plastic bottles (e.g., nalgene) must be used for samples collected for metals analysis. A separate, plastic container should accompany glass containers if metals analysis is to be performed along with other analyses. Likewise, other sample

characteristics may dictate that glass cannot be used. For example, in the case of a strong alkali waste or hydrofluoric solution, plastic containers may be more suitable because glass containers may be etched by these compounds and create adsorptive sites on the container's surface.

b. Volume of the Container

The volume of sample to be collected will be dictated by the analysis being performed and the sample matrix. The laboratory must supply bottles of sufficient volume to perform the required analysis. In most cases, the methodology dictates the volume of sample material required to complete the analysis. However, individual laboratories may provide larger volume containers for various analytes to ensure sufficient quantities for duplicates or other QC checks.

To facilitate transfer of the sample from the sampler into the container and to minimize spillage and sample disturbance, wide-mouth containers are recommended. Aqueous volatile organic samples must be placed into 40-milliliter (ml) glass vials with polytetrafluoroethylene (PTFE) (e.g., TeflonTM) septums. Non-aqueous volatile organic samples should be collected in the same type of vials or in 4-ounce (oz) wide-mouth jars provided by the laboratory. These jars should have PTFE-lined screw caps.

c. Color of Container

Whenever possible, amber glass containers should be used to prevent photodegradation of the sample, except when samples are being collected for metals analysis. If amber containers are not available, then containers holding samples should be protected from light (i.e., place in cooler with ice immediately after filling).

d. Container Closures

Container closures must screw on and off the containers and form a leak-proof seal. Container caps must not be removed until the container is ready to be filled with the sample, and the container cap must be replaced (securely) immediately after filling it. Closures should be constructed of a material which is inert with respect to the sampled material, such as PTFE (e.g., TeflonTM). Alternately, the closure may be separated from the sample by a closure liner that is inert to the sample material such as PTFE sheeting. If soil or sediment samples are being collected, the threads of the container must be wiped clean with a dedicated paper towel or cloth so the cap can be threaded properly.

e. Decontamination of Sample Containers

Sample containers must be laboratory cleaned by the laboratory performing the analysis. The cleaning procedure is dictated by the specific analysis to be performed on the sample. Sample containers must be carefully examined to ensure that all containers appear clean. Do not mistake the preservative as unwanted residue. The bottles should not be field cleaned. If there is any question regarding the integrity of the bottle, then the laboratory must be contacted immediately and the bottle(s) replaced.

f. Sample Bottle Storage and Transport

No matter where the sample bottles are, whether at the laboratory waiting to be packed for shipment or in the field waiting to be filled with sample, care must be taken to avoid contamination. Sample shuttles or coolers, and sample bottles must be stored and transported in clean environments. Sample bottles and clean sampling equipment must never be stored near solvents, gasoline, or other equipment that is a potential source of cross-contamination. When under chain of custody, sample bottles must be secured in locked vehicles, and custody sealed in shuttles or in the presence of authorized personnel. Information which documents that proper storage and transport procedures have been followed must be included in the field notebook and on appropriate field forms.

2.2 Decontamination of Sampling Equipment

Proper decontamination of all re-usable sampling equipment is critical for all sampling episodes. The SOP for Decontamination of Field Equipment and SOPs for method-specific or instrument-specific tasks must also be referred to for guidance for decontamination of various types of equipment.

2.3 Quality Assurance/Quality Control Samples

QA/QC samples are intended to provide control over the proper collection and tracking of environmental measurements, and subsequent review, interpretation and validation of generated analytical data. The SOPs for Collection of Quality Control Samples, for Evaluation and Validation of Data, and for Field Record Keeping and Quality Assurance/Quality Control must be referred to for detailed guidance regarding these respective procedures. SOPs for method-specific or instrument-specific tasks must also be referred to for guidance for QA/QC procedures.

2.4 Sample Preservation Requirements

Certain analytical methodologies for specific analytes require chemical additives in order to stabilize and maintain sample integrity. Generally, this is accomplished under the following two scenarios:

- a. Sample bottles are preserved at the laboratory prior to shipment into the field.
- b. Preservatives are added in the field immediately after the samples are collected.

Many laboratories provide pre-preserved bottles as a matter of convenience and to help ensure that samples will be preserved immediately upon collection. A problem associated with this method arises if not enough sample could be collected, resulting in too much preservative in the sample. More commonly encountered problems with this method include the possibility of insufficient preservative provided to achieve the desired pH level or the need for additional preservation due to chemical reactions caused by the addition of sample liquids to pre-preserved bottles. The use of pre-preserved bottles is acceptable; however, field sampling teams must always be prepared to add additional preservatives to samples if the aforementioned situations occur. Furthermore, care must be exercised not to overfill sample bottles containing preservatives to prevent the sample and preservative from spilling and therefore diluting the preservative (i.e., not having enough preservative for the volume of sample).

When samples are preserved after collection, special care must be taken. The transportation and handling of concentrated acids in the field requires additional preparation and adherence to appropriate preservation procedures. All preservation acids used in the field should be trace-metal or higher-grade.

2.5 Sample Handling

After the proper sample bottles have been received under chain-of-custody, properly decontaminated equipment has been used to collect the sample, and appropriate preservatives have been added to maintain sample integrity, the final step for the field personnel is checking the sample bottles prior to proper packing and delivery of the samples to the laboratory.

All samples should be organized and the labels checked for accuracy. The caps should be checked for tightness and any 40-ml volatile organic compound (VOC) bottles must be checked for bubbles. Each sample bottle must be placed in an individual "zip-lock" bag to protect the label, and placed on ice. The bottles must be carefully packed to prevent breakage during transport. When several bottles have been collected for an individual sample, they should not be placed adjacent to each other in the cooler to prevent possible breakage of all bottles for a given sample. If there are any samples which are known or suspected to be highly contaminated, these should be placed in an individual cooler under separate chain-of-custody to prevent possible cross contamination. Sufficient ice (wet or blue packs) should be placed in the cooler to maintain the temperature at 4 degrees Celsius (°C) until delivery at the laboratory. Consult the work plan to determine if a particular ice is specified as the preservation for transportation (e.g., the United States Environmental Protection Agency does not like the use of blue

packs because they claim that the samples will not hold at 4°C). If additional coolers are required, then they should be purchased. The chain-of-custody form should be properly completed, placed in a "zip-lock" bag, and placed in the cooler. One copy must be maintained for the project files. The cooler should be sealed with packing tape and a custody seal. The custody seal number should be noted in the field book. Samples collected from Monday through Friday will be delivered to the laboratory within 24 hours of collection. If Saturday delivery is not available, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if certain analytes require a shorter delivery time. If overnight mail is utilized, then the shipping bill must be maintained for the files and the laboratory must be called the following day to confirm receipt.

3.0 EQUIPMENT AND MATERIALS

3.1 General equipment and materials may include, but not necessarily be limited to, the following:

- a. Sample bottles of proper size and type with labels.
- b. Cooler with ice (wet or blue pack).
- c. Field notebook, appropriate field form(s), chain-of-custody form(s), custody seals.
- d. Black pen and indelible marker.
- e. Packing tape, "bubble wrap", and "zip-lock" bags.
- f. Overnight (express) mail forms and laboratory address.
- g. Health and safety plan (HASP).
- h. Work plan/scope of work.
- i. Pertinent SOPs for specified tasks and their respective equipment and materials.

3.2 Preservatives for specific samples/analytes as specified by the laboratory. Preservatives must be stored in secure, spillproof glass containers with their content, concentration, and date of preparation and expiration clearly labeled.

3.3 Miscellaneous equipment and materials including, but not necessarily limited to, the following:

- a. Graduated pipettes.
- b. Pipette bulbs.
- c. Litmus paper.

- d. Glass stirring rods.
- e. Protective goggles.
- f. Disposable gloves.
- g. Lab apron.
- h. First aid kit.
- i. Portable eye wash station.
- j. Water supply for immediate flushing of spillage, if appropriate.
- k. Shovel and container for immediate containerization of spillage-impacted soils, if appropriate.

4.0 PROCEDURE

- 4.1 Examine all bottles and verify that they are clean and of the proper type, number, and volume for the sampling to be conducted.
- 4.2 Label bottles carefully and clearly with project name and number, site location, sample identification, date, time, and the sampler's initials using an indelible marker.
- 4.3 Collect samples in the proper manner (refer to specific sampling SOPs).
- 4.4 Conduct preservation activities as required after each sample has been collected. Field preservation must be done immediately and must not be done later than 30 minutes after sample collection.
- 4.5 Conduct QC sampling, as required.
- 4.6 Seal each container carefully and place in an individual "zip lock" bag.
- 4.7 Organize and carefully pack all samples in the cooler immediately after collection (e.g., bubble wrap). Insulate samples so that breakage will not occur.
- 4.8 Complete and place the chain-of-custody form in the cooler after all samples have been collected. Maintain one copy for the project file. If the cooler is to be transferred several times prior to shipment or delivery to the laboratory, it may be easier to tape the chain-of-custody to the exterior of the sealed cooler. When exceptionally hazardous samples are known or suspected to be present, this should be identified on the chain-of-custody as a courtesy to the laboratory personnel.
- 4.9 Add additional ice as necessary to ensure that it will last until receipt by the laboratory.

- 4.10 Seal the cooler with packing tape and a custody seal. Record the number of the custody seal in the field notebook and on the field form. If there are any exceptionally hazardous samples, then shipping regulations should be examined to ensure that the sample containers and coolers are in compliance and properly labeled.
- 4.11 Samples collected from Monday through Friday will be delivered to the laboratory within 24 hours of collection. If Saturday delivery is not available, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if certain analytes require a shorter delivery time.
- 4.12 Maintain the shipping bill for the project files if overnight mail is utilized and call the laboratory the following day to confirm receipt.

END OF PROCEDURE

Date: May 5, 2000

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for using m-scopes. A m-scope is an electronic sounding device used to measure the depth to ground water below an established (surveyed) measuring point (MP). Measuring the depth to water (DTW) below the surveyed MP provides information for calculating ground-water elevations needed to construct ground-water elevation maps and determine the direction of ground-water flow.

M-scopes can be less accurate than a steel tape because the wire can kink, measurement increment marks can shift, and the tip may have been cut off and replaced without proper documentation. Thus, it is mandatory that a m-scope be calibrated before use.

2.0 DECONTAMINATION

The m-scope must be pre-cleaned (decontaminated) using a non-phosphate, laboratory-grade solution and rinsed with copious amounts of distilled or deionized water. This process is repeated before each measurement and following the final measurement.

3.0 CALIBRATION

The m-scope must be calibrated before being used to measure water levels. Calibration is accomplished by measuring the water level with the m-scope followed by a measurement using a steel tape. This dual measurement procedure is continued until the individual is confident that measurements taken using both devices are similar and the m-scope is reliable. The calibration procedure is documented in the field notebook or on an appropriate field form, and initialed and dated.

4.0 PROCEDURE

- 4.1 If the well is not vented, then remove the cap and wait several minutes for the water level to equilibrate. Take several measurements to ensure that the water level measured is in equilibrium with the aquifer (i.e., not changing substantially).
- 4.2 The manufacturer's model must be noted because some have switches, lights, beepers, or a combination of the above.
- 4.3 The 1-foot or 5-foot marked intervals on the electrical line must be checked to ensure that they have not shifted, and the bottom of the probe has not been cut. Check on a periodic basis that the cord has not kinked.
- 4.4 The water-level measurement is taken by lowering the probe into the well until the instrument-specific detection method (e.g., light, beeper, or both) is activated by contacting the water.

- 4.5 The electrical line is held at the MP and, using a ruler (e.g., carpenter's folding ruler) or an engineer's scale, the distance from the "held" point to the nearest marked interval is measured. The distance measured is added to, or subtracted from, the marked interval reading. The result is the DTW.
- 4.6 Measurements will be taken accurately and to the nearest 0.01 foot.
- 4.7 After measuring all wells in an area, always re-measure at least one well, preferably the first well measured, to see if the static water level has changed (e.g., due to pumping in the area, tidal effects, etc.). If a significant change has occurred, it may be necessary to re-measure other wells.
- 4.8 If there are previous water-level measurements available for the wells, then have these data available to compare the measurements with those just taken. Use these data to see if water levels are similar or if they have changed. If water levels have changed, then check if the changes are consistent (i.e., all up or all down) and make sense.
- 4.9 Water-level elevations are calculated by subtracting the DTW from the MP and a water-elevation map is constructed (contoured) on a well location map. This also provides a check to evaluate if the water levels make sense (or anomalies are evidenced). Re-measure the well(s) where anomalies are found as a check on the initial measurement(s).
- 4.10 If anomalies persist or water-level trends are different from the historical database, then check to see if hydrogeologic conditions and/or stresses have changed (e.g., discharge areas, pumping and/or injection wells, etc.).
- 4.11 All pertinent data will be documented in the field notebook, and initialed and dated.

END OF PROCEDURE

Date: May 5, 2000

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for purging a well prior to the collection of a ground-water sample. Purging (evacuating) a well involves the removal of the standing column of water in the well to allow "fresh" (representative) formation water to enter the well. Two conventionally used methods for well purging include: 1) discharge of a specified number of casing volumes of water (which is more commonly used); and 2) pumping until specific indicator parameters (e.g., specific conductance, pH, temperature) stabilize. Wells must be purged prior to sampling to ensure the collection of representative formation ground water for water-quality analysis.

For accepted, existing sampling and analysis programs, the same purging method will be used each time to maintain consistency. For new sampling and analysis programs, the basis for the purging technique(s) will be site-specific field conditions, client input, the experience of Roux Associates, Inc. and regulatory agency(ies) guidelines (e.g., some states permit purging a low-yield well to dryness while others insist that some water remains in the well).

2.0 EQUIPMENT AND MATERIALS

2.1 The following equipment may be needed to purge a monitoring well before sampling:

- a. Bailers.
- b. Centrifugal pumps.
- c. Electrical submersible pumps.
- d. Peristaltic pumps.
- e. Positive gas-displacement devices.
- f. Bladder pumps.
- g. Hand-operated diaphragm or bilge pump(s).
- h. Teflon™ tape, electrical tape.
- i. Tape measure (stainless steel, steel, fiberglass) with 0.01-foot measurement increments and chalk (e.g., blue carpenter's) or m-scope.
- j. Appropriate discharge hose and valves.

- k. Appropriate discharge tubing (e.g., polypropylene) if using a peristaltic pump.
- l. Appropriate compressed gas if using bladder-type or gas-displacement device.
- m. Extension cord(s) or portable generator (and fuel) if using an electric submersible pump.
- n. Non-absorbent cord (e.g., polypropylene, etc.), cotton (absorbent) cord.
- o. Tripod(s).
- p. Water Well Handbook.
- q. Explosimeter.
- r. Flow meter.

2.2 Bailers or centrifugal pumps are recommended for shallow, small diameter monitoring wells. For deep wells, or large diameter wells, a submersible pump is recommended.

3.0 DECONTAMINATION

Each piece of equipment that is used to evacuate wells (e.g., bailers, pumps, hoses) will be decontaminated thoroughly prior to the introduction of the equipment into the well and prior to leaving the site. Additionally, disposable items (e.g., cord, tubing) will be changed between each well purged and discarded in an appropriate manner.

4.0 PROCEDURE

- 4.1 The depth to water (DTW) is measured and subtracted from the sounded (total) depth of the well to calculate the length of the column of standing water in the well (in feet).
- 4.2 The volume of the standing water in the well is calculated by multiplying the length of standing water by a coefficient which equates the diameter of the well to gallons per linear foot. (Refer to the attached table from the Water Well Handbook for the coefficient or use the following equation $[V=(7.48 \text{ gal/ft}^3)(r^2h)]$, where V is volume of water in gallons, r is the radius of the well casing in feet, and h is the height of the water column in the well in feet].)
- 4.3 If purging is performed by evacuating a specified number of casing volumes, then three to five volumes are purged (typical regulatory agency requirement).
- 4.4 If wells are screened in low permeability formations, then the well may go dry prior to removing the specified volume of water. If the recovery rate is fairly

rapid and time allows, then remove more than one casing volume; otherwise, the evacuation of one casing volume may suffice. (Refer to the site sampling and analysis plan [SAP] for details of purging a low-yield well.)

- 4.5 Evacuation will occur from the top of the water column in the well to ensure that “fresh” formation water enters the bottom of the well through the screen, moves up as standing water is removed from the top, and all standing water is removed (i.e., only representative formation water is in the well).
- 4.6 The volume of water purged from the well must be measured and can be calculated directly by discharging into containers of known volume or can be calculated by multiplying rate of flow by time.
- 4.7 If a submersible or centrifugal pump is used, then the intake is set just below the dynamic (pumping) water level in the well. The rate of flow in gallons per minute (gpm) can be measured using a calibrated bucket (e.g., 5-gallon) if the rate is relatively low, or a 55-gallon drum if the rate is relatively high, and a watch capable of measuring time in second intervals. A precalibrated flow meter may also be used if available.
- 4.8 After the specified number of casing volumes have been evacuated from the well, the pump intake is lifted slowly until it breaks suction to confirm that any standing water above the intake has been purged.
- 4.9 If a bailer is used, then the bailer is lowered only deep enough to remove water from the top of the water column and a 5-gallon bucket is used to measure the volume of water evacuated.
- 4.10 If purging is not executed by evacuating a specified number of well volumes, then purging is performed by pumping or bailing the well until specific indicator parameters (e.g., specific conductance, pH, temperature) stabilize. The volume of water removed is documented on an appropriate field form or in the field notebook.
- 4.11 Water purged from the well will be disposed of in accordance with the appropriate method outlined in the site SAP.
- 4.12 If historic site data indicate that explosive gases could be present and accumulate in the well, then an explosimeter will be used to check vapor concentrations in wells at the site prior to beginning the purging procedure. Vapor concentrations in a well that exceed the 25 percent lower explosive limit (LEL) will require specific precautionary measures to allow purging the well without danger of explosion or fire (e.g., use of cotton cord for bailers or lowering pumping devices, non-electric powered pumps). These conditions will be addressed in the site health and safety plan (HASP) and/or SAP.

END OF PROCEDURE

Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for the sampling of ground-water monitoring wells for dissolved constituents. As part of the SOP for the sampling of ground-water monitoring wells, sample collection equipment and devices must be considered, and equipment decontamination and pre-sampling procedures (e.g., measuring water levels, sounding wells, and purging wells) must be implemented. Sampling objectives must be firmly established in the work plan before considering the above.

Valid water-chemistry data are integral to a hydrogeologic investigation that characterizes ground-water quality conditions. Water-quality data are used to evaluate both current and historic aquifer chemistry conditions, as well as to estimate future conditions (e.g., trends, migration pathways). Water-quality data can be used to construct ground-water quality maps to illustrate chemical conditions within the flow system, to generate water-quality plots to depict conditions with time and trends, and to perform statistical analyses to quantify data variability, trends, and cleanup levels.

