FORMER PFIZER INC SITE D
KINGS COUNTY
BROOKLYN, NEW YORK

SITE MANAGEMENT PLAN

NYSDEC Site Number: V00350

Prepared for:

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Peapack, New Jersey 07977

Prepared by:

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Revisions to Final Approved Site Management Plan:

Revision No.	Date Submitted	Summary of Revision	NYSDEC Approval Date

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JUNE 2018

CERTIFICATION STATEMENT

I, Charles J. McGuckin, certify that I am currently a NYS registered professional engineer and that this Site Management 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).

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

6/27/18
Date

CHARLES J. MCGUCKIN
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LIST OF ACRONYMS

6 NYCRR	Title 6 of the New York Codes, Rules and Regulations
AWQSGV	Ambient Water Quality Standards and Guidance Value
CAMP	Community Air Monitoring Plan
Cis-1,2-DCE	Cis-1,2-Dichloroethene
CMWP	Corrective Measures Work Plan
COC	Certificate of Completion
COCs	Compounds of Concern
CVOCs	Chlorinated Volatile Organic Compounds
EC	Engineering Control
EWP	Excavation Work Plan
Ft bls	Feet Below Land Surface
HASP	Health and Safety Plan
IC	Institutional Control
ISCO	In-Situ Chemical Oxidation
NAVD 88	North American Vertical Datum of 1988
NYS	New York State
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OER	Office of Environmental Remediation
Part 375	Part 375
PCE	Tetrachloroethene
Pfizer	Pfizer Inc
PID	Photoionization Detector
PoG	Protection of Groundwater
PRR	Periodic Review Report
QA/QC	Quality Assurance/Quality Control
RA	Remedial Action
RAO	Remedial Action Objective
RAWP	Remedial Action Work Plan
RCA	Recycled Concrete Aggregate
RI	Remedial Investigation
RIR	Remedial Investigation Report
RIWP	Remedial Investigation Work Plan
RP	Remedial Party
RSO	Remedial System Optimization
SCG	Standards, Criteria and Guidelines
SCO	Soil Cleanup Objective
SMP	Site Management Plan
SPEED	Searchable Property Environmental E-Database
SVOCs	Semivolatile Organic Compounds
TCE	Trichloroethene
TCL	Target Compound List
USEPA	United States Environmental Protection Agency

VC	Vinyl Chloride
VCA	Voluntary Cleanup Agreement
VCP	Voluntary Cleanup Program
VOCs	Volatile Organic Compounds

ES EXECUTIVE SUMMARY

The following provides a brief summary of the controls implemented for the Site, as well as the inspections, monitoring, maintenance and reporting activities required by this Site Management Plan (SMP):

Site Identification:

Site Identification No. V00350
Former Pfizer Inc Site D
191 Harrison Avenue and 60-66 Gerry Street
Brooklyn, New York

Institutional Controls:	1. The property may be used for restricted residential, commercial, and industrial use;
	2. Environmental Easement
	3. Performance of soil vapor intrusion evaluation in event of redevelopment.
	4. All Engineering Controls (ECs) must be inspected at a frequency and in a manner defined in the SMP.
Engineering Controls:	1. Cover system
	2. *In-situ* Chemical Oxidation (ISCO) Injections.
Inspections:	Frequency
1. Cover Inspection	Annually; First inspection to occur no more than 15 months after issuance of Certificate of Completion (COC) or upon completion of redevelopment, whichever occurs first
2. Site-Wide Inspection	Annually; First inspection to occur no more than 15 months after issuance of the COC
Monitoring:	
1. Monitoring wells - Groundwater	Quarterly for first 2 years. Any change in frequency after two years will need to be approved by the NYSDEC.

Site Identification:

Site Identification No. V00350
Former Pfizer Inc Site D
191 Harrison Avenue and 60-66 Gerry Street
Brooklyn, New York

Monitoring (cont.):	Frequency (cont.):
2. Indoor Air Sampling	Annually upon completion of redevelopment through completion of groundwater remediation and post monitoring
Reporting:	
1. Monthly Progress Report (Ongoing, as necessary)	Monthly through issuance of COC
2. Groundwater Monitoring Report	Quarterly corresponding with monitoring frequency
3. Periodic Review Report	Annually

Further descriptions of the above requirements are provided in detail in the latter sections of this Site Management Plan.