2.0 EQUIPMENT AND MATERIALS

2.1 In order to sample ground water from monitoring wells, specific equipment and materials are required. The equipment and materials list may include, but not necessarily be limited to, the following:

- a. Bailers (Teflon™ or stainless steel).
- b. Pumps (centrifugal, peristaltic, bladder, electric submersible, bilge, hand-operated diaphragm, etc.).
- c. Gas-displacement device(s).
- d. Air-lift device(s).
- e. Teflon™ tape, electrical tape.
- f. Appropriate discharge hose.
- g. Appropriate discharge tubing (e.g., polypropylene, teflon, etc.) if using a peristaltic pump.
- h. Appropriate compressed gas if using bladder-type or gas-displacement device.

**STANDARD OPERATING PROCEDURE 4.4
FOR SAMPLING GROUND-WATER MONITORING
WELLS FOR DISSOLVED CONSTITUENTS**

Page 2 of 7

- i. Portable generator and gasoline or alternate power supply if using an electric submersible pump.
- j. Non-absorbent cord (e.g., polypropylene, etc.).
- k. Plastic sheeting.
- l. Tape measure (stainless steel, steel, fiberglass) with 0.01-foot measurement increments and chalk (blue carpenter's).
- m. Electronic water-level indicators (e.g., m-scope, etc.) or electric water-level/product level indicators.
- n. Non-phosphate, laboratory-grade detergent.
- o. Distilled/Deionized water.
- p. Potable water.
- q. Paper towels, clean rags.
- r. Roux Associates' field forms (e.g., daily log, well inspection checklist, sampling, etc.) and field notebook.
- s. Well location and site map.
- t. Well keys.
- u. Stop watch, digital watch with second increments, or watch with a second hand.
- v. Water Well Handbook.
- w. Calculator.
- x. Black pen and water-proof marker.
- y. Tools (e.g., pipe wrenches, screwdrivers, hammer, pliers, flashlight, pen knife, etc.).
- z. Appropriate health and safety equipment, as specified in the site health and safety plan (HASP).
- aa. pH meter(s) and buffers.
- bb. Conductivity meter(s) and standards.
- cc. Thermometer(s).

- dd. Extra batteries (meters, thermometers, flashlight).
- ee. Filtration apparatus, filters, pre-filters.
- ff. Plasticware (e.g., premeasured buckets, beakers, flasks, funnels).
- gg. Disposable gloves.
- hh. Water jugs.
- ii. Laboratory-supplied sample containers with labels.
- jj. Cooler(s).
- kk. Ice (wet, blue packs).
- ll. Masking, duct, and packing tape.
- mm. Chain-of-custody form(s) and custody seal(s).
- nn. Site sampling and analysis plan (SAP).
- oo. Site health and safety plan (HASP).
- pp. Packing material (e.g., bubble wrap)
- qq. "Zip-lock" plastic bags.
- rr. Overnight (express) mail forms.

3.0 DECONTAMINATION

- 3.1 Make sure all equipment is decontaminated and cleaned before use (refer to the SOP for Decontamination of Field Equipment for detailed decontamination methods, summaries for bailers and pumps are provided below). Use new, clean materials when decontamination is not appropriate (e.g., non-absorbent cord, disposable gloves). Document, and initial and date the decontamination procedures on the appropriate field form and in the field notebook.
 - a. Decontaminate a bailer by: 1) wearing disposable gloves, 2) disassembling (if appropriate) and scrubbing in a non-phosphate, laboratory-grade detergent and distilled/deionized water solution, and 3) rinsing first with potable water and then distilled/deionized water.
 - b. Decontaminate a pump by: 1) wearing disposable gloves, 2) flushing the pump and discharge hose (if not disposable) first with a non-phosphate, laboratory-grade detergent and potable water solution in an appropriate

container (clean bucket, garbage can, or 55-gallon drum) and then with distilled/deionized water or potable water, and 3) wiping pump-related equipment (e.g., electrical lines, cables, discharge hose) first with a clean cloth and detergent solution and then rinsing or wiping with a clean cloth and distilled/deionized water or potable water.

3.2 Note that the decontamination procedures for bailers and pumps are the minimum that must be performed. Check the work plan to determine if chemicals specified by individual state regulatory agencies must also be used for decontamination procedures (e.g., hexane, nitric acid, acetone, isopropanol, etc.).

4.0 CALIBRATION OF FIELD ANALYSIS EQUIPMENT

Calibrate field analysis equipment before use (e.g., thermometers, pH and conductivity meters, etc.). Refer to the specific SOP for field analysis for each respective piece of equipment. Document, and initial and date the calibration procedures on the appropriate field form, in the field notebook, and in the calibration log book.

5.0 PROCEDURE

5.1 Document, and initial and date well identification, pre-sampling information, and problems encountered on the appropriate field form and in the field notebook as needed.

5.2 Inspect the protective casing of the well and the well casing, and note any items of concern such as a missing lock, or bent or damaged casing(s).

5.3 Place plastic sheeting around the well to protect sampling equipment from potential cross contamination.

5.4 Remove the well cap or plug and, if necessary, clean the top of the well off with a clean rag. Place the cap or plug on the plastic sheeting. If the well is not vented, allow several minutes for the water level in the well to equilibrate. If fumes or gases are present, then diagnose these with the proper safety equipment. Never inhale the vapors.

5.5 Measure the depth to water (DTW) from the measuring point (MP) on the well using a steel tape and chalk or an electronic sounding device (m-scope). Refer to the specific SOPs for details regarding the use of a steel tape or a m-scope for measuring water levels. Calculate the water-level elevation. Document, and initial and date the information on the appropriate field form and in the field notebook.

5.6 Measuring the total depth of the well from the MP with a weighted steel tape. Calculate and record the volume of standing water in the well casing on the appropriate field form and in the field notebook.

- 5.7 Decontaminate the equipment used to measure the water level and sound the well with a non-phosphate, laboratory-grade detergent solution followed by a distilled/deionized water rinse.
- 5.8 Purge the well prior to sampling (refer to the SOP for Purging a Well). The well should be pumped or bailed to remove the volume of water specified in the work plan. Usually three to five casing volumes are removed if the recharge rate is adequate to accomplish this within a reasonable amount of time.

If the formation cannot produce enough water to sustain purging, then one of two options must be followed. These include: 1) pumping or bailing the well dry, or 2) pumping or bailing the well to "near-dry" conditions (i.e., leaving some water in the well). The option employed must be specified in the work plan and be in accordance with regulatory requirements.

If the well is purged dry, then all the standing water has been removed and upon recovery the well is ready for sampling. However, depending on the rate of recovery and the time needed to complete the sampling round, one of the following procedures may have to be implemented: 1) the well may have to be sampled over a period of more than one day; 2) the well may not yield enough water to collect a complete suite of samples and only select (most important) samples will be collected; or 3) the well may not recover which will preclude sampling. Regardless of the option that must be followed, the sampling procedure must be fully documented. When preparing to conduct a sampling round, review drilling, development and previous sampling information (if available) to identify low-yielding wells in order to purge them first, and potentially allow time for the well to recover for sampling.

- 5.9 Record the physical appearance of the water (i.e., color, turbidity, odor, etc.) on the appropriate field form and in the field notebook, as it is purged. Note any changes that occur during purging.
- 5.10 If a bailer is used to collect the sample, then:
 - a. Flush the decontaminated bailer three times with distilled/deionized water.
 - b. Tie the non-absorbent cord (polypropylene) to the bailer with a secure knot and then tie the free end of the bailer cord to the protective casing or, if possible, some nearby structure to prevent losing the bailer and cord down the well.
 - c. Lower the bailer slowly down the well and into the water column to minimize disturbance of the water surface. If a bottom-filling bailer is used, then do not submerge the top of the bailer; however, if a top-filling bailer is used, then submerge the bailer several feet below the water surface.

- d. Remove and properly discard one bailer volume from the well to rinse the bailer with well water before sampling. Again, lower the bailer slowly down the well to the appropriate depth depending on the bailer type (as discussed above in 5.11 c). When removing the bailer from the well, do not allow the bailer cord to rest on the ground but coil it on the protective plastic sheeting placed around the well. Certain regulatory agencies require that the first bailer volume collected be utilized for the samples.
- 5.11 If a pump is used to collect the sample, then use the same pump used to purge the well and, if need be, reduce the discharge rate to facilitate filling sample containers and to avoid problems that can occur while filling sample containers (as listed in Number 5.14, below). Alternately, the purge pump may be removed and a thoroughly decontaminated bailer can be used to collect the sample.
- 5.12 Remove each appropriate container's cap only when ready to fill each with the water sample, and then replace and secure the cap immediately.
- 5.13 Fill each appropriate, pre-labeled sample container carefully and cautiously to prevent: 1) agitating or creating turbulence; 2) breaking the container; 3) entry of, or contact with, any other medium; and 4) spilling/splashing the sample and exposing the sampling team to contaminated water. Immediately place the filled sample container in a ice-filled (wet ice or blue pack) cooler for storage. If wet ice is used it is recommended that it be repackaged in zip-lock bags to help keep the cooler dry and the sample labels secure. Check the work plan as to whether wet ice or blue packs are specified for cooling the samples because certain regulatory agencies may specify the use of one and not the other.
- 5.14 "Top-off" containers for volatile organic compounds (VOCs) and tightly seal with Teflon™-lined septums held in place by open-top screw caps to prevent volatilization. Ensure that there are no bubbles by turning the container upside down and tapping it gently.
- 5.15 Filter water samples (Procedure 4.6) collected for dissolved metals analysis prior to preservation to remove the suspended sediment from the sample. If water samples are to be collected for total metals analysis, then collect a second set of samples without field filtering.

In the event that the regulatory agency(ies) want unfiltered samples for metals analysis, a second set of filtered samples should also be collected. Because unfiltered samples are indications of total metals (dissolved and suspended) they are not representative of aquifer conditions because ground water does not transport sediment (except in some rare cases). Thus, the results for dissolved metals in ground water should be based on filtered samples even if both filtered and unfiltered sets are presented in a report.

- 5.16 Add any necessary preservative(s) to the appropriate container(s) prior to, or after (preferred), the collection of the sample, unless the appropriate preservative(s) have already been added by the laboratory before shipment.
- 5.17 Collect quality control (QC) samples as required in the work plan to monitor sampling and laboratory performance. Refer to the SOP for Collection of Quality Control Samples.
- 5.18 Conduct field analyses after sample collection is complete by measuring and recording the temperature, conductivity, pH, etc. (as called for in the work plan). Note and record the "final" physical appearance of the water (after purging and sampling) on an appropriate field form and in the field notebook.
- 5.19 Wipe the well cap with a clean rag, replace the well cap and protective cover (if present). Lock the protective cover.
- 5.20 Verify that each sample is placed in an individual "zip-lock" bag, wrapped with "bubble wrap," placed in the cooler, and that the cooler has sufficient ice (wet ice or blue packs) to preserve the samples for transportation to the analytical laboratory.
- 5.21 Decontaminate bailers, hoses, and pumps as discussed in the decontamination SOP. Wrap decontaminated equipment with a suitable material (e.g., clean plastic bag or aluminum foil). Discard cords, rags, gloves, etc. in a manner consistent with site conditions.
- 5.22 Complete all necessary field forms, field notebook entries, and the chain-of-custody forms. Retain one copy of each chain-of-custody form. Secure the cooler with sufficient packing tape and a custody seal.
- 5.23 Samples collected from Monday through Friday will be delivered within 24 hours of collection. If Saturday delivery is not available, samples collected on Friday must be delivered by Monday morning. Consult the work plan to determine if any of the analytes require a shorter delivery time.

END OF PROCEDURE

STANDARD OPERATING PROCEDURE 4.6
FOR FILTRATION OF GROUNDWATER AND SURFACE-
WATER SAMPLES FOR DISSOLVED METALS ANALYSIS

Page 1 of 3

Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for the field filtration of groundwater samples for dissolved metals analysis prior to sample preservation. Filtering is implemented when the water sample contains suspended fine-grained materials (fines) that cannot be prohibited from entering the water sample by well development or well design. However, as fines are not always distinctly visible in the water sample, all water samples to be analyzed for dissolved metals will undergo filtration. Groundwater samples from bedrock formations to be analyzed for dissolved metals must also be filtered.

It should be noted that filtration of groundwater for metals analysis has been a standard practice with the United States Geological Survey (USGS) for many years. However, it should also be noted that certain regulatory agencies insist that groundwater samples for metals analysis are not filtered. In this case, the analytical results are actually representative of total metals (i.e., dissolved and suspended). Nevertheless, in order to quantify the concentrations of dissolved metals in groundwater, filtration will be employed.

Within this framework, filtration refers to the filtering of water either directly or at the end of a filtration series through a 0.45 micrometer (micron) membrane filter. The presence of a large quantity of fines may require the prefiltration of the sample with a larger-size membrane filter prior to the 0.45 micron filter to avoid clogging the 0.45 micron filter and using an exorbitant amount of time to filter the sample.

Filtration must be done as soon as possible after a water sample is collected, preferably at the same time that the water is produced. If there is a delay between the time that the water sample is collected and the time that filtration occurs, then the time lag and reason for the delay must be documented. The filtering equipment and membrane must be suitable for the intended analysis. Where permitted by regulatory agencies, disposable in-line filters and disposable funnel-type filters may be used. Depending upon the sampling needs, sterile disposable filtering devices may be preferable since they eliminate the need for field decontamination. Materials known to adversely affect the analytical procedure must not be used. The site sampling and analysis plan (SAP) must be referred to for these and other site specific filtration conditions.

In the event that surface water is being analyzed for dissolved metals, the filtration process described below is also used.

2.0 MATERIALS AND EQUIPMENT

To field filter groundwater samples, specific equipment and materials are required. The equipment and materials listed below may be needed in addition to the materials and equipment listed in various sampling SOPs.

- a. Non-phosphate, laboratory-grade detergent.
- b. Distilled/Deionized water.
- c. Potable water.
- d. Field forms (e.g., daily log, sampling, etc.) and field notebook.
- e. Filtration apparatus (e.g., disposable plastic filtering apparatus, disposable in-line filters, Gelman apparatus, Buchner funnel, etc.), filters, prefilters.
- f. Plasticware (e.g., premeasured buckets, beakers, flasks, funnels).
- g. TeflonTM tape.
- h. Vacuum pump (e.g., hand-operated or electric).
- i. Appropriate tubing and fittings.
- j. Disposable gloves.
- k. Sample jars with appropriate preservative (e.g., nitric acid) and labels.

3.0 DECONTAMINATION

3.1 Decontamination is not necessary if sterile, disposable plastic filtering equipment is utilized. If applicable, it may be useful to collect a distilled water field blank through a representative disposable filter to demonstrate proper "decontamination." If re-usable filtering equipment is being used, the following is the minimum decontamination procedure:

- a. Wear disposable gloves while cleaning filtering equipment to avoid contamination and change gloves as needed.
- b. Prepare a non-phosphate, laboratory-grade detergent solution and distilled or deionized water in a bucket.
- c. Remove vacuum tubing from flask.
- d. Remove filter membrane from funnel.

- e. Disassemble filtering apparatus (flask and funnel) and scrub each piece of equipment with a brush and solution.
- f. Rinse with potable water.
- g. Rinse with copious amounts of distilled or deionized water.
- h. Allow to dry and wrap equipment with a suitable material (e.g., clean plastic bag) in preparation for the next use.

3.2 The decontamination procedure must consider regulatory agency(ies) specifications which must be provided in the site SAP, and may include decontamination variations such as nitric acid rinses, acetone rinses, etc.

4.0 PROCEDURE

- 4.1. Ensure that the filtering equipment is disposable and dedicated or is properly decontaminated before each use.
- 4.2. Assemble the filtering apparatus (funnel and flask), and connect the vacuum pump in case it is needed to augment gravity filtration.
- 4.3. Place a clean (new) 0.45-micron pore-size filter in the funnel. Use larger, pore-size filters if prefiltering is required (i.e., if significant suspended sediment is present that would quickly clog the 0.45-micron filter and prevent continuous filtration or result in excessive time for filtration).
- 4.4. Obtain the water sample using an appropriate, decontaminated sample-collection device (e.g., bailer, pump).
- 4.5. Pass the unpreserved water sample through the 0.45 micron filter into the flask. If the sample contains significant sediment, then pass it through a prefilter before using the 0.45 micron filter. Apply a vacuum using the vacuum pump if needed to facilitate filtering.
- 4.6. Transfer the filtered water sample to the appropriate, prelabeled sample container containing the preservative (e.g., nitric acid) being careful not to overfill the container and dilute the preservative.
- 4.7. Follow standard operating procedures for sample documentation, shipping, and tracking (i.e., record keeping).
- 4.8. Decontaminate all reusable filtering (and sampling) equipment that came in contact with the water sample. Properly disposal of all non-reusable equipment in a manner appropriate with site conditions.

END OF PROCEDURE

Date: May 5, 2000

1.0 PURPOSE

The purpose of this Standard Operating Procedure (SOP) is to establish guidelines for the collection of soil samples for laboratory analysis. This SOP is applicable to soil samples collected from split-spoon samplers during drilling, hand auger samples, grab samples from stockpiled soils, surface samples, test pit samples, etc.

2.0 CONSIDERATIONS

Soil samples may be collected in either a random or biased manner. Random samples can be based on a grid system or statistical methodology. Biased samples can be collected in areas of visible impact or suspected source areas. Soil samples can be collected at the surface, shallow subsurface, or at depth. When samples are collected at depth the water content should be noted, since generally "soil sampling" is restricted to the unsaturated zone. Equipment selection will be determined by the depth of the sample to be collected. A thorough description of the sampling locations and proposed methods of sample collection should be included in the work plan.

Commonly, surface sampling refers to the collection of samples at a 0 to 6 inch depth interval. Certain regulatory agencies may define the depth interval of a surface sample differently, and this must be defined in the work plan. Collection of surface soil samples is most efficiently accomplished with the use of a stainless steel trowel or scoop. For samples at greater depths a decontaminated bucket auger or power auger may be needed to advance the hole to the point of sample collection. Another clean bucket auger should then be used to collect the sample. To collect samples at depths of greater than approximately six feet the use of a drill rig and split spoon samples will usually be necessary. In some situations, sample locations are accessed with the use of a backhoe.