1.0 INTRODUCTION

1.1 General

This SMP is a required element of the remedial program for the Former Pfizer Inc Site D located in Brooklyn, New York. A site location map is attached as Figure 1. The Site is currently in the New York State (NYS) Voluntary Cleanup Program (VCP) as Site No. V00350, which consists of multiple properties and operable units described below. The VCP is administered by the New York State Department of Environmental Conservation (NYSDEC).

Pfizer Inc (Pfizer), the Remedial Party (RP), entered into a Voluntary Cleanup Agreement (VCA) on September 19, 2003, with the NYSDEC to remediate the property located north of Gerry Street. The property was then known as Site B and was divided into a western portion with a street address of 59-71 Gerry Street, and an eastern portion with a street address of 73-87 Gerry Street. Subsequent key dates related to the Volunteer's application to the VCA are listed below:

- The VCA was amended on March 22, 2011 to include a 0.68-acre property across Gerry Street 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. (a.k.a. Congregation YGS) as Volunteers.
- On May 29, 2014, the NYSDEC modified the operable units to the following:
    - OU-1 consists of the Former Site D property (owned by 58 Gerry St LLC); and
    - OU-2 consists of the western portion of Former Site B located at 59-71 Gerry Street and Lot 52, which is the western most lot of the formerly Pfizer-owned (eastern) portion of Site B (both properties owned by YGS Inc., a.k.a. Congregation YGS); and
    - OU-3 consists of the remainder of the eastern portion of Former Site B, Lots 45 through 50 (owned by Oholie Shloma).

The portion of the property that is the subject of this SMP is designated as OU-1 (a.k.a. Former Site D).

A figure showing the Site location and boundaries of Former Site D is provided in Figure 2. The boundaries of the Site are more fully described in the metes and bounds site description that is part of the Environmental Easement provided in Appendix A.

After completion of the remedial work, some contamination was left at Former Site D, which is hereafter referred to as "remaining contamination". Institutional and Engineering Controls (ICs and ECs) have been incorporated into the site remedy specific to Former Site D to control the potential for exposure to remaining contamination to ensure protection of public health and the environment. An Environmental Easement granted to the NYSDEC, and recorded with the Kings County Clerk, requires compliance with this SMP and all ECs and ICs placed on the site. Figure 3 shows the location of the EC for the Site.

This SMP was prepared to manage remaining contamination at Former Site D until the Environmental Easement is extinguished in accordance with ECL Article 71, Title 36. This plan has been approved by the NYSDEC, and compliance with this plan is required by the grantor of the Environmental Easement and the grantor's successors and assigns. This SMP may only be revised with the approval of the NYSDEC.

It is important to note that:

- This SMP details the site-specific implementation procedures that are required by the Environmental Easement at Former Site D. Failure to properly implement the SMP is a violation of the Environmental Easement, which is grounds for revocation of the COC;

  Failure to comply with this SMP is also a violation of Environmental Conservation Law, 6NYCRR Part 375 and the VCA (Index No. D2-0010-0703; Site # V00350) for the Site, and thereby subject to applicable penalties.

All reports associated with Former Site D can be viewed by contacting the NYSDEC or its successor agency managing environmental issues in New York State. A list of contacts for persons involved with the Former Site D site is provided in Appendix B of this SMP.

This SMP was prepared by Roux Environmental Engineering and Geology, D.P.C., on behalf of Pfizer, in accordance with the requirements of the NYSDEC's DER-10 ("Technical Guidance for Site Investigation and Remediation"), dated May 2010, and the guidelines provided by the NYSDEC. This SMP addresses the means for implementing the ICs and/or ECs at Former Site D that are required by the Environmental Easement for the site.