3.0 MATERIALS/EQUIPMENT

- a. A work plan which outlines soil sampling requirements.
- b. Field notebook, field form(s), maps, chain-of-custody forms, and custody seals.
- c. Decontamination supplies (including: non-phosphate, laboratory grade detergent, buckets, brushes, potable water, distilled water, regulatory-required reagents, aluminum foil, plastic sheeting, etc.).
- d. Sampling device (split-spoon sampler, stainless steel hand auger, stainless steel trowel, etc.).
- e. Stainless steel spoons or spatulas.
- f. Disposable sampling gloves.

- g. Laboratory-supplied sample containers with labels.
- h. Cooler with blue or wet ice.
- i. Plastic sheeting.
- j. Black pen and indelible marker.
- k. Zip-lock bags and packing material.
- l. Tape measure.
- m. Paper towels or clean rags.
- n. Masking and packing tape.
- o. Overnight (express) mail forms.

4.0 DECONTAMINATION

All reusable sampling equipment will be thoroughly cleaned according to the decontamination SOP. Where possible, thoroughly pre-cleaned and wrapped sampling equipment should be used and dedicated to individual sampling locations. Disposable items such as sampling gloves, aluminum foil, and plastic sheeting will be changed after each use and discarded in an appropriate manner.

5.0 PROCEDURE

- 5.1 Prior to collecting soil samples, ensure that all sampling equipment has been thoroughly cleaned according to the decontamination SOP. If samples are to be collected at depth, then the boring must be advanced with thoroughly cleaned equipment to the desired sampling horizon and a different thoroughly cleaned sampler must be used to collect the sample.
- 5.2 Using disposable gloves and a pre-cleaned, stainless steel spatula or spoon, extract the soil sample from the sampler, measure the recovery, and separate the wash from the true sample. Where allowed by regulatory agency(ies), disposable plastic spoons may be used.
- 5.3 Place the sample in a laboratory-supplied, pre-cleaned sample container. This should be done as quickly as possible and this is especially important when sampling for volatile organic compounds (VOCs). Samples to be analyzed for VOCs must be collected prior to other constituents.
- 5.4 The sample container will be labeled with appropriate information such as, client name, site location, sample identification (location, depth, etc.), date and time of collection, and sampler's initials.

- 5.5 Using the remaining portion of soil from the sampler, log the sample in detail and record sediment characteristics (color, odor, moisture, texture, density, consistency, organic content, layering, grain size, etc.).
- 5.6 If soil samples are to be composited in the field, then equal portions from selected locations will be placed on a clean plastic sheet and homogenized. Alternately, several samples may be submitted to the laboratory for compositing by weight. The method used is dependent upon regulatory requirements. Specific compositing procedures shall be approved by the appropriate regulatory agency and described in the work plan. Samples to be analyzed for VOCs will not be composited unless required by a regulatory agency.
- 5.7 After the sample has been collected, labeled, and logged in detail, it is placed in a zip-lock bag and stored in a cooler at 4°C.
- 5.8 A chain-of-custody form is completed for all samples collected. One copy is retained and two are sent with the samples in a zip-lock bag to the laboratory. A custody seal is placed on the cooler prior to shipment.
- 5.9 Samples collected from Monday to Friday are to be delivered to the laboratory within 24 hours of collection. If Saturday delivery is unavailable, samples collected on Friday must be delivered by Monday morning. Check the work plan to determine if any analytes require a shorter delivery time.
- 5.10 The field notebook and appropriate forms should include, but not be limited to the following: client name, site location, sample location, sample depth, sample identification, date and time collected, sampler's name, method of sample collection, number and type of containers, geologic description of material, description of decontamination procedures, etc. A site map should be prepared with exact measurements to each sample location in case follow-up sampling is necessary.
- 5.11 All reusable sampling equipment must be thoroughly cleaned in accordance with the decontamination SOP. Following the final decontamination (after all samples are collected) the sampling equipment is wrapped in aluminum foil. Discard any gloves, foil, plastic, etc. in an appropriate manner that is consistent with site conditions.

END OF PROCEDURE

**STANDARD OPERATING PROCEDURE 5.4
FOR SCREENING SOIL SAMPLES FOR VOLATILE ORGANIC
VAPORS USING A PORTABLE PHOTOIONIZATION
DETECTOR**

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Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for screening soil samples for volatile organic vapors using a portable photoionization detector (PID). This SOP is applicable to soil samples collected from split-spoon samplers during drilling, hand auger samples, and grab samples from stockpiled soils.

2.0 CONSIDERATIONS

The primary objective of photoionization screening of soil samples is to obtain a qualitative understanding of the distribution of volatile organic compounds (VOCs) in soil. The proper design of an organic vapor screening program requires an understanding of site hydrogeology, potential source areas, and potential constituents of concern. Sample locations and frequency must be fully defined in the work plan. The work plan should outline the type of lamp to be utilized in the PID based on the ionization potentials and response factors of the constituents of concern. The work plan must also clearly describe the heating or equilibration procedures to be employed if they differ from those described in this SOP. Regardless of the specific equilibration procedure employed, it is imperative that each sample be treated identically to allow the photoionization results from different locations to be compared. Observations such as water, clay, and organic content should be noted to facilitate interpretation of the data. Every effort should be made to collect a representative portion of soil from the sampling device.

3.0 MATERIALS/EQUIPMENT

- a. A work plan which outlines photoionization screening requirements.
- b. Decontamination supplies (including: non-phosphate, laboratory grade detergent, buckets, brushes, potable water, distilled water, regulatory-required reagents [e.g., acetone, nitric acid, hexane, etc.], aluminum foil, plastic sheeting, etc.).
- c. Field notebook, field form(s), maps, chain-of-custody forms.
- d. Sampling device (split-spoon sampler, stainless steel hand auger, stainless steel trowel, etc.).
- e. Stainless steel spoons or spatulas.
- f. Disposable plastic spoons.
- g. Plastic sheeting.
- h. Aluminum foil.

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- i. Mason jars or driller's jars.
- j. Water bath (hot plate, extension cord, water tray, thermometer).
- k. Photoionization detector with charging unit.
- l. Calibration gases with regulator.
- m. Indelible marker.
- n. Masking tape.
- o. Disposable sampling gloves.

4.0 DECONTAMINATION

Where possible, thoroughly pre-cleaned and wrapped sampling equipment must be used and dedicated to individual sampling locations. Disposable items such as sampling gloves, aluminum foil, and sample jars will be changed after each use and discarded in an appropriate manner. If only photoionization results are to be obtained, then split-spoon samples and hand augers may be cleaned with a soap and water wash and potable water rinse or steam cleaning, and a final distilled water rinse. However, if samples are to be collected concurrently for laboratory analytical results, then all reusable sampling equipment must be thoroughly decontaminated according to the SOP for decontamination of field equipment.

5.0 CALIBRATION

The PID must be calibrated according to the manufacturer's specifications at a minimum frequency of once per day prior to collecting photoionization readings. In addition, periodic checks (e.g., every 2 hours or every ten samples) with the standard gas will be conducted to confirm that the calibration has not drifted. The time, date, and calibration procedure must be clearly documented in the field notebook and the calibration log. If at any time the photoionization results appear erratic or inconsistent with field observations, then the unit must be recalibrated. If calibration is difficult to achieve, then the unit's lamp should be checked for dirt or moisture and cleaned, as necessary. During humid or wet conditions, the unit should be calibrated on a more frequent basis as determined by field personnel.

6.0 PROCEDURE

- 6.1 Extract the soil sample from the sampler, quickly measure the recovery, and separate the wash from the true sample by using a dedicated, stainless steel spatula. Where allowed by regulatory agency(ies), disposable plastic spoons may be used.

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- 6.2 Place the sample in a pre-cleaned glass jar (as quickly as possible to avoid loss of VOCs) filling the jar half full. Place an aluminum foil seal between the glass and metal cap and screw tight.
- 6.3 Label jars with the boring number, depth of sample, date of collection and blow counts. In addition, the field personnel will ensure the following: samples are taken at appropriate depths; unrepresentative portions of the sample are discarded properly; that the sampler is decontaminated properly between use; and the driller uses proper methods during sample collection and does not use oil or grease on tools entering the borehole.
- 6.4 Log the sample in detail and record sediment characteristics (color, odor, moisture, texture, density, consistency, organic content, and layering).
- 6.5 After the sample has been collected, heat the sample under controlled conditions in a water bath for a 2 minute period.
- 6.6 Ensure that the PID has been calibrated and that the calibration information is documented in the field book. Pierce the aluminum foil seal with the probe from the PID and measure the relative concentration of VOCs in the headspace of the soil sample. The initial (peak) reading must be recorded.
- 6.7 Record the PID reading in the field notebook, on an appropriate field form, and on the base map, if appropriate.
- 6.8 Place any material not representative of the interval sampled in a pile with the other cuttings from the borehole.
- 6.9 If only photoionization results are to be obtained, then reusable sampling devices may be cleaned with a soap and water wash and a potable water rinse. The sampler will then be rinsed with distilled water, assembled and placed on plastic sheeting for reuse. A more rigorous decontamination procedure is required when samples are also being collected for laboratory analysis. Refer to the SOP for collection of soil samples for laboratory analysis for additional information.

END OF PROCEDURE

Date: May 5, 2000

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for measuring the pH of water in the field. The pH is measured in the field using a pH meter which should have the ability to compensate for temperature (automatically or manually). The pH will be measured in standard units (SU) and can be recorded with or without the SU designation. The conventional means of recording a pH value is without a unit designation (e.g., 7.0); however, the SU designation may be used provided the term is defined as standard units when first referenced. The manufacturer's instrument manual for each particular pH meter, which is maintained with the instrument, will be referred to for calibration, use, repair, maintenance, or trouble-shooting operations.

The pH is measured in the field to provide the pH of the water under ambient (in situ) conditions. The pH is a measure of acidic (<7.0) or basic (>7.0) nature of the water and is used to assist in evaluating the mobility of contaminants. In addition, pH measurements can be used during well purging to help determine when sufficient ground water has been purged (removed) from a well (i.e., the standing water in the well has been removed and replaced with "fresh" water from the aquifer). The determination is made when pH readings have achieved stabilization or near-stabilization.

2.0 CALIBRATION

- 2.1 Calibration of the pH meter is to be performed at the beginning and end of each day's use in accordance with the manufacturer's specific instructions. Usual procedures are given below.
- 2.2 Recalibration must occur if: 1) the pH of the samples being measured is outside the previous calibration range; 2) the procedure or use conditions warrant frequent calibrations; 3) four or more hours have elapsed; or 4) the instrument has been moved from one area to another (e.g., offsite or out of the study area).
- 2.3 Two buffer calibrations bracketing the expected pH range of samples are to be performed prior to its use in a study. Three pH buffers (4.0, 7.0, and 10.0) are read after standardization at pH of 7.0 to evaluate the linearity and electrodes.
- 2.4 The measurements of sample and buffers are made while stirring. The samples and buffers are measured at the same temperature; therefore, the pH meter must be temperature compensated. If not, then record the temperature.
- 2.5 The following information is documented in the calibration logbook at the time of calibration:
 - a. Date.
 - b. pH meter identification.

- c. Calibration results using pH standards.
- d. Initials of the individual performing calibration.

3.0 PROCEDURE

- 3.1 A warm-up period may or may not be necessary for the instrument, depending on instrument requirements. The manufacturer's instrument manual must be followed.
- 3.2 The pH electrodes must be kept in good working order as follows:
 - a. Proper levels of electrolyte solution are maintained. The electrolyte solution level should be at least 1 inch above the solution being measured.
 - b. The electrodes must be carefully rinsed with distilled or deionized water before each measurement.
- 3.3 The water sample (approximately 500 milliliters [ml]) is placed in a clean container and the temperature and pH are measured immediately.
- 3.4 The temperature of the sample is measured and the pH meter is compensated for the water temperature. If compensation is not possible, then record the temperature.
- 3.5 The electrodes are immersed in a water sample and stirred continuously until the pH reading equilibrates. The pH will be measured and recorded in increments of 0.1 or 0.1 SU.
- 3.6 Pertinent data are documented in the field notebook or appropriate field form, and initialed and dated.
- 3.7 The electrodes are rinsed with distilled or deionized water and the unit stored properly in accordance with the manufacturer's instructions (e.g., capping and storing in a buffer such as altex electrode storage solution). The electrodes are not to be stored in potable water, or distilled or deionized water.

END OF PROCEDURE

Date: May 5, 2000

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for measuring the electrical conductance (conductivity) of water in the field. The conductivity is measured in the field using a conductivity meter which compensates for temperature (automatically or manually). Some conductivity meters measure directly in micromhos/ centimeter ($\mu\text{mhos}/\text{cm}$) while others have to be converted to this unit. Conductivity will be recorded in $\mu\text{mhos}/\text{cm}$. The manufacturer's instrument manual of each particular conductivity meter, which is maintained with the instrument, will be referred to for calibration, use, repair, maintenance, or trouble-shooting operations.

The specific conductivity is measured in the field as a measure of the total dissolved solids (TDS) in the ground water or surface water. TDS data can then be used as a qualitative measure of contamination and to assist in evaluating electrical resistivity and borehole geophysical data. In addition, specific conductivity measurements can be used during well purging to help determine when sufficient ground water has been purged (removed) from a well (i.e., the standing water in the well has been removed and replaced with "fresh" water from the aquifer). The determination is made when conductivity readings have achieved stabilization or near-stabilization.

2.0 CALIBRATION

- 2.1 Calibration is in accordance with the manufacturer's specific directions.
- 2.2 Calibration of the conductivity meter is to be performed at the beginning and end of each day's use.
- 2.3 Recalibration must occur if: 1) the specific conductivity of samples being measured is outside the calibration standard solution range; or 2) the instrument has been moved from one area to another (e.g., offsite or out of the study area).
- 2.4 Choose a conductivity calibration solution that is near the conductivity of the water samples to be measured.
- 2.5 Select the appropriate conductivity calibration solution and adjust the span on the instrument to the conductivity calibration solution value.
- 2.6 Rinse the probe in distilled or deionized water and store the probe according to the manufacturer's specifications (e.g., distilled or deionized water, or a buffer solution).
- 2.7 The following information is documented in the calibration logbook:
 - a. Date.

- b. Conductivity meter identification.
- c. Initials of individual performing calibration.
- d. Calibration results.

3.0 PROCEDURE

- 3.1 The conductivity electrodes must be kept in good working order as specified by the manufacturer.
- 3.2 The water sample is placed in a clean, appropriate container(s) and the temperature and conductivity are measured immediately.
- 3.3 The temperature of the sample is taken and the conductivity meter is compensated for the water temperature.
- 3.4 The probe is immersed in a water sample until the meter equilibrates.
- 3.5 In reading the conductivity meter scale, one or more of the following may have to be considered:
 - a. The reading may have to be multiplied appropriately (e.g., the reading is expressed in micromhos/centimeter).
 - b. If the conductivity meter is not capable of compensating for temperature differences, then note that the conductance measurements are not temperature compensated and document the temperatures.
 - c. If the conductivity meter can be compensated for temperature, then adjust the temperature control before reading the conductance measurement. (Some meters automatically compensate for temperature, and this should be documented.)
- 3.6 Conductivity measurements are recorded in the field notebook and on the appropriate field form, and initialed and dated. Units of $\mu\text{mhos}/\text{cm}$ are used to represent conductivity.
- 3.7 The probe will be cleaned with distilled or deionized water after each use and will be stored according to the manufacturer's specifications (e.g., conductivity cells may have to be stored in distilled or deionized water, or a buffer solution).

END OF PROCEDURE

Date: May 5, 2000

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for measuring water temperature in the field. Temperature measuring devices may include thermometers, and pH and/or conductivity meters equipped with a temperature probe. The temperature measuring device must be rapidly equilibrating, precision-grade, and meet or exceed National Bureau of Standards (NBS) specifications for accuracy. Temperature will be measured and recorded in degrees Celsius/Centigrade ($^{\circ}$ C). If the temperature measuring device is a meter, then the manufacturer's instrument manual, which is maintained with the instrument, will be referred to for calibration, use, repair, maintenance, or trouble-shooting operations.

Temperature data is collected in the field to determine the temperature of the water sample under ambient (in situ) conditions. Temperature data can be used to evaluate the mobility of compounds in ground water and flow conditions. In addition, temperature measurements can be used during well purging to help determine when sufficient ground water has been purged (removed) from a well (i.e., the standing water in the well has been removed and replaced with "fresh" water from the aquifer). The determination is made when temperature readings have achieved stabilization or near-stabilization.

2.0 CALIBRATION

- 2.1 Calibration of thermometers and temperature measuring meters will be performed before entering the field and checked upon return to the office.
- 2.2 Temperature measuring devices will be calibrated against a NBS-traceable thermometer.
- 2.3 If a thermometer is used to measure temperature, then the thermometer must read within 1° C to 1.5° C of the NBS-traceable thermometer. If the thermometer does not read within this range and the thermometer cannot be calibrated, then it will not be used for temperature measurements and will be disposed of in an appropriate manner. If the thermometer does not read within this range and the thermometer can be calibrated, then the thermometer will be calibrated to the NBS-traceable thermometer.
- 2.4 If a temperature measuring meter is used to measure temperature, then the meter must read within 1° C to 1.5° C of the NBS-traceable thermometer. If the meter does not read within this range and the meter cannot be calibrated, then it will not be used for temperature measurements and will be sent to the manufacturer for service and repair. If the meter does not read within this range and the meter can be calibrated, then the meter will be calibrated to the NBS-traceable thermometer.
- 2.5 The following information is documented in the calibration logbook at the time of calibration:

- a. Date.
- b. Thermometer and/or Meter identification.
- c. Calibration results relative to NBS-traceable thermometer.
- d. Initials of individual performing calibration.

3.0 PROCEDURE

- 3.1 The water sample (approximately 500 milliliters [ml]) is placed in a clean container and the temperature is measured immediately.
- 3.2 If a thermometer is used, then the thermometer is first rinsed with distilled or deionized water and is then immersed in water until the temperature equilibrates. The temperature is read in °C. The thermometer is rinsed again after measuring the temperature.
- 3.3 If a temperature measuring meter is used, then the probe is first carefully rinsed with distilled or deionized water. The probe is then immersed in water according to the manufacturer's specifications (e.g., specified submergence, stirred) until the temperature equilibrates. The temperature is read in °C. The probe is rinsed again after measuring the temperature.
- 3.4 Temperature data are recorded in the field notebook or appropriate field form, and initialed and dated.

END OF PROCEDURE

Date: May 5, 2000

1.0 PURPOSE

The purpose for this standard operating procedure (SOP) is to establish the guidelines for decontamination of all field equipment potentially exposed to contamination during drilling, and soil and water sampling. The objective of decontamination is to ensure that all drilling, and soil-sampling and water-sampling equipment is decontaminated (free of potential contaminants): 1) prior to being brought onsite to avoid the introduction of potential contaminants to the site; 2) between drilling and sampling events/activities onsite to eliminate the potential for cross-contamination between boreholes and/or wells; and 3) prior to the removal of equipment from the site to prevent the transportation of potentially contaminated equipment offsite.

In considering decontamination procedures, state and federal regulatory agency requirements must be considered because of potential variability between state and federal requirements and because of variability in the requirements of individual states. Decontamination procedures must be in compliance with state and/or federal protocols in order that regulatory agency(ies) scrutiny of the procedures and data collected do not result in non acceptance (invalidation) of the work undertaken and data collected.

2.0 PROCEDURE FOR DRILLING EQUIPMENT

The following is a minimum decontamination procedure for drilling equipment. Drilling equipment decontamination procedures, especially any variation from the method itemized below, will be documented on an appropriate field form or in the field notebook.

- 2.1 The rig and all associated equipment should be properly decontaminated by the contractor before arriving at the test site.
- 2.2 The augers, drilling casings, rods, samplers, tools, rig, and any piece of equipment that can come in contact (directly or indirectly) with the soil, will be steam cleaned onsite prior to set up for drilling to ensure proper decontamination.
- 2.3 The same steam cleaning procedures will be followed between boreholes (at a fixed on-site location[s], if appropriate) and before leaving the site at the end of the study.
- 2.4 All on-site steam cleaning (decontamination) activities will be monitored and documented by a member(s) of the staff of Roux Associates, Inc.
- 2.5 If drilling activities are conducted in the presence of thick, sticky oils (e.g., PCBs) which coat drilling equipment, then special decontamination procedures may have to be utilized before steam cleaning (e.g., hexane scrub and wash).

2.6 Containment of decontamination fluids may be necessary (e.g., rinseate from steam cleaning) or will be required (e.g., hexane), and disposal must be in accordance with state and/or federal procedures.

3.0 PROCEDURE FOR SOIL-SAMPLING EQUIPMENT

The following is a minimum decontamination procedure for soil-sampling equipment (e.g., split spoons, stainless-steel spatulas). Soil-sampling equipment decontamination procedures, especially any variation from the method itemized below, will be documented on an appropriate field form or in the field notebook.

- 3.1 Wear disposable gloves while cleaning equipment to avoid cross-contamination and change gloves as needed.
- 3.2 Steam clean the sampler or rinse with potable water. If soil-sampling activities are conducted in the presence of thick, sticky oils (e.g., PCBs) which coat sampling equipment, then special decontamination procedures may have to be utilized before steam cleaning and washing in detergent solution (e.g., hexane scrub and wash).
- 3.3 Prepare a non-phosphate, laboratory-grade detergent solution and distilled or potable water in a clean bucket.
- 3.4 Disassemble the sampler, as necessary and immerse all parts and other sampling equipment in the solution.
- 3.5 Scrub all equipment in the bucket with a brush to remove any adhering particles.
- 3.6 Rinse all equipment with copious amounts of potable water followed by distilled or deionized water.
- 3.7 Place clean equipment on a clean plastic sheet (e.g., polyethylene)
- 3.8 Reassemble the cleaned sampler, as necessary.
- 3.9 Transfer the sampler to the driller (or helper) making sure that this individual is also wearing clean gloves, or wrap the equipment with a suitable material (e.g., plastic bag, aluminum foil).

As part of the decontamination procedure for soil-sampling equipment, state and/or federal protocols must be considered. These may require procedures above those specified as minimum for Roux Associates, Inc., such as the use of nitric acid, acetone, etc. Furthermore, the containment and proper disposal of decontamination fluids must be considered with respect to regulatory agency(ies) requirements.

4.0 PROCEDURE FOR WATER-SAMPLING EQUIPMENT

The following is a decontamination procedure for water-sampling equipment (e.g., bailers, pumps). Water-sampling equipment decontamination procedures, especially any variation from the method itemized below, will be documented on an appropriate field form or in the field notebook.

4.1 Decontamination procedures for bailers follow:

- a. Wear disposable gloves while cleaning bailer to avoid cross-contamination and change gloves as needed.
- b. Prepare a non-phosphate, laboratory-grade detergent solution and potable water in a bucket.
- c. Disassemble bailer (if applicable) and discard cord in an appropriate manner, and scrub each part of the bailer with a brush and solution.
- d. Rinse with potable water and reassemble bailer.
- e. Rinse with copious amounts of distilled or deionized water.
- f. Air dry.
- g. Wrap equipment with a suitable material (e.g., clean plastic bag, aluminum foil).
- h. Rinse bailer at least three times with distilled or deionized water before use.

4.2 Decontamination procedures for pumps follow:

- a. Wear disposable gloves while cleaning pump to avoid cross-contamination and change gloves as needed.
- b. Prepare a non-phosphate, laboratory-grade detergent solution and potable water in a clean bucket, clean garbage can, or clean 55-gallon drum.
- c. Flush the pump and discharge hose (if not disposable) with the detergent solution, and discard disposable tubing and/or cord in an appropriate manner.
- d. Flush the pump and discharge hose (if not disposable) with potable water.
- e. Place the pump on clear plastic sheeting.
- f. Wipe any pump-related equipment (e.g., electrical lines, cables, discharge hose) that entered the well with a clean cloth and detergent solution, and rinse or wipe with a clean cloth and potable water.
- g. Air dry.

- h. Wrap equipment with a suitable material (e.g., clean plastic bag).

As part of the decontamination procedure for water-sampling equipment, state and/or federal protocols must be considered. These may require procedures above those specified as minimum for Roux Associates, Inc., such as the use of nitric acid, acetone, etc. Furthermore, the containment and proper disposal of decontamination fluids must be considered with respect to regulatory agency(ies) requirements.

Remedial Action Work Plan

APPENDIX C

Community Air Monitoring Plan

February 11, 2015

COMMUNITY AIR MONITORING PLAN

**Pfizer Inc Site B and Site D
Williamsburg
Brooklyn, New York**

Prepared for:

**PFIZER INC
60-66 Gerry Street
Brooklyn, New York 11206**

ROUX ASSOCIATES, INC.

Environmental Consulting & Management

ROUX

209 Shafter Street, Islandia, New York 11749 ♦ 631-232-2600

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APPENDIX

A. Action Limit Report

1.0 INTRODUCTION

This Community Air Monitoring Plan (CAMP) has been prepared by Roux Associates, Inc. (Roux Associates) and Remedial Engineering, P.C. (Remedial Engineering), on behalf of Pfizer Inc (Pfizer) for the Work to be performed for the remediation of Operable Unit 1 (OU-1) of Site B and Site D located in Williamsburg, Brooklyn, New York. The CAMP will monitor the ambient air for concentrations of volatile organic compounds (VOCs) and particulates upwind and downwind of the work area. The CAMP will be implemented at all times during ground intrusive activities. The CAMP is designed to provide a measure of protection for the downwind community and onsite workers not directly involved with the subject work activities from potential airborne contaminant releases as a direct result of remedial and construction activities. This plan is consistent with the New York State Department of Health's (NYSDOH) Generic Community Air Monitoring Plan guidance documents.

A portion of the intrusive activities will be conducted with work below the water table in moist soil. This high moisture content will provide for “natural” dust suppression. If implemented, direct loading and offsite transport of excavated soils will also minimize particulate emissions.

Please also note offsite migration of VOCs and particulates are not expected to occur during performance of ground intrusive activities within Building 25A. Since this work will be conducted indoors, meteorological data will not be collected. VOC and particulate monitoring will be performed at the work zone and hourly at two locations outside of Building 25A, as shown on Plate 7 of the OU-1 Remediation Action Work Plan.

2.0 AIR MONITORING PROCEDURES DURING REMEDY IMPLEMENTATION

The specifics of the CAMP are discussed in this section.

2.1 Meteorological Data

Meteorological data consisting of wind speed, wind direction, temperature, barometric pressure, and relative humidity will be collected. At a minimum, a full set of meteorological parameters will be measured and recorded at the start of each workday, noon of each workday, and the end of each workday. Wind direction readings will be utilized to position the VOC and particulate monitoring equipment in appropriate upwind and downwind locations. A Davis Corporation wireless instrument station or equivalent will be used to measure and log the meteorological monitoring data.

2.2 VOC Monitoring

VOCs will be monitored continuously at the upwind perimeter and downwind perimeter of the designated work areas during all ground intrusive activities. A portable hand-held photo-ionization detector (PID), such as a MiniRAE 3000 or similar equipment, will be used to perform the monitoring at a height of approximately four to five feet above land surface (i.e., the breathing zone). The monitoring equipment will be capable of measuring total VOC concentrations and integrating (averaging) over periods of 15 minutes or less. The data logging averaging period will be set to 15-minutes with time and date stamp recording. The audible alarm on the PID will be set at 5 parts per million (ppm). All VOC monitoring will be performed using a PID calibrated at least once per day prior to work activities and recalibrated as needed thereafter.

The following summarizes VOC action levels and the appropriate responses:

- If the ambient air concentration of total organic vapors at the downwind perimeter of the work area exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities must be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities can resume with continued monitoring.
- If total organic vapor levels at the downwind perimeter of the work area persist at levels in excess of 5 ppm over background but less than 25 ppm, work activities must be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps are performed, work activities can resume, provided the total organic vapor level is below 5 ppm over background for the 15-minute average.

- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities must be shutdown, the source of vapors identified, and corrective measures taken to abate emissions, as described below in Section 2.2.1.

All readings will be recorded and made available for New York State Department of Environmental Conservation (NYSDEC) and NYSDOH personnel to review. Daily monitoring equipment locations and meteorological conditions will also be documented in the Daily Report. If an exceedance of the Action Limits occurs, an Action Limit Report (ALR), as shown in Appendix A, will be completed.

2.2.1 Potential Corrective Measures and VOC Suppression Techniques

If the 15-minute integrated VOC level at the downwind location persists at a concentration that exceeds the upwind level by more than 5 ppm but less than 25 ppm during the work, then vapor suppression techniques will be employed. The following techniques, or others, may be employed to mitigate the generation and migration of fugitive organic vapors:

- limiting the excavation size;
- backfilling the excavation;
- spraying water onto the excavation faces and equipment;
- covering soil stockpiles with 6-mil plastic sheeting;
- hauling waste materials in properly tarped containers; and/or
- applying vapor suppressant foam.

Any corrective measures or VOC suppression techniques that are implemented will be recorded in the field logbook and will be available for the NYSDEC and NYSDOH personnel to review.

2.3 Particulate Monitoring

Air monitoring for particulates (i.e., dust) will be performed continuously during all ground intrusive activities. Monitoring equipment such as a MIE Data Ram or similar equipment will be used to perform the monitoring at a height of approximately four to five feet above land surface (i.e., the breathing zone). The monitoring equipment will be capable of measuring particulate matter smaller than 10 microns (PM₁₀) and integrating (averaging) over periods of 15 minutes or

less. The data logging averaging period will be set to 15-minutes with time and date stamp recording. The audible alarm on the particulate monitoring device will be set at 90 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$). This setting will allow proactive evaluation of worksite conditions prior to reaching the action level of $100 \mu\text{g}/\text{m}^3$ above background. The monitors will be calibrated at least once per day prior to work activities and recalibrated as needed thereafter. In addition, fugitive dust migration will be visually assessed during all ground intrusive activities.

The following summarizes particulate action levels and the appropriate responses:

- If the downwind PM-10 particulate level is $100 \mu\text{g}/\text{m}^3$ greater than background (upwind perimeter) for the 15-minute period, or if airborne dust is observed leaving the work area, then dust suppression techniques must be employed. Work may continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed $150 \mu\text{g}/\text{m}^3$ above the upwind level and provided that no visible dust is migrating from the work area.
- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than $150 \mu\text{g}/\text{m}^3$ above the upwind level, work must be stopped and an evaluation of activities initiated. Work can resume provided that dust suppression measures (as described in Section 2.3.1 below) and other controls are successful in reducing the downwind PM-10 particulate concentration to within $150 \mu\text{g}/\text{m}^3$ of the upwind level and in preventing visible dust migration.

All readings will be recorded and be available for NYSDEC and NYSDOH personnel to review. Daily monitoring equipment locations and meteorological conditions will also be documented in the Daily Report. If an exceedance of the Action Limits occurs, an ALR as shown in Appendix A will be completed.

2.3.1 Potential Particulate Suppression Techniques

If the integrated particulate level at the downwind location exceeds the upwind level by more than $100 \mu\text{g}/\text{m}^3$ at any time during remediation activities, then dust suppression techniques will be employed. The following techniques, or others, may be employed to mitigate the generation and migration of fugitive dusts:

- limiting the excavation size;
- backfilling the excavation;
- spraying water onto the excavation faces and equipment;

- covering soil stockpiles with plastic sheeting;
- hauling waste materials in properly tarped containers; and/or
- limiting vehicle speeds onsite.

Work may continue with dust suppression techniques provided that downwind PM₁₀ levels are not more than 150 µg/m³ greater than the upwind levels.

There may also be situations where the dust is generated by the work and migrates to downwind locations, but is not detected by the monitoring equipment at or above the action level. Therefore, if dust is observed leaving the working area, dust suppression techniques such as those listed above will be employed.

If dust suppression techniques do not lower particulates to below 150 µg/m³, or visible dust persists, work will be suspended until appropriate corrective measures are identified and implemented to remedy the situation.

Any corrective measures or VOC suppression techniques that are implemented will be recorded in the field logbook and will be available for the NYSDEC and NYSDOH personnel to review.

2.4 Reporting

All recorded monitoring data will be downloaded and field logged periodically, including action limit reports (if any) and daily CAMP monitoring location plans. All records will be maintained onsite for NYSDEC/NYSDOH review. A summary of CAMP findings, including excursions, will be provided in the Daily and Monthly Reports. All CAMP monitoring records will be included in the overall Final Engineering Report that will be submitted to the NYSDEC and NYSDOH and will include all of the CAMP data collected, daily monitoring station location maps, and copies of the ALRs (if any). If an ALR is generated due to VOC exceedances, the NYSDEC and NYSDOH will be notified within 24 hours of the exceedance.

Community Air Monitoring Plan

APPENDIX A

Action Limit Report

ACTION LIMIT REPORT

Project Location: _____

Date: _____ Time: _____

Name: _____

Contaminant: PM-10: _____ VOC: _____

Wind Speed: _____ Wind Direction: _____

Temperature: _____ Barometric Pressure: _____

DOWNWIND DATA

Monitor ID #: _____ Location: _____ Level Reported: _____

Monitor ID #: _____ Location: _____ Level Reported: _____

UPWIND DATA

Monitor ID #: _____ Location: _____ Level Reported: _____

Monitor ID #: _____ Location: _____ Level Reported: _____

BACKGROUND CORRECTED LEVELS

Monitor ID #: _____ Location: _____ Level Reported: _____

Monitor ID #: _____ Location: _____ Level Reported: _____

ACTIONS TAKEN

Remedial Action Work Plan

APPENDIX D

Professional Profile of Remedial Engineer

Charles J. McGuckin, P.E.

Principal Engineer

Technical Specialties:

Engineering design of soil and groundwater remediation systems, brownfields cleanup plans, stormwater studies and engineered natural treatment systems.

Experience Summary:

Twenty five years of experience: Principal, Senior and Project Engineer with Roux Associates; President of Remedial Engineering, P.C.; and Design Engineer at Dvirka and Bartilucci Consulting Engineers.

Credentials:

B.C.E., Civil Engineering, University of Delaware, 1987.

M.B.A., Management, Adelphi University, 1992.

Professional Engineer: New York, New Jersey, Pennsylvania, Rhode Island, Connecticut, Vermont, Virginia, North Carolina, Ohio and Michigan

Professional Affiliations:

American Society of Civil Engineers.

WEF Hazardous Waste Committee, 1996 – 1998.

Publications:

Assessment and Remediation of Off-Spec Asphalt Disposal Areas - Co-authored, Contaminated Soils, Volume 3, Amherst Scientist Publishers, 1998.

Use of a Subsurface Flow Constructed Wetlands for Collection and Removal of Water Containing BTEX, Co-authored, Proceedings of the 2000 Petroleum Hydrocarbons and Organic Chemicals in Groundwater Conference, National Ground Water Association.

Key Projects:

- Principal Engineer providing expert settlement support services to a county municipality in New York State. The case involved an EPA Order for underground storage tank (UST) compliance for over 50 county operated facilities with over 125 USTs. The project involved the field inventory of the USTs at each facility and development of both Interim and final compliance plans to comply with EPA, NYSDEC and local UST regulations. Detailed cost estimates were prepared for multiple scenarios for upgrading USTs including tightness testing, manway repairs, leak detection and overfill protection monitoring systems, UST removal and replacement, and new piping. The upgrade evaluation and negotiations included incorporation of Supplemental Environmental Project (SEPs) in accordance with EPA requirements. SEPs included centralized monitoring systems for leak detection and inventory control.
- Principal Engineer for the preparation of an expert report for a former valve manufacturing facility in Coxsackie, New York. The report was prepared on behalf of counsel for a Contractor who performed remedial construction work for this State “Superfund” site. The actions were against the holder of the construction contract, NYSDEC, and their engineering consultant. The remedial action included building demolition, remediation of soils impacted by chlorinated VOCs, removal of DNAPL source areas, treatment of excavated soils using low temperature thermal desorption, and consolidation and capping of metals impacted soils. The expert project work involved a detailed review of the RI/FS, remedial action plans and construction progress documentation to formulate opinions as to the industry acceptable accuracy of the Contract Documents.
- Senior Engineer for the performance of a stormwater runoff evaluation for a manufacturing facility in Watertown, New York. Roux Associates was retained as third party to evaluate the drainage design and construction elements for an industrial landfill cap. The evaluation was performed for the facility owner in support of potential litigation arising from onsite building

flooding incidents following a severe snow and rain storm event. The scope of work included an evaluation of the existing onsite storm sewer system capacity, calculation of runoff flow rates for the 300-acre contributing area, review of landfill cap surface drainage design, review of erosion control measures implemented during construction, and analysis of specific flooding incident causes. The runoff analyses were performed using the TR 55 Method for three conditions: pre-capped, capping under construction prior to establishment of vegetation, and final vegetated cap design. Recommendations were made to improve the site drainage including design of surface drainage swales, temporary berms and sediment traps during construction and modification of snow handling practices.