1.2 Revisions

Revisions to this plan will be proposed in writing to the NYSDEC's project manager. Revisions will be necessary upon, but not limited to, the following occurring: a change in media monitoring requirements, upgrades to or shut-down of a remedial system, post-remedial removal of contaminated sediment or soil, or other significant change to the site conditions. In accordance with the Environmental Easement for the site, the NYSDEC will provide a notice of any approved changes to the SMP, and append these notices to the SMP that is retained in its files.

1.3 Notifications

Notifications will be submitted by the property owner of Former Site D to the NYSDEC, as needed, in accordance with NYSDEC's DER – 10 for the following reasons:

- 60-day advance notice of any proposed changes in site use that are required under the terms of the VCA, 6NYCRR Part 375 and/or Environmental Conservation Law.
- 7-day advance notice of any field activity associated with the remedial program.
- 15-day advance notice of any proposed ground-intrusive activity pursuant to the Excavation Work Plan.
- Notice within 48-hours of any damage or defect to the foundation, structures or EC that reduces or has the potential to reduce the effectiveness of an EC, and likewise, any action to be taken to mitigate the damage or defect.
- Verbal notice by noon of the following day of any emergency, such as a fire; flood; or earthquake that reduces or has the potential to reduce the effectiveness of ECs in place at the site, with written confirmation within 7 days that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.
- Follow-up status reports on actions taken to respond to any emergency event requiring ongoing responsive action submitted to the NYSDEC within 45 days describing and documenting actions taken to restore the effectiveness of the ECs.

Any change in the ownership of the site or the responsibility for implementing this SMP will include the following notifications:

- At least 60 days prior to the change, the NYSDEC will be notified in writing of the proposed change. This will include a certification that the prospective purchaser/Remedial Party has been provided with a copy of the VCA, and all approved work plans and reports, including this SMP.
- Within 15 days after the transfer of all or part of the site, the new owner's name, contact representative, and contact information will be confirmed in writing to the NYSDEC.

Table 1 below includes contact information for the above notification. The information on this table will be updated as necessary to provide accurate contact information. A full listing of Former Site D site-related contact information is provided in Appendix B.

Table 1: Notifications*

Name	**Contact Information**
NYSDEC, DER, Bureau of Technical Support Site Control Section	Chief, Site Control Section New York State Department of Environmental Conservation Division of Environmental Remediation, 625 Broadway Albany NY 12233-7020
Man-tsz Yau	(718)-482-4897 man-tzu.yau@dec.ny.gov
Jane O'Connell	(718) 482-4599 jane.oconnell@dec.ny.gov

* Note: Notifications are subject to change and will be updated as necessary.

2.0 SUMMARY OF PREVIOUS INVESTIGATIONS AND REMEDIAL ACTIONS

2.1 Site Location and Description

Former Site D is located in Brooklyn, Kings County, New York and is identified as Block 2269 and Lot 1 on the New York City Tax Map. The site is an approximately 0.68-acre area and is bounded by Gerry Street to the north, Bartlett Street to the south, a vacant lot to the east, and Harrison Avenue to the west (see Figure 2 – Site Layout Map). The boundaries of the site are more fully described in Appendix C – Survey Map, Metes and Bounds.. The owner(s) of the Former Site D site parcel(s) at the time of issuance of this SMP is:

58 Gerry St LLC

The responsibilities of the implementation of this SMP are divided and carried out by both the owner and the RP of Former Site D, and are more fully described in Appendix D.

2.2 Physical Setting

2.2.1 Land Use

Former Site D consists of the following: five, interconnected vacant buildings with two exterior courtyards within the property line (Figure 2). Former Site D is zoned for commercial use and is currently vacant. Historically Arlington Press, a company that specialized in labels and package inserts for the pharmaceutical industry, had leased the five interconnected buildings that comprise Former Site D from 1987 to the end of 2007. No other entity has occupied the vacated buildings since then.

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:

North:

- A sheet metal shop;
- Several vacant properties along Gerry Street;

- A set of three vacant apartment buildings within the OU-3 property boundary; and
- Private girls' school, located within the former OU-2 property boundary

South:

- A five-story condemned apartment building that abuts Site D to the south, and fronts on Bartlett Street. Pfizer does not own, and has never owned, the condemned apartment building or the adjacent vacant lot.