- Project Engineer for the evaluation of expected remedial costs for nine hazardous waste sites, two of which are federal Superfund sites. The evaluation of both single and multiple PRP sites was performed to identify costs for an insurance claim. The expected remedial costs for nine sites, which include landfills or facility surface impoundments, totaled approximately \$65 million. Remedial plans evaluated for multiple site operable units included groundwater pump and treat, alternative water supply systems, soil/sludge in situ solidification and treatment, and wetlands restoration. Additional work included evaluating invoices for site work previously performed and allocating expenses into their appropriate operable unit and work type, i.e., defense or indemnity.
- Principal Engineer for preparation of a site management plan for redevelopment of a former watch case factory in Sag Harbor, New York. The primary engineering controls for the former factory conversion to a residential building consisted of a vapor barrier and an active subslab depressurization system (SSDS) to address chlorinated VOCs. The SSDS system was complicated due to the existing 100 year old structure. A unique raised floor approach was designed to allow for the SSDS installation. The system design, approved by NYSDEC and NYSDOH includes multiple legs, dual blowers, low vacuum alarms and monitoring points.
- Principal Engineer for the Remedial Action Work Plan (RAWP) for redevelopment of a shopping center in the Bronx, New York. The RAWP elements included soil and groundwater management plans, stormwater management, air monitoring and vapor mitigation systems. To address vapor intrusion, active subslab depressurization systems were designed for two pad buildings. One system for a new retail building construction and one retro-fit system for an existing building to be used as a restaurant. Closure reports were prepared and certified documenting all remediation work and approved by NYC Mayor’s Office of Environmental Remediation (OER).
- Principal Engineer for the preparation of a preliminary remedial design for the remediation and restoration of a pond and surface water tributaries to Canaan Lake that have been impacted from leachate generated from an upgradient former municipal landfill located in Holtsville, New York. Completed a preliminary remedial design for the construction of a compost-based permeable reactive barrier for the removal and treatment of leachate prior to discharge to the surface water, followed by restoration of the surface water body and surrounding wetlands. The project included development of a long term remedial strategy to reduce rainfall infiltration into the landfill and minimize leachate generation. Current plans to reduce rainfall infiltration include the planting of 3,250 hybrid poplars, regrading and lining of drainage swales, and the

Charles J. McGuckin, P.E. Principal Engineer

resurfacing of low lying areas consistent with recreational facilities.

- Principal engineer for the preparation of the feasibility study, IRM plans, and remedial design/remedial action plans for a 40-acre former manufacturing facility in Rensselaer, New York. IRM Soil remediation included excavation of over 10,000 cubic yards of CVOC and metals source material for disposal at multiple facilities based on waste characteristics. Basement cleaning was performed in three large buildings to remove accumulated process sludges. Lagoon closure plans included sediment removal, dewatering, soil washing, and soil capping. The final remedy for the site includes a groundwater perimeter containment trench and 40 gpm treatment system for metals and VOCs and a 9-acre vegetated cap for a former landfill.
- Principal Engineer for final capping elements and wetlands restoration work and completion of the Final Engineering Report for an inactive hazardous waste site in Syracuse, New York. The project included onsite consolidation of lead impacted waste; 7-acre landfill cap with vegetated layer, cover soil, and geomembrane; stormwater runoff controls; reconstruction of waste water ponds; and an 8-acre wetland restoration. An O & M Plan was prepared and implemented consisting of groundwater, surface water and landfill gas monitoring, and annual cap and wetland inspections.
- Principal Engineer for the feasibility studies and remedial action work plans for multiple operable units of a large railyard located in Sunnyside, Queens, New York under the NYSDEC Inactive hazardous waste program. For the former engine house and maintenance area unit, pre-design studies included product plume thickness data collection and modeling, *ex situ* biopiles treatment, *in situ* enhanced bioremediation, and *in situ* chemical oxidation. The final design consisted of decontamination and removal of structures, excavation of hot spot soils for PCBs and lead, UST closures, a dual phase high vacuum extraction system and *in situ* bioremediation.
- Principal Engineer responsible for the preparation of the remediation completion report at Captain's Cove former municipal landfill State Superfund Site located in Glen Cove, New York. This work has been performed in accordance with Title 3 of the NYS Environmental Quality Bond Act under contract to the City of Glen Cove. Design elements included excavation plans, radiological waste monitoring, demo debris and waste separation and screening, dewatering water management, waste disposal, and site restoration. Additional work included the delisting of a six-acre "clean" portion of the site to allow the development of a ferry terminal and esplanade and development of alternative cleanup standards consistent with future site uses. Site remediation will accommodate site redevelopment as a commercial waterfront and operating ferry service and seaport area.
- Principal Engineer for the remediation of a former Manufactured Gas Plant (MGP) facility in Brooklyn, NY, including oversight of the excavation of both the former gasholders, and adjacent contaminated hotspots requiring offsite thermal desorption of over 30,000 tons of coal tar impacted soil. Directed the Community Air Monitoring Program (CAMP) specific to the MGP impacted soil removal, as required by both New York State Department of Environmental Conservation (NYSDEC) and New York State Department of Health (NYSDOH). Remedial activity met all substantive requirements of the NYSDEC approved Remedial Action Work Plan for the Site. The remedy included design of a passive subsurface vapor monitoring/recovery system for a 500,000 sq.ft. retail structure in Brooklyn, NY. The system design integrated a perforated piping system complemented by a protective vapor barrier below the structural floor slab to monitor and mitigate volatile organic compound vapors. Multiple vapor barrier options were evaluated to determine the optimum design based on the site conditions.
- Principal Engineer for the preparation of the remedial action work plan for an 11-acre former Department of Defense owned Site that manufactured airplane parts along Hempstead Harbor in Manorhaven, New York. The project is regulated under the NYSDEC Voluntary Cleanup Program. The remedial design consisted of both soil vapor extraction/air sparging and *in situ* enhanced bioremediation systems for Site groundwater impacted by chlorinated VOCs. The final remedial design and site management plan are expected to include soil capping, vapor barriers and passive ventilation systems to be incorporated into a residential redevelopment with waterfront access.
- Project Engineer for the design and construction management of a 600 gpm groundwater extraction and treatment system to prevent offsite migration at a petroleum storage and pipeline transfer facility in Providence, Rhode Island. The treatment system was designed to remove iron, BTEX, and naphthalene from the groundwater to below surface water discharge standards for the Providence River. The system processes consisted of equalization, aeration, de-aeration, flocculation, clarification, air stripping, dual media filtration, granular activated carbon adsorption (liquid and vapor phase), and sludge thickening and dewatering. The system included an outfall diffuser designed in accordance with the CORMIX computer model.
- Senior Engineer responsible for the design, construction management, and O&M of a 60,000-gpd constructed wetlands treatment system for a former manufacturing facility in Virginia. The 16-acre treatment system was designed within an existing phragmites wetland to remove zinc and iron from landfill leachate prior to discharge to an adjacent creek. The treatment system consisted of alkalinity producing cells, oxic ponds, compost and limestone berms, anaerobic cells and aerobic cells. The design included a 400-foot reinforced earthen dike together with hydraulic control structures and piping to maintain cell water levels and flow rates. The system also includes a pump station and force main for both effluent discharge and irrigation purposes. Joint wetlands and local permit approvals were obtained for the project.
- Senior Engineer for the performance of a feasibility study and remedial design for the closure of a concrete oil/water separator filled with refinery sludge and demolition materials impacted with lead at a former refinery in Providence, Rhode Island. Remedial alternatives were developed and evaluated including capping and containment using a perimeter slurry wall, sheet piling or concrete wall sealing; excavation and disposal; and *in situ* solidification. The capping and containment using a slurry wall alternative was selected for implementation of the remedial design. The design consisted of removal and replacement of existing monitoring wells, sealing of separator wall openings, a 2-acre multi-layer cap, a 1200-foot long by 30-foot deep soil-bentonite slurry wall, and a perimeter drainage swale. The multi-layer cap included a 40-mil HDPE geomembrane and a geosynthetic clay liner. The slurry wall was keyed into the existing clay confining layer beneath the separator. The design incorporated disposal of an additional 10,000 cubic yards of petroleum impacted soil under the cap.
- Principal Engineer for the preparation of field implementation plans, construction monitoring, and Engineers Certification Report for a former manufactured gas Plant (MGP) site in

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Manhattan, New York. The site was one of the first projects completed under the NYS Brownfields Cleanup Program. The remedy included soil excavation and offsite thermal treatment, a sheet pile barrier wall, a vapor barrier and basement ventilation system. A comprehensive air monitoring program was conducted due to the concerns over coal tar residue emissions and odors on the surrounding community. The remedy was incorporated into the design and construction of the headquarters office building of an international media company.

- Principal Engineer for the management of a soil and groundwater remediation system for a nationwide overnight delivery distribution center in Brooklyn, New York as part of the NYSDEC Voluntary Cleanup Program. A risk-based remedial approach that called for the remediation of "hot spot" source area soils, and mass-reduction of VOCs was successfully utilized for the Site. As a result, the focus of remediation was on reducing the mass of VOCs in on-site groundwater to a level where natural attenuation would be effective in remediation of VOCs. To address the contamination in the source area, a soil vapor extraction (SVE) and air sparge (AS) system consisting of 8 SVE wells and 17 AS wells was designed, constructed, operated and maintained for a period of approximately 3 years. Permanent shutdown of the system was approved by the NYSDEC.
- Senior Engineer for the design and construction management of a soil remediation and stormwater management project at a 16-acre former pesticide warehouse facility in Dayton, New Jersey. The Site was redeveloped for storage and trailer parking. The project consisted of consolidation of pesticide contaminated soils; asphalt capping of the 3.5 acre contaminated soils area; stormwater collection, conveyance and detention; and site regrading. The evaluation included TR-55 runoff modeling for pre and post capping and development conditions. The storm sewer system consisted of multiple catch basins, over 2,000 linear feet of reinforced concrete pipe ranging in size from 15 to 30 inches, and a recharge basin. A Soil Erosion and Sedimentation Control Plan and a NJPDES General Permit were prepared for the project.
- Project Principal for the performance of LNAPL remediation studies at the New Jersey Transit former Lake Street Bus Garage in Newark, New Jersey. The studies involved evaluating remedial alternatives for free product recovery, performance of an LNAPL recovery pilot test and cost estimating. A RAWP and engineering design plans were prepared for both the bus garage and the adjacent park properties. The remedy included excavation of the source area, horizontal recovery wells, a vertical recovery trench, *in situ* oxidation injections and product recovery using vacuum extraction.
- Senior Engineer for the performance of a stormwater management analysis for a 28-acre industrial landfill in Virginia. The principal objective of the study was to identify engineering controls to minimize stormwater runoff to a metals contaminated sediment impoundment. The study included TR-55 runoff modeling and storage analyses for multiple detention ponds. Three engineering control alternatives were identified including landfill cap regrading, diversion using berms and swales, and diking and weir raising.
- Senior Engineer for the investigation, design, and construction management of the closure of a 2-acre fire-water supply pond and modification of the stormwater conveyance system at a former manufacturing facility in Williamsburg, Virginia. The investigation phase of the project was focused on determining the sources and loading of metals influent to the pond. Field activities included examination of the existing stormwater

drainage system, subwatershed delineation, groundwater monitoring, and installation of automatic stormwater sampling devices. The final design included 400 feet of open concrete channels, 250 feet of culvert replacement, sliplining of 370 feet of 36-inch RCP culvert, reconstruction of five catch basins, placement of 10,000 cubic yards of clay fill within the pond and regrading of existing drainage ditches. Erosion control measures and slope stabilization were also included as well as the design of a special outlet structure for minimizing erosion at the outfall.

- Project Principal for the investigation and closure of five USTs at the New Jersey Transit Broad Street Station site in Summit, New Jersey. Tank sizes ranged from 20,000 to 30,000-gallon capacity. UST closure program completed in accordance with the NJDEP Technical Requirements for Site Remediation. Closure report prepared and submitted to the NJDEP and subsequent issuance of a No Further Action letter from the NJDEP.
- Project Engineer of the underground storage tank (UST) program for a major retail chain store in the New York, New Jersey and Pennsylvania region. Responsibilities included preparation of a UST management plan based on federal, state, and local regulations and costs to prioritize UST maintenance. The tank designs included plans and specifications for the removal and replacement, or upgrading, of USTs to meet regulatory requirements. The engineering design involved fuel requirements for dual heating and back-up generator usage, mechanical pumping equipment and fire wall design.
- Project Engineer for the design and construction management of a 1,000 sq.ft. hazardous and flammable materials storage facility in Syosset, New York. The facility included concrete secondary containment dikes, access ramps, sprinkler system modifications, and lighting. The separate flammable materials area included 2-hour fire rated concrete block walls and doors, ventilation equipment and a fire alarm system. Permitting services were performed for the Nassau County Department of Health, the Nassau County Fire Marshall, and the Building Department.
- Project Engineer for the design of a 2,000 sq.ft. hazardous waste storage facility in Astoria, New York. Prior to construction, demolition of an existing building was required and included removal of asbestos and lead paint. The project included driving treated timber piles and excavation and removal of contaminated soil and groundwater. The structure consisted of a steel frame with a metal standing seam roof system, decorative masonry block walls, and a roll-up door. Temporary and permanent fencing were required along with concrete sidewalk replacement.
- Senior Engineer for the decommissioning of a pharmaceutical facility covering two entire city blocks as a part of a NYSDEC Voluntary Cleanup Agreement in Brooklyn, New York. Responsibilities include technical review of Interim Remedial Measure (IRM) work plans for lead and mercury-contaminated soil excavation and disposal, implementation of these work plans (excavation and offsite disposal), preparation of biddable plans and specifications, review of IRM Closure Reports, and obtaining closure documentation from regulators on a fast track basis to allow redevelopment for a large scale shopping complex and public schools.
- Senior Engineer providing construction management services in support of the BNYCP Cogeneration Facility construction and Brooklyn Navy Yard facility decommissioning. Work included preparation of construction management plans, supervision of soil, concrete, and sediment disposal activities, asbestos surveys, and PCB sampling and analysis work. A NYCDEP wastewater

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discharge permit was prepared for the million gallon per day stream condensate and wastewater backwash flow rate.

- Project Principal for performing remedial alternative cost estimating for a New Jersey Transit site in Montclair, New Jersey, which is to be redeveloped as a firehouse. A cost estimate prepared by another consultant was reviewed as part of the scope of work. The proposed remedial alternative for the site consisted of excavation and disposal of PAH-impacted fill material and capping. The alternative remedy proposed by Roux Associates was a more risk-based approach, resulting in a cost savings of approximately \$100,000 for New Jersey Transit.
- Project Engineer for the design and construction management of cap repair and drainage improvement measures for an industrial hazardous waste landfill in Tennessee. Components of the design included replacement of the primary clay cover material, temporary and permanent erosion and sedimentation control measures, and a lined drainage channel to minimize the generation of landfill leachate. The project included the performance of a focused feasibility study to characterize the flow, quality, and treatability of the leachate. A feasibility study was also performed in order to evaluate constructed wetlands remedial technology as a method of effective and economical treatment of leachate.
- Senior Engineer for the remedial design and construction management of a 7-acre off-spec asphalt waste pond at a former refinery in New England. The asphalt material exhibited a low load bearing capacity combined with a viscous, tacky surface. An in situ solidification mix design was developed consisting of liquification using hot water and a 2-stage lime kiln dust reagent injection and mixing step. Gravel was added to the mix when the existing subgrade material was of insufficient bearing capacity. Solidified material was tested for unconfined compressive strength, durability, and TCLP. The final cover material consisted of a 6-inch vegetated layer.
- Principal Engineer for the performance of LNAPL remediation studies for a former bus maintenance facility and a segment of a Metropolitan Subway System in Newark, New Jersey. The studies involved evaluating groundwater and soil monitoring data, performance of LNAPL recovery pilot tests, evaluation of remedial alternatives and cost estimating. Recommendations included the use of mobile high vacuum extraction methods to collect LNAPL while minimizing capital expenditures and permanent low vacuum extraction methods to minimize odors to subway cars and surrounding communities.

Litigation Support Experience

- Project Engineer for the evaluation of remedial investigations and remedial cost estimates for a 30-acre former book publishing facility in Poughkeepsie, New York. The evaluation included the review of Phase I and Phase II investigation reports, remedial investigation (RI) and feasibility study (FS) reports, and the remedial investigation work plan. The findings included the presence of chlorinated volatile organic compounds in the soil and groundwater as well as identification of underground storage tanks. Deficiencies were identified in both the RI and FS reports by comparing with the NYSDEC's required criteria and recommendations were proposed for the RI work plan to further delineate source areas. Based on the remedial investigation review, revised costing assumptions were made and remedial cost estimates were prepared totaling \$3.6 million.

Water Treatment Experience:

- Senior Engineer for the engineering design of a 10 gpm groundwater recovery and treatment system at a former tank farm in Rhode Island. The recovery system included a 200-foot

slotted HDPE horizontal well, a 400-foot coated concrete swale and curbing, and a series of seepage collection points manifolded to a common receiving structure. The entire system was designed for passive recovery and gravity flow transmission targeting free-product seepage areas. The treatment system consisted of a collection sump retrofitted within an existing separator, a coalescing plate oil/water separator, a surge tank, a bag filter, and carbon adsorption units. The project included a permit modification for discharge to the Providence River.

- Design Engineer for the design and start-up operation of a 2 mgd packed tower aeration system for potable water in Williston Park, New York. The primary contaminants were trichloroethane and tetrachloroethene which were stripped below drinking water standards. The design process included full scale pilot testing to assure proper removal levels.
- Design Engineer for the design, construction and start-up operation of a 5 mgd industrial cooling water treatment system utilizing mechanical surface aeration. The system consisted of two lined aeration basins operating in series with floating mechanical aerators to remove volatile organic contaminants to levels suitable for recharge into the Long Island groundwater aquifer. The primary contaminants were 1,1-dichloroethene, trichloroethane, tetrachloroethene and vinyl chloride.
- Design Engineer for the design and construction of a 4 mgd granular activated carbon system for potable water in Hempstead, New York. The primary contaminants consisted of more than 8 volatile and semivolatile organic compounds. Responsibilities included site inspection for the installation of the six vessels containing 20,000 lbs of carbon in each. The system was designed for 99.9% removal efficiency with two units operating in series.

Constructed Wetlands Experience

- Senior engineer for the conceptual design of a constructed wetlands stormwater treatment system for a coal handling freight railroad facility in Norfolk, Virginia. The design consists of treatment of contaminated stormwater runoff generated from maintenance and fuel handling areas onsite. The design treatment performance objective is the reduction of total suspended solids, oil and grease, and selected metals to levels below the SPDES permit discharge standards established for two of the site's outfalls discharging to the Elizabeth River. The 3-acre system consists of a passively operated 200,000-gpd subsurface-type constructed wetlands with a low visual impact and specialized structural design to meet the needs of a busy railyard facility. Additional design components include stormwater bypass structures, jacking beneath tracks, a grit chamber, a lift station, and outfall modifications. A joint wetlands permit will be prepared for the project.
- Senior Engineer for the feasibility study, conceptual design and construction of four constructed wetlands units and sedimentation basin for a stormwater treatment system along Cedar Swamp Creek for the City of Glen Cove, New York. The project consisted of review of stormwater studies of the 12 square mile contributing watershed, compilation of USGS water quality and flow data, evaluation of stormwater treatment methods and best management practices and optimum site selection along the creek. The constructed wetlands design included a forebay, high and low marsh cells, a micropool, and stormwater bypass structures for removal of sediment, nitrogen, phosphorus, and trace metals during first flush events. Final design for the first 1.8 acre constructed wetlands unit was completed and performance of construction management is ongoing. Design activities include structural and hydraulic design tasks with specific emphasis on storm water bypass. The

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Principal Engineer

design has been integrated into an intermodal transportation project with the addition of bicycle and walking paths. NYSDEC and Army Corps permits were obtained for the project.