East:

- United Talmudical Academy is located approximately 370 feet southeast of OU-1 at 102 Bartlett Street.

West:

- One day-care center is located at 11 Bartlett Street, approximately 200 feet southwest of Former Site D.

No hospitals are located within 500 feet of Former Site D.

2.2.2 Geology

Former Site D is 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 dip gently toward the southeast, following the topography of the bedrock surface.

During previous investigations of Former Site D, four distinct geologic strata were encountered from land surface to a depth of approximately 35 feet below land surface (ft bls). The observed lithology is as follows:

- A brown sand stratum (i.e., fill material) at the surface 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 and/or sand/silt stratum that underlies the aforementioned fill material at Former Site B and Former 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 Former Site B and Former Site D with an average approximate thickness of 10 to 15 feet.

- A minimum 10 feet thick, low permeability, gray silt/clay stratum that underlies the above sand stratum throughout Former Site B and Former Site D.

There are additional site-specific features in addition to the above. Most of the surface of Former Site D is covered by concrete that is approximately one to two feet thick, installed as part of the original building structure. The following change in lithology is present in the two areas excavated as part of the NYSDEC-approved Remedial Action Work Plan (RAWP) conducted in 2015 to remove source areas:

- A layer of recycled concrete aggregate (RCA) was used to backfill from the bottom of the excavations to one foot above the water table; and
- A layer of material approved for reuse from the Site was backfilled from 2 ft bls to a foot above the water table is present within the excavations; and
- The top two feet of the excavation completed within Building 25A was backfilled using clean, imported sand; and
- The excavation completed in the Former Site D courtyard was backfilled using RCA from 6 inches bls to 2 feet; and
- The top 6-inches of the excavation completed in the Former Site D courtyard was capped using concrete.

A geologic cross section of the areas described above is shown in Figure 4. Site specific boring logs are provided in Appendix D.

2.2.3 Hydrogeology

Shallow 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.

During previous investigations, the groundwater flow direction under Former Site D and the eastern portion of Former Site B was determined to be to the northeast. This is generally consistent with the regional groundwater flow direction. The groundwater flow direction under 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, and is observed to flow to the west-northwest from Gerry Street toward Wallabout Street.

A groundwater contour map based on conditions observed in October 2016 is shown in Figure 5. The elevation datum used is the Brooklyn Vertical Datum. Groundwater elevation data from this gauging event is provided in Table 2. Groundwater monitoring well construction logs are provided in Appendix E.

2.3 Investigation and Remedial History

The following narrative provides a remedial history timeline and a brief summary of the available project records to document key investigative and remedial milestones for the property in the VCP. Full titles for each of the reports referenced below are provided in Section 8.0 - References.

2.3.1 Historical Former Site B Investigation

Multiple site investigations were performed on Former Site B between 1996 and 2011. The investigations consisted of soil, groundwater, and soil vapor sampling on Former Site B and the adjacent sidewalk areas. Remedial measures consisted of Interim Remedial Measure activities conducted in 2002 to remove nine underground storage tanks, two tank-like structures, 4,735 tons of impacted soils, and 18,449 gallons of groundwater; and subsequent installation and operation of a soil vapor extraction/air sparge treatment system from October 2006 to February 2011. In addition, groundwater was sampled quarterly between September 2006 and September 2012, and semi-annually between September 2012 and March 2013. These efforts were successful in remediating the petroleum impacts on Former Site B, but chlorinated volatile organic compound (CVOC) impacts remained. It was proposed that these CVOCs could potentially be migrating from unidentified upgradient sources.

A potential upgradient contaminant source location was recognized during the December 7, 2009 discovery of a 1955 affidavit related to a permit to construct by the owner of a tetrachloroethene (PCE) reclamation business located at 66 Gerry Street (a.k.a. Former Site D). Although Former Site D was not in a regulatory program at the time, the scope of work was discussed with the NYSDEC prior to performance at Pfizer's initiative to explore whether an offsite contaminant source existed beneath or around Building 25A located on Former Site D. The objective of the Expanded Delineation Investigation was to determine the extent of CVOCs present in groundwater and soil upgradient of Former Site B, focusing on areas within and proximate to Former Site D.