- Project Engineer for the design of a 7,000 gpd subsurface flow-type constructed wetlands treatment system for a refinery site in Rhode Island. The system was designed to treat a surface-water stream impacted by petroleum hydrocarbons. The system's high aesthetic, low visual impact appeal was ideal for its golf course setting. Both phragmites SPP and Typha SPP wetland species were incorporated in the design in order to assess the biodegradation/biotransformation processes effectiveness. A growth and maturation plan and a treatment evaluation plan were developed in order to evaluate the system performance.
- Lead Engineer responsible for technical review of a design for modifications to a constructed wetlands system in Nicholas County, West Virginia. The system was designed to treat the leachate from a solid waste landfill at a maximum capacity of 30 gpm. The complete water tight treatment system consisted of a sedimentation basin, stabilization basin, a series of three wetland cells and a finishing ditch. The wetland cells consisted of a double liner system with leachate collection piping overlaid with stone fill and a matrix of plant life. The technology combines physical, geochemical and biological removal mechanisms operating simultaneously.

Permitting/Compliance Plans

- Project Engineer for the preparation of a Spill Prevention Control and Countermeasure (SPCC) Plan and a Storm Water Pollution Prevention Plan (SWPPP) for an 850-acre petroleum storage terminal in New England. The SPCC Plan involved the inventory of 50 bulk storage tanks and miscellaneous storage vessels and an assessment of barge loading areas, truck loading racks, additive loading areas, pumping stations, and a network of aboveground pipelines. The SWPPP encompassed an inventory and surveying of the existing storm sewer system, an evaluation of oil/water separator performance and identification of storm water management controls and practices.
- Project Engineer for the design of modifications to multiple discharge facilities along the Providence and Runnins Rivers in Rhode Island. Permitting activities were performed with the following agencies: Rhode Island Department of Environmental Management (RIDEM) Pollutant Discharge Elimination System (RPDES), RIDEM Division of Freshwater Wetlands, Coastal Resources Management Council (CRMC), and the Army Corps of Engineers.

Sanitary Experience

- Design Engineer for the evaluation of a municipal sanitary sewer system consisting of approximately 70 miles of piping ranging in size from 8 inch to 16 inch, in Garden City, New York. The sewer system was evaluated for existing and proposed flow capacity, surcharging, infiltration of groundwater, inflow of storm water, root encroachment, and sewer breaks. Evaluation methods consisted of hydraulic profile analysis, television inspection of piping, field inspection of manholes, and flow measurement. Sewer upgrading methods were evaluated including direct replacement, manhole restoration and pipe slip lining, and a rehabilitation program was implemented.
- Design Engineer for the City of Glen Cove's industrial wastewater pretreatment program which was established to monitor significant industrial users discharging to the city's wastewater treatment plant to minimize upsets to the biological treatment mechanisms. The program work included annual facility inspections, wastewater discharge sampling, review and

evaluation of quarterly self-monitoring results, calculation of discharge penalty fees, preparation of annual monitoring reports for each facility and development of wastewater discharge permits to comply with City regulations.

- Design Engineer for a heavy metals study for the municipal sanitary sewer system in the City of Glen Cove, New York. The heavy metals study consisted of the development and performance of a city-wide sewer sampling program to identify the sources of heavy metals loadings on the wastewater treatment plant. The evaluation included industrial sources, scavengers, non-industrial sources, the plant operation itself, and review of existing heavy metal studies. Recommendations were provided for minimization of loadings and pretreatment to protect the plant operations.

Stormwater Experience

- Design Engineer for the evaluation and conceptual design of a water management plan for a 200 acre proposed office complex in Bethpage, New York. The design included inlets, piping and recharge basin sizing for peak storm water runoff flows as well as a system of architectural ponds and level control structures. For dry periods, the design included flow controls connected to an existing cooling water system to maintain pond levels and for utilization as a water supply for an irrigation sprinkler system during the growing season.
- Design Engineer for the design of a municipal storm drainage system for a 200-acre contributing area in Garden City, New York. The purpose of the drainage system was to alleviate severe flooding problems for eight homes located in a local low point of a residential neighborhood. The system included over 4,800 linear feet of reinforced concrete piping ranging in size from 12 to 60 inches. Design considerations included hydraulic gradient analysis, inlet capacity, utility crossings, minimization of removals of established trees, a county road crossing, utilization of existing structures and piping, and a headwall discharge to a recharge basin. Additional design items included pavement restoration, service line relocations, curbs and sidewalks, and maintenance and protection of traffic.

Site Assessment Experience

- Principal Engineer for the performance of a Brownfields Demonstration Pilot Program in the Hamlet of New Cassel for the Town of North Hempstead, New York. Under an EPA grant, Roux Associates created an inventory of 50 potential commercial/industrial properties within New Cassel and evaluated these properties based on perceived contamination and potential for redevelopment/reuse. Eight sites exhibiting the greatest potential for redevelopment were selected to perform Phase I Environmental Site Assessments. Of these eight sites, four sites were selected for Brownfield Site investigations to identify the nature and extent of contamination in soil and groundwater and provide potential remedial alternatives and cleanup costs to revitalize these properties. The Brownfields Demonstration Pilot Program also included community outreach activities to promote a unified approach to the redevelopment of Brownfields in new Cassel.
- Senior Engineer for coordination and review of Phase I environmental site assessments for five large research and development complexes located throughout the eastern United States for a major chemical company. The site assessments were performed for due diligence prior to engaging in long-term property lease agreements. The site assessments evaluated chemical storage and handling areas and previous site usage.
- Senior Engineer for coordination and review of Phase I environmental site assessments for 12 properties associated with

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tennis centers acquisition on Long Island, New York. The properties were either active tennis center facilities or vacant parcels available for new construction. All site assessments were conducted in accordance with ASTM standards for commercial real estate transactions. Primary concerns identified were USTs, drum storage areas, and unauthorized dumping.

- Project Manager representing a group of banks investing in a 20-acre commercial property in Westchester, New York. The onsite soil was contaminated with several volatile and semivolatile organics. Performed an evaluation of the remediation plan which included onsite biological treatment of soils and aeration and oil water separation of groundwater.

Water Main Experience

- Project Engineer for the design of over 6,000 feet of ductile iron water main in sizes from 4 to 16 inches for Town of Hempstead, New York Department of Water and the Nassau County, New York Department of Public Works. The designs included wet and dry connections to existing mains, fittings, valves, copper services and fire hydrants. Restoration work included replacement of asphalt pavement, concrete sidewalk and curbs, and grass areas.
- Design Engineer for the design and construction management of over 10,000 feet of ductile iron water main in sizes from 6 to 12 inches for the Town of Wallkill, New York. The designs included booster pump station upgrades, a stream crossing, a wetlands crossing, jacking of 36-inch casing beneath a state highway, air release chambers, copper service re-connections, fire hydrants, valves and appurtenances. Restoration work included wetlands restoration, backfilling and regrading within a NYSDOT right-of-way and grass and pavement replacement.
- Design Engineer for the design and construction management of upgrades to a 3.7 mgd potable water booster pump station for the Town of Wallkill, New York. The design featured the replacement of a hydropneumatic tank and pump system with three larger capacity centrifugal pumps. The upgrades were performed while maintaining the pump station service. The pump station revisions included piping, pump pads, shut-off valves, silent check valves, pressure relief valves, gauges, ventilation equipment and a motor control center.

Feasibility Study Experience

- Senior Engineer for the performance of a feasibility study and remedial design of a free product containment and recovery system at a former refinery in New England. The areal extent of the free-product plume was approximately 10 acres with a measured thickness of up to eight feet. Pilot testing activities consisted of pump tests, baileys tests, and funnel and gate systems with and without sheeting. The selected remedial alternative consisted of re-routing and repair of active storm sewer piping, closure-in place of a former 72-inch storm drain using clay fill material to form a barrier wall, and installation of multiple recovery trenches totaling 450 linear feet. The recovery trenches were installed to a depth of 14 feet using a deep trenching machine and were completed with gravel, horizontal perforated piping, recovery wells, and monitoring wells to accommodate both passive and active product recovery pumping equipment. Product recovery enhancement pilot testing was also performed by using non-ionic surfactants, mechanical re-working of soil and vacuum extraction methods.

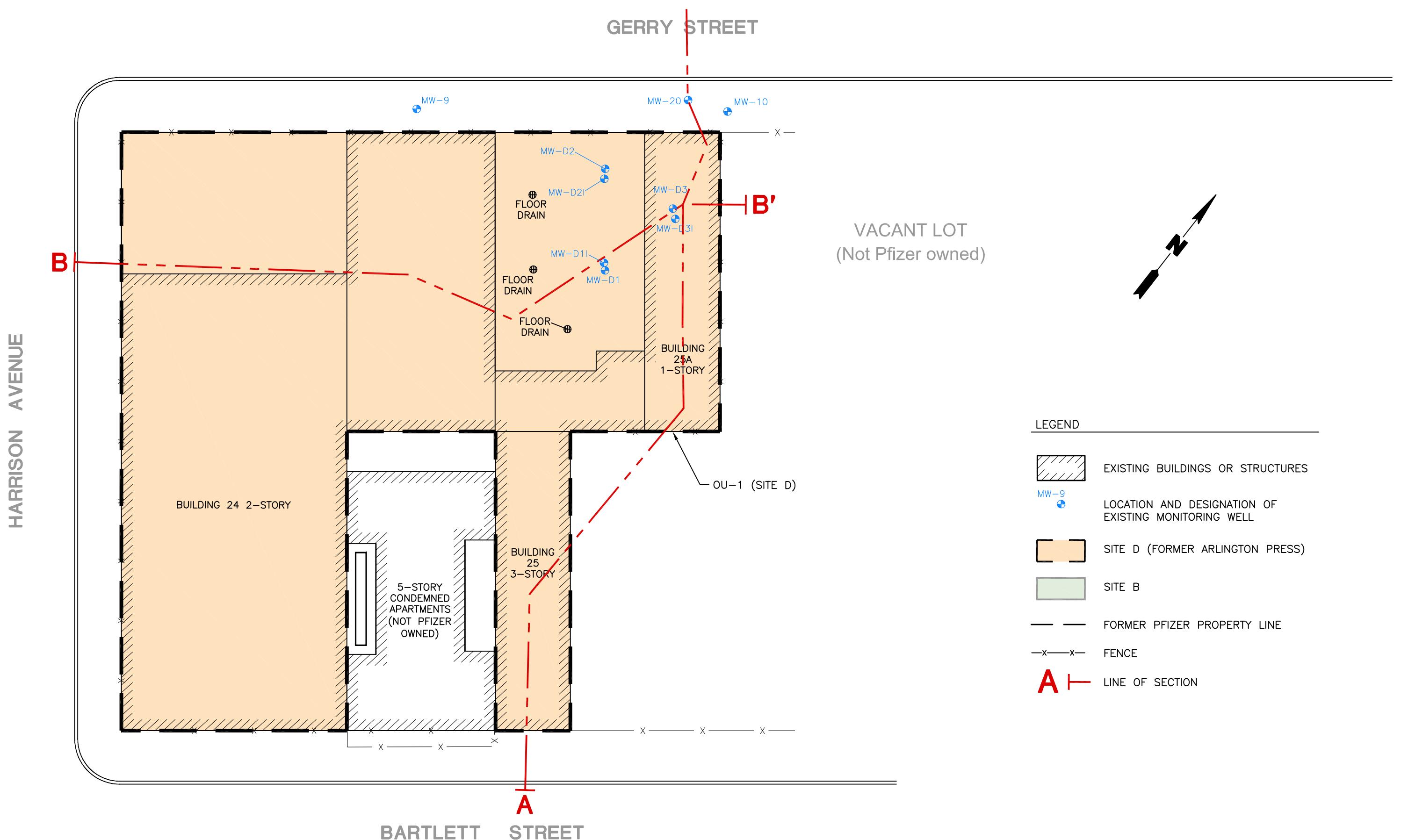
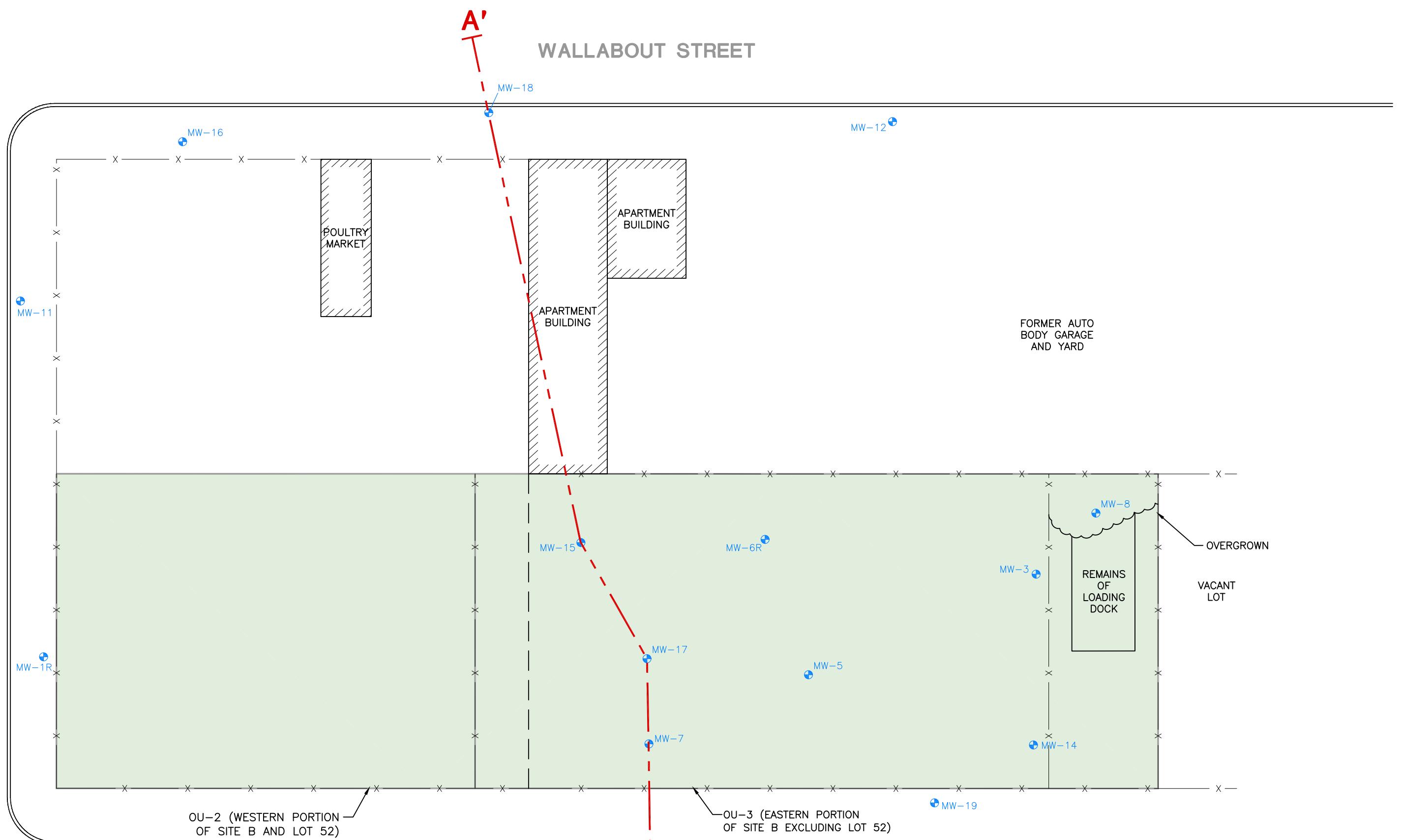
- Project Engineer for the performance of a feasibility study for the containment of a free-product plume beneath a refinery site in Rhode Island. The feasibility study included analysis of groundwater modeling, bench and pilot scale treatability studies, groundwater quality characterization, identification and screening of discharge alternatives, and treatment process evaluations. The work also included the evaluation of the discharge of treatment system effluent to several receptors including groundwater, wetlands, sanitary sewers, and storm sewers. Discharge requirements were evaluated for process water, off-gas air and residual wastes. Several treatment processes were also evaluated including metals precipitation and sludge dewatering, VOC and SVOC removal, and off-gas treatment. Preferred alternatives for each process were selected for remedial design development.

- Project Engineer for the performance of a feasibility study for a hazardous waste landfill located at a Superfund site in Tennessee. The feasibility study focused on the characterization and quantification of landfill leachate consisting of chlorinated organic compounds as well as proprietary pesticide compounds. The remedial technologies which were evaluated included leachate collection alternatives, onsite treatment alternatives and offsite disposal methods. An analysis was performed for onsite treatment technologies which included constructed wetlands, biological fluidized bed reactor, and granular activated carbon adsorption. The technologies were assembled into four feasible remedial alternatives and treatability studies were recommended to confirm the suitability of selected processes.