2.3.2 Expanded Delineation Investigation Report

The Expanded Delineation Investigation was performed by Roux Associates on behalf of Pfizer in accordance with the "Expanded Delineation Investigation Work Plan" dated March 26, 2010. The investigation provided a thorough analysis of 14 discrete groundwater and soil sampling locations. In summary, groundwater impacts were discovered underneath the south sidewalk of Gerry Street and the northern half of Building 25A (located within Former Site D), and CVOCs in soil were discovered underneath the northcentral portion of Building 25A. These findings are consistent with the conclusion that soil impacts underneath Building 25A are the likely source of groundwater CVOC contamination present at Former Site B.

Based on the findings of the Expanded Delineation Investigation and discussions between Pfizer and the NYSDEC, the Site B VCA was amended to expand the site boundaries to include the entirety of Site D. The amended VCA went into effect on March 22, 2011. A stipulation of the amended VCA was that Pfizer submit a RIWP for Site D within 30-days of the execution of the VCA amendment. The results of the *Expanded Delineation Investigation Report* were presented in the *Remedial Investigation Work Plan* (RIWP), prepared by Roux Associates, dated April 22, 2017. The RIWP was submitted for NYSDEC review on April 22, 2011.

2.3.3 Remedial Investigation Report

Soil, groundwater, and soil vapor were characterized in the Remedial Investigation (RI) conducted by Roux Associates on behalf of Pfizer. The investigation provided a thorough analysis of soil and groundwater using monitoring wells, membrane interface probes, test pits, and onsite/offsite soil vapor sampling, and was performed in accordance with the following NYSDEC approved work plans:

- The RIWP dated January 17, 2012;
- "Supplemental Remedial Investigation Work Plan" dated January 30, 2013; and
- "Supplemental Soil Vapor Investigation Work Plan" dated June 25, 2013.

Based on the findings of Site B and Site D investigations, the compounds of concern (COCs) were identified as four CVOCs: PCE, trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), and vinyl chloride (VC). Other CVOCs that have been detected in soil, groundwater, and/or soil vapor (e.g., trans-1,2 dichloroethene) are at significantly lower levels, by comparison, and mostly meet applicable standards.

The results of the RI were presented in the *Remedial Investigation Report* (RIR), prepared by Roux Associates, dated March 27, 2014, and are summarized below.

Soil samples with COC exceedances of the Protection of Groundwater (PoG) Criteria in Title 6 of the New York Codes, Rules and Regulations (6 NYCRR) Part 375 (Part 375) dated December 14, 2006 were present underneath the north-central portion of Building 25A in Former Site D, and the eastern portion of the main courtyard of Former Site D. The exceedances were at depths ranging from six (6) to 21 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 soil cleanup objectives (RRSCOs) were 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 found are consistent with historic fill in urban environments (i.e., Brooklyn, New York) and not due to a release at Former Site B or Former Site D.

A groundwater plume containing dissolved CVOC extended from the northern part of Former Site D to Former Site B. CVOC exceedances of the NYSDEC Ambient Water Quality Standards and Guidance Value (AWQSGV) had been detected at multiple monitoring wells within the plume. The groundwater plume is present to approximately 30 ft bls, which coincides with the top of a confining silt/clay layer that limits vertical migration (as described above in Section 2.2.2).

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

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

2.3.4 Remedial Action Work Plan

The following is a summary of the activities completed during the Remedial Action (RA) to address the CVOC impacted soil and groundwater at Former Site D:

- Excavation of soil and materials exceeding the Part 375 PoG Criteria for VOCs, to the extent practicable within Building 25A and the main courtyard of Former Site D;
- Groundwater remediation consisting of in situ chemical oxidation (ISCO) injections in the Former Site D main courtyard and in the vicinity of monitoring wells MW 18, MW 20, MW D2, and MW D2I;
- 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;

- Collection and analysis of end-point soil samples to evaluate the performance of the remedy with respect to attainment of soil cleanup objectives (SCOs);
- Collection and analysis of groundwater samples to evaluate the performance and effectiveness of the remedy with respect to AWQSGVs;
- 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;
- 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 RRSCOs;
- 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;
- Recording of a Deed Restriction, including Institutional Controls, to prevent future exposure to any residual contamination remaining at the Site;
- 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.

2.4 Remedial Action Objectives

The remedial goals for soil at Former Site D were to meet the PoG SCOs for CVOCs in soil and to limit exposure to contaminated soil and groundwater through use of an engineered composite cap system for areas above RRSCOs. Groundwater beneath Former Site D was addressed through source removal and treatment; excavation and disposal of CVOC impacted soils and ISCO injection treatment for groundwater. Consistent with Part 375, the proposed remedies for Former Site D were fully protective of public health and the environment, taking into account the current, intended and potential future land use.

The Remedial Action Objectives (RAOs) for the Former Site D are as listed in the RAWP dated February 2015 are as follows:

2.4.1 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.

2.4.2 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.

2.4.3 Soil Vapor

RAOs for Public Health Protection

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

2.5 Remaining Contamination

The RA was designed to reduce the concentration of Former Site D contaminants through excavation of source material within the Former Site D main courtyard and Building 25A. Due to structural engineering concerns associated with the onsite buildings, adjacent sidewalks, and other Site constraints, all soil contamination was not removed as part of the performance of the RA. As a result, soil contamination remains at several locations across Former Site D that exceeds the NYSDEC PoG SCOs for multiple VOCs including the four CVOC COCs identified above (Figure 6). This residual contamination was addressed with an ISCO injection treatment program that reduced groundwater concentrations. Remaining residual groundwater impacts will be addressed by the completion of an additional ISCO injection treatment plan, further discussed in Section 3.3.

2.5.1 Soil

The RA addressed CVOC contaminated soil in the two identified source areas within the Former Site D main courtyard and Building 25A through excavation, low-level CVOCs in these areas and offsite through ISCO, and limiting contact with potentially-contaminated soil by installing a composite cover over the disturbed areas. Although source area soil was removed in both locations, minor soil contamination remains to the north of both excavation areas and at the edges of the excavations adjacent to the Building 25A foundations (Figure 6). This material, which potentially extends beneath Former Site D building foundations and sidewalks, could not be removed due to structural integrity issues.

The results of soil sampling data, post-RA, are respectively presented in Table 3.

2.5.2 Groundwater

The RA addressed groundwater through removal and/or treatment of source area soil with VOCs above PoG SCOs. A component of the RAWP was an ISCO injection program to treat VOCs in groundwater and soil where excavation could not be completed during the RA, namely the soils outside of the two excavations, and areas outside of Former Site D where residual impacts were documented (i.e., near MW-18 and MW-8). The most recent round of post-injection groundwater monitoring (October 2016) indicated detections above NYSDEC AWQSGV for seven (7) compounds, of which four (4) were the identified COCs:

- 1,1-Dichloroethane was detected in only MW-16R with an estimated value of 5.1 milligrams per liter (µg/L);

- 1,2-Dichloroethane was detected in only MW-16R with an estimated value of 1.0 µg/L;
- 1,2-Dichloroethene (total), is a compound that consists of the total summation of the concentrations of trans and cis-1,2-DCE. A majority of this concentration consists of cis-1,2-DCE and any recorded exceedances are attributed to this COC;
- Cis-1,2-DCE concentrations ranged from 33 µg/L to 14,000 µg/L with the highest concentration detected in MW-D2 and MW-D2I located within the main courtyard area;
- PCE concentrations ranged from 8.4 µg/L to an estimated value of 97 µg/L with the highest concentration detected in MW-D2;
- TCE concentrations ranged from 5.2 µg/L to 38 µg/L with the highest concentrations detected in MW-8 (a monitoring well located within Former Site B property boundaries); and
- VC concentrations ranged from an estimated value of 2.3 µg/L to 2,800 µg/L with the highest concentration detected in the duplicate sample collected from MW-D2I in the main courtyard.

Table 4 and Figure 7 summarize the results of all samples of groundwater that exceed the SCGs after completion of the RA