Remedial Action Work Plan

PLATES

1. Site Plan
2. Cross Sections
3. Groundwater Flow Direction – March 17, 2014
4. VOCs Detected in Soil at Site B and Site D
5. SVOCs Detected in Soil at Site B and Site D
6. Metals, Cyanide, PCBs, Pesticides and Herbicides Detected in Soil at Site B and Site D
7. Proposed Remedial Action Layout



30' 0 30'

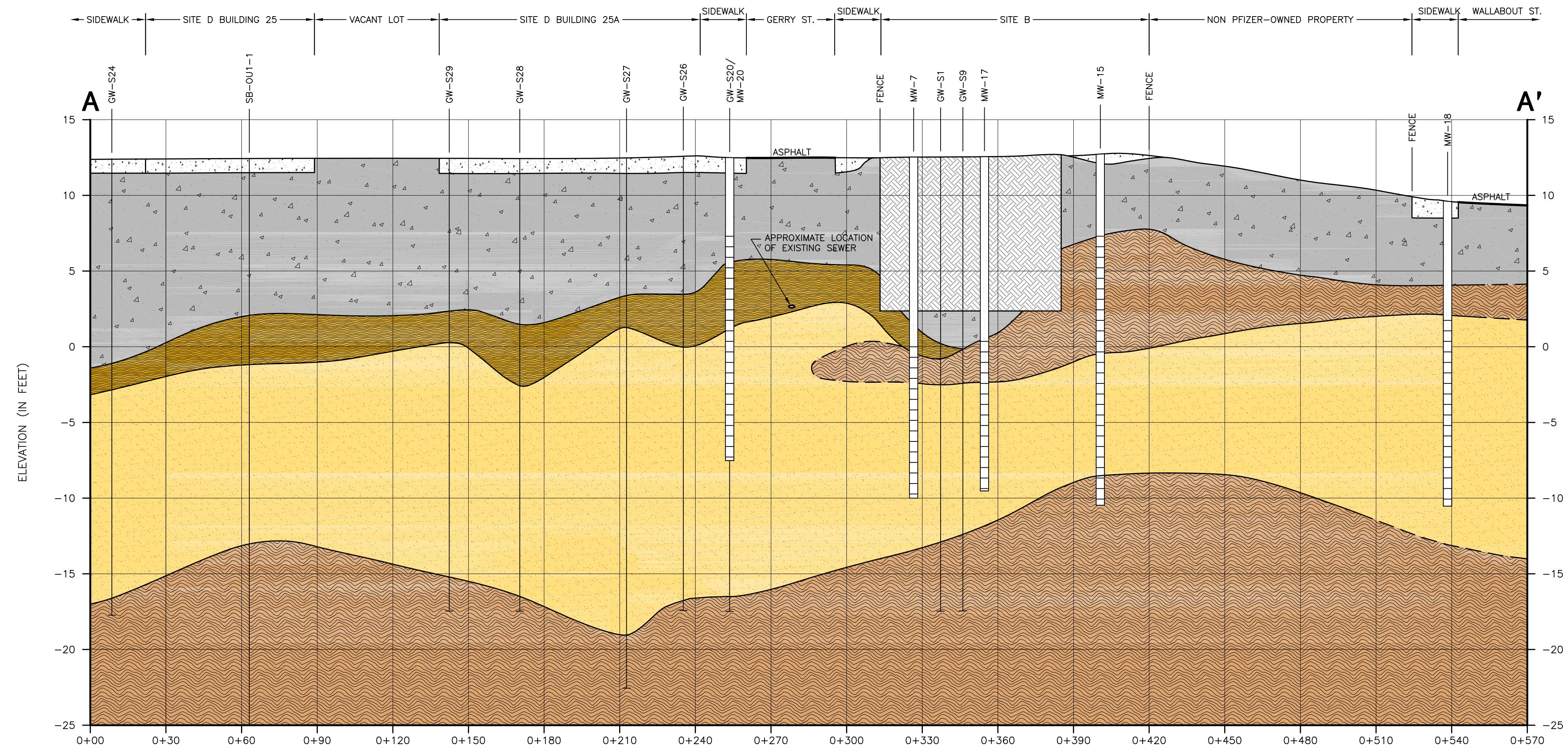
Title: SITE PLAN

Prepared For: PFIZER INC BROOKLYN, NEW YORK

ROUX ASSOCIATES, INC. Environmental Consulting and Management

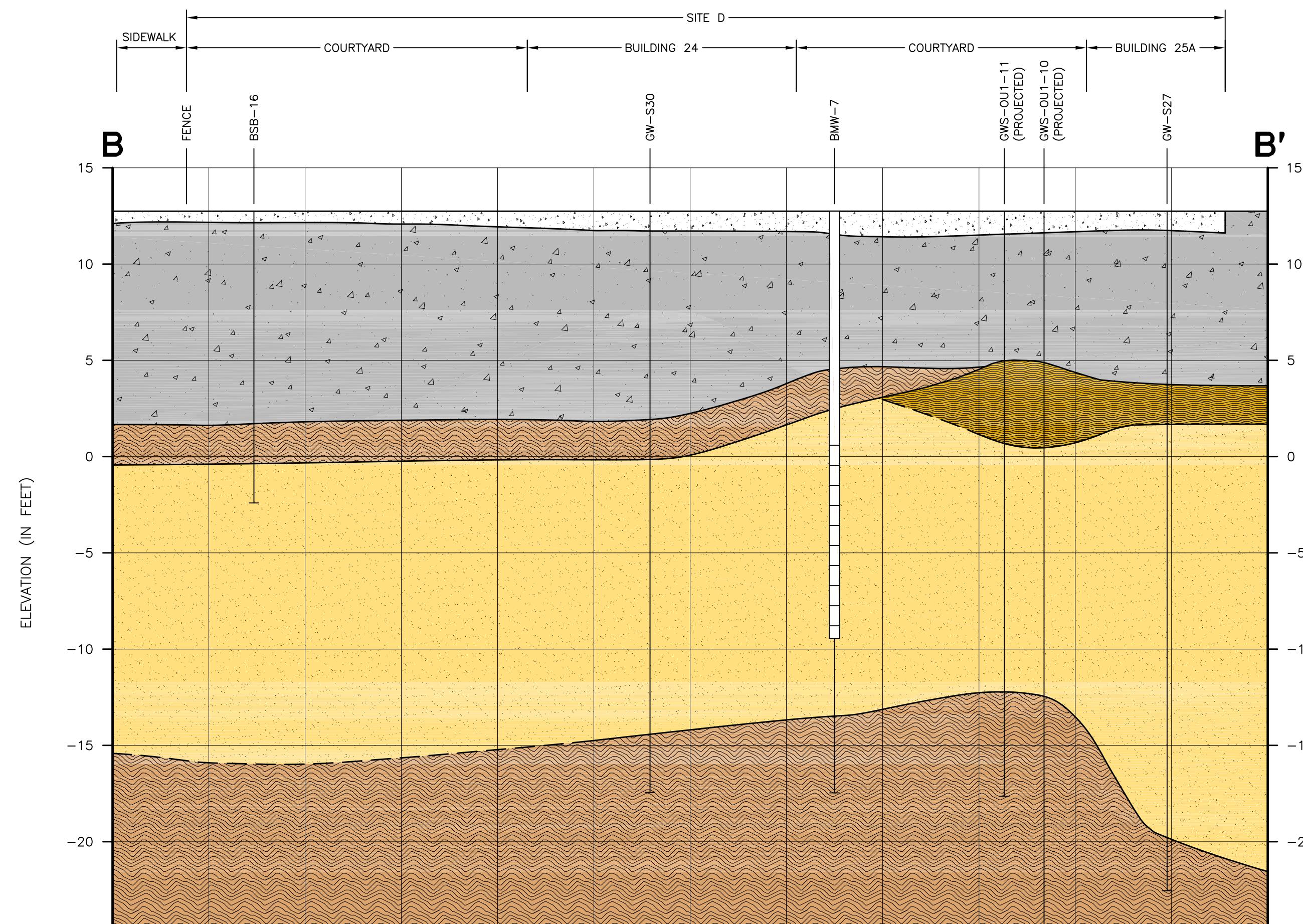
Compiled by: W.K. Date: 04SEPT14
Prepared by: G.M. Scale: AS SHOWN
Project Mgr: W.K. Project: 0047.0044Y040
File: 0047.0044Y605R.03.DWG

PLATE 1



SECTION A-A'

HORIZONTAL SCALE: 1" = 30'
VERTICAL SCALE: 1" = 5'
VERTICAL EXAGGERATION: 6X



SECTION B-B'

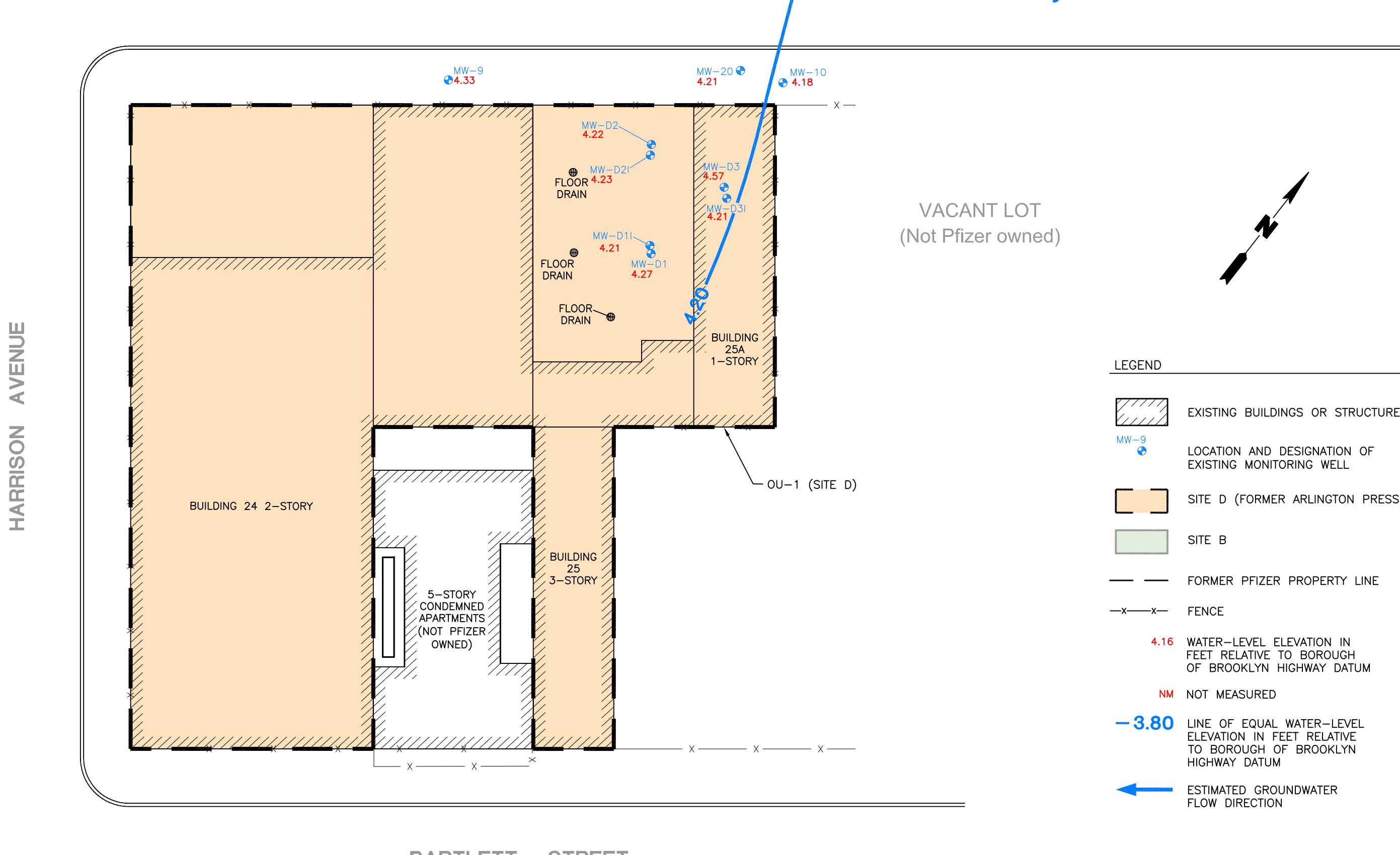
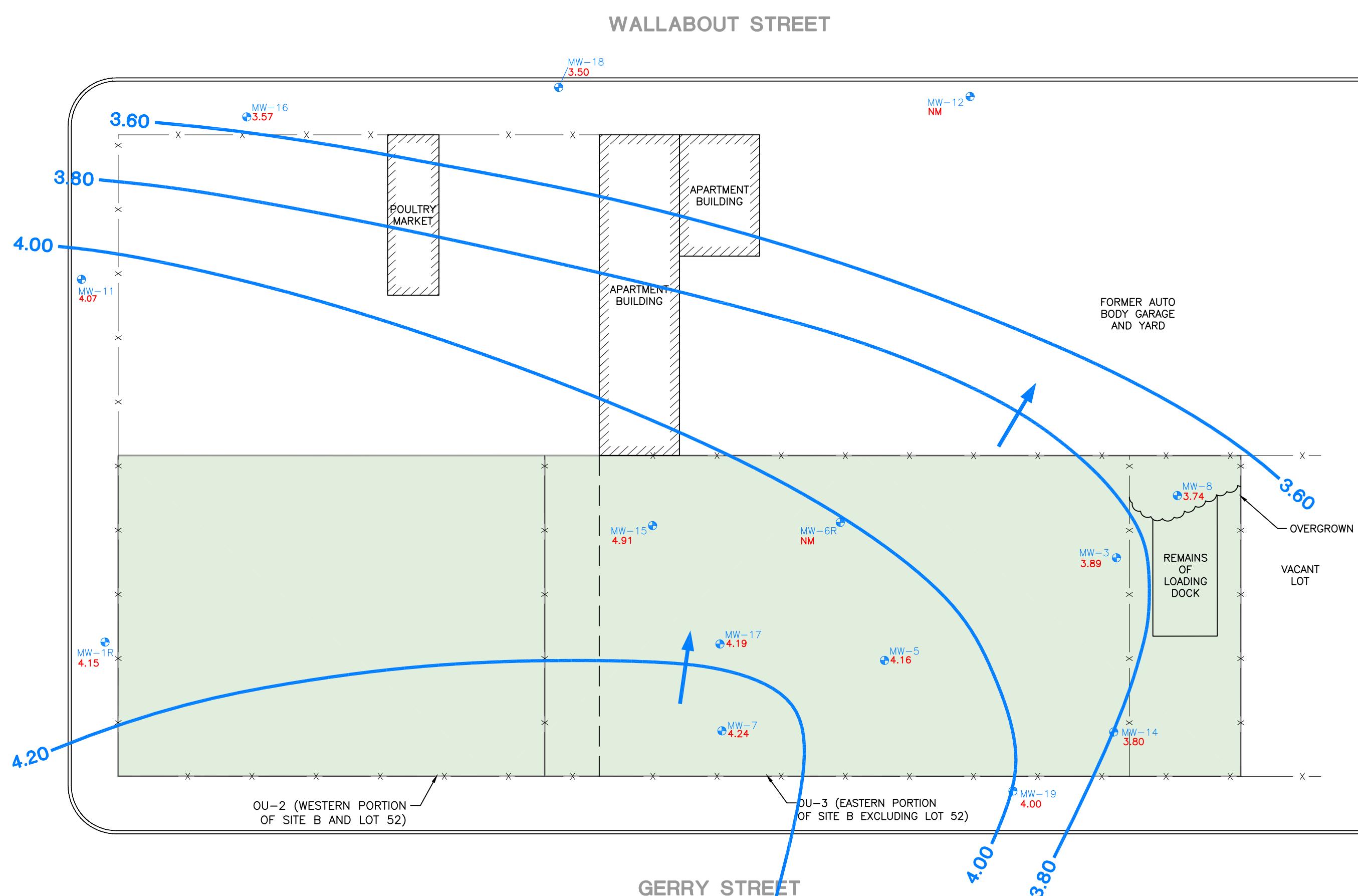
HORIZONTAL SCALE: 1" = 20'
VERTICAL SCALE: 1" = 5'
VERTICAL EXAGGERATION: 4X

LEGEND	
	FILL MATERIAL CONSISTING OF VARYING GRAIN SIZES OF SAND AND ONE OR MORE OF THE FOLLOWING CONSTITUENTS: GRAVEL, SILT, CINDERS, BRICKS, WOOD, GLASS, ASH, CONCRETE
	PRIMARILY SAND AND MAY CONTAIN GRAVEL AND OR SMALL AMOUNTS OF CLAY AND SILT
	CLEAN BACKFILL PLACED DURING PREVIOUS INTERIM REMEDIAL MEASURES ACTIVITIES
	SILT/CLAY
	SILT/SAND
	CONCRETE
	WELL SCREEN INTERVAL
	SOIL BORING DEPTH

NOTES

1. DASHED LINES INDICATE INFERRED DELINEATION BETWEEN LAYERS.
2. ELEVATION IN FEET RELATIVE TO BOROUGH OF BROOKLYN HIGHWAY DATUM.
3. SB-OU1-1 AND GWS-OU1-10 EXTEND BELOW MAXIMUM DEPTH OF SECTION.
4. PROJECTED LOCATIONS WERE PROJECTED THE SHORTEST DISTANCE (PERPENDICULAR) TO SECTION LINES.

CROSS SECTIONS	
SITE B AND SITE D OU-1 RAWP	Prepared For:
	PFIZER INC BROOKLYN, NEW YORK
ROUX ROUX ASSOCIATES, INC. Environmental Consulting and Management	Compiled by: W.K. Date: 15SEPT14 Prepared by: G.M. Scale: AS SHOWN Project Mgr: W.K. Project: 0047.0044Y605R.02.DWG File: 0047.0044Y605R.02.DWG



NOTE

WATER-LEVEL ELEVATION AT MW-15 WAS LIKELY AN ERRONEOUS MEASUREMENT, AND MW-D3 IS LIKELY AFFECTED BY PERCHED GROUNDWATER. BOTH WERE EXCLUDED FROM DATA USED TO DETERMINE GROUNDWATER ELEVATION CONTOURS.

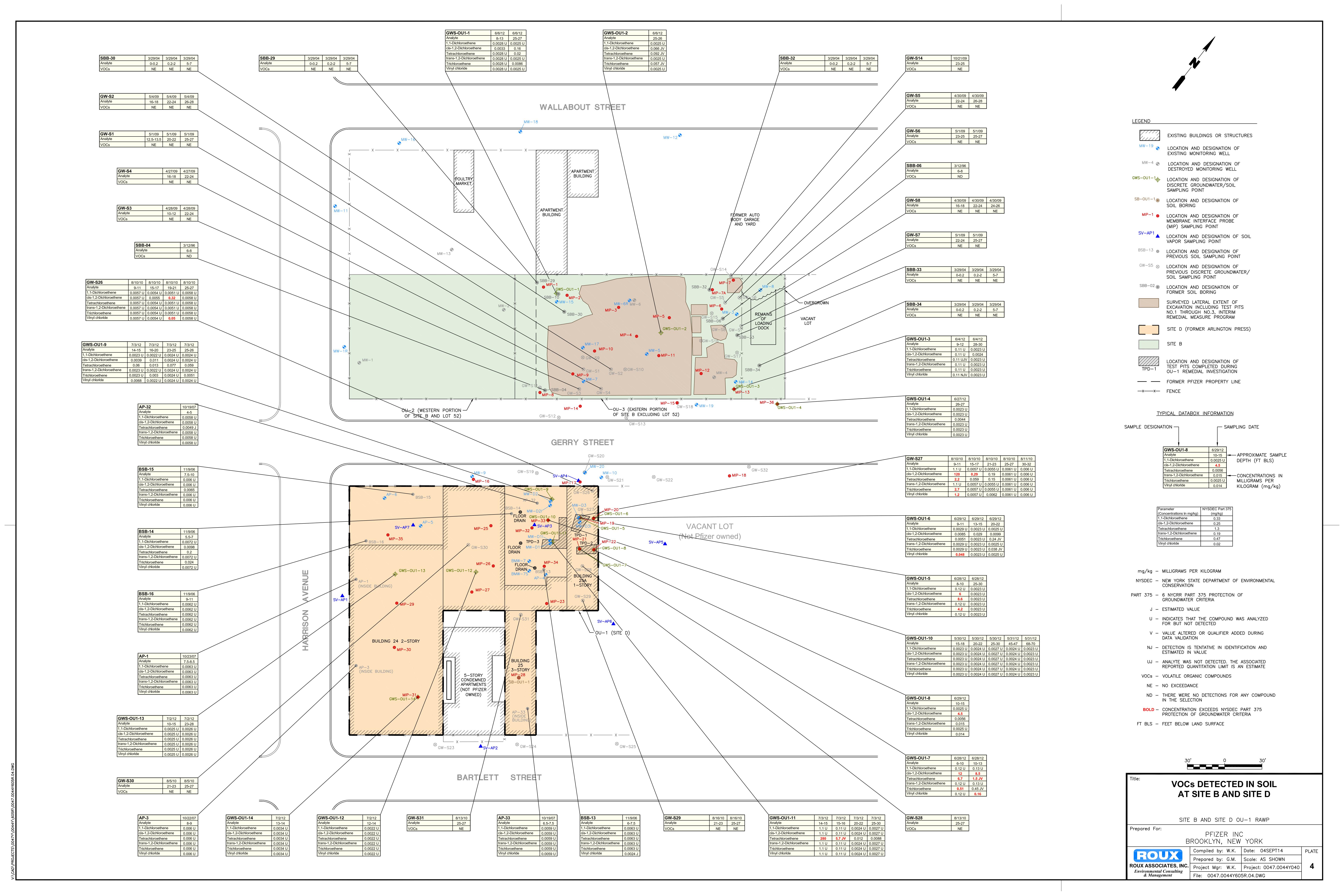
Title: GROUNDWATER FLOW DIRECTION
MARCH 17, 2014

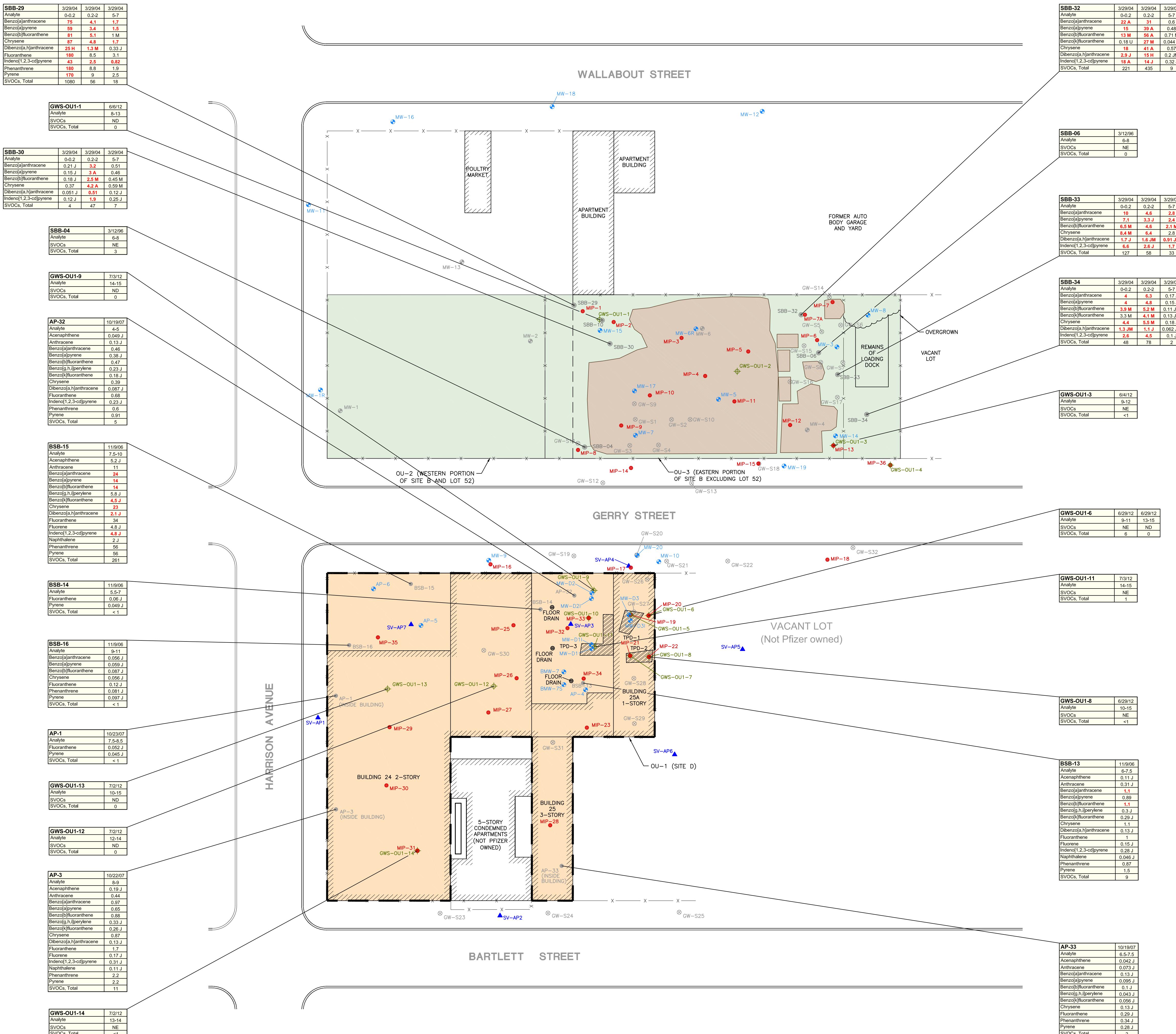
SITE B AND SITE D OU-1 RAWP

Prepared For:

PFIZER INC
BROOKLYN, NEW YORK

ROUX ROUX ASSOCIATES, INC. <i>Environmental Consulting and Management</i>	Compiled by: W.K.	Date: 04SEPT14
	Prepared by: G.M.	Scale: AS SHOWN
	Project Mgr: W.K.	Project: 0047.0044Y040
	File: 0047.0044Y605R.03.DWG	

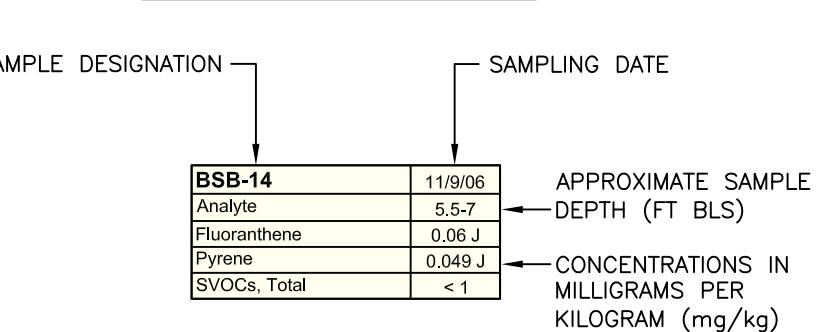




LEGEND

- EXISTING BUILDINGS OR STRUCTURES
- MW-19 LOCATION AND DESIGNATION OF EXISTING MONITORING WELL
- MW-18 LOCATION AND DESIGNATION OF DESTROYED MONITORING WELL
- GWS-OU1-1 LOCATION AND DESIGNATION OF DISCRETE GROUNDWATER/SOIL SAMPLING POINT
- SB-OU1-1 LOCATION AND DESIGNATION OF SOIL BORING
- MIP-1 LOCATION AND DESIGNATION OF MEMBRANE INTERFACE PROBE (MIP) SAMPLING POINT
- SV-AP1 LOCATION AND DESIGNATION OF SOIL VAPOR SAMPLING POINT
- BSB-13 LOCATION AND DESIGNATION OF PREVIOUS SOIL SAMPLING POINT
- GW-S5 LOCATION AND DESIGNATION OF PREVIOUS DISCRETE GROUNDWATER/SOIL SAMPLING POINT
- SBB-02 LOCATION AND DESIGNATION OF FORMER SOIL BORING
- SURVEYED LATERAL EXTENT OF EXCAVATION INCLUDING TEST PITS NO.1 THROUGH NO.3, INTERIM REMEDIAL MEASURE PROGRAM
- SITE D (FORMER ARLINGTON PRESS)
- SITE B
- TPD-1 LOCATION AND DESIGNATION OF TEST PITS COMPLETED DURING OU-1 REMEDIAL INVESTIGATION
- FORMER PFIZER PROPERTY LINE
- x-x- FENCE

TYPICAL DATABASE INFORMATION



Parameter (Concentrations in mg/kg)	NYSDEC Part 375 (mg/kg)
Acenaphthene	100
Anthracene	100
Benzo[a]anthracene	1
Benzo[a]pyrene	1
Benzo[b]fluoranthene	1
Benzo[g,h]pyrene	100
Benzo[k]fluoranthene	3.9
Chrysene	3.9
Dibenz[a,h]anthracene	0.33
Fluoranthene	100
Fluorene	100
Indeno[1,2,3-cd]pyrene	0.5
Naphthalene	100
Phenanthrene	100
Pyrene	100

mg/kg = MILLIGRAMS PER KILOGRAM
NYSDEC = NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

PART 375 = 6 NYCR Part 375 RESTRICTED RESIDENTIAL USE CRITERIA

J = ESTIMATED VALUE
U = INDICATES THAT THE COMPOUND WAS ANALYZED BUT NOT DETECTED

M = MANUALLY INTEGRATED COMPOUND

A = CONCENTRATION EXCEEDS INSTRUMENT CALIBRATION RANGE OR BELOW THE REPORTING LIMIT

H = ALTERNATE PEAK SELECTION UPON ANALYTICAL REVIEW

SVOCs = SEMIVOLATILE ORGANIC COMPOUNDS

NE = NO EXCEDANCE

ND = THERE WERE NO DETECTIONS FOR ANY COMPOUND IN THE SELECTION

BOLD = CONCENTRATION EXCEEDS NYSDEC PART 375 RESTRICTED RESIDENTIAL USE CRITERIA

FT BLS = FEET BELOW LAND SURFACE

30' 0 30'

SVOCs DETECTED IN SOIL AT SITE B AND SITE D

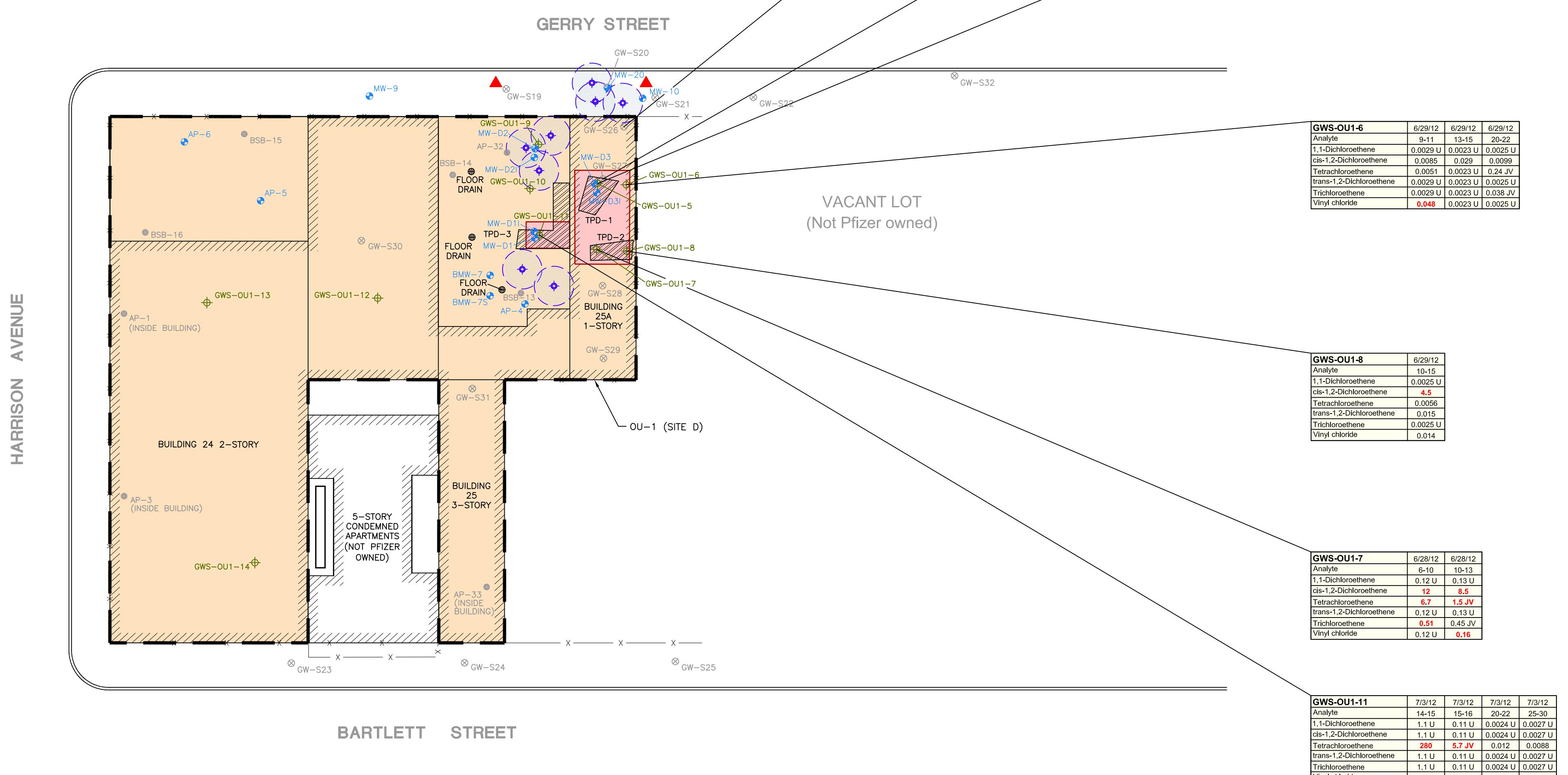
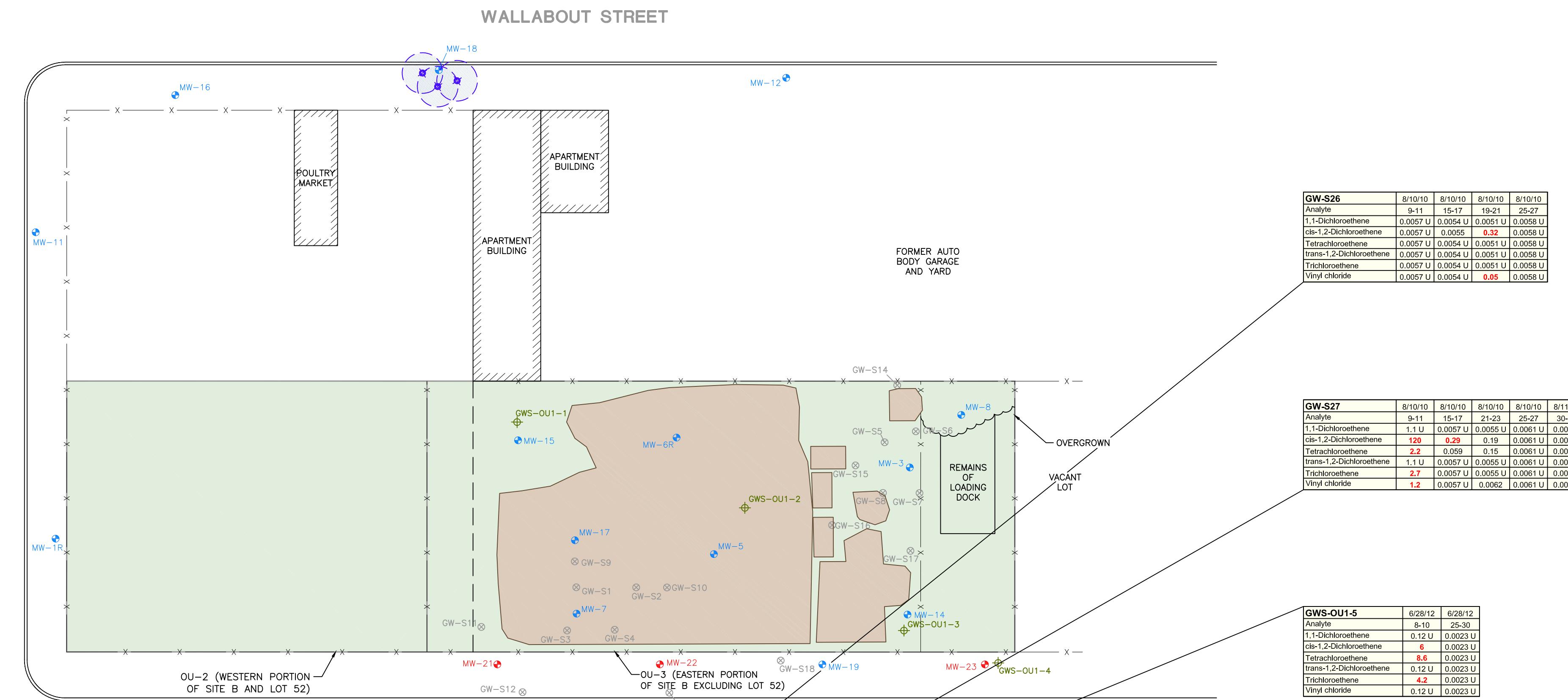
SITE B AND SITE D OU-1 RAWP

Prepared For: **PFIZER INC**
BROOKLYN, NEW YORK

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

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PLATE 5



<p>Title: PROPOSED REMEDIAL ACTION LAYOUT</p> <p>SITE B AND SITE D OU-1 RAWP</p> <p>Prepared For:</p> <p style="text-align: center;">PFIZER INC BROOKLYN, NEW YORK</p>			
 <p>ROUX ASSOCIATES, INC. <i>Environmental Consulting & Management</i></p>	Compiled by: W.K.	Date: 04SEPT14	PLAT 7
	Prepared by: G.M.	Scale: AS SHOWN	
	Project Mgr: W.K.	Project: 0047.0044Y040	
	File: 0047.0044Y605R2.01.DWG		

SITE B AND SITE D OU-1 RAWP

PFIZER INC
BROOKLYN, NEW YORK

Compiled by: W.K. Date: 04SEF
Prepared by: G.M. Scale: AS SH
Printed by: W.K. Printed: 04SEF

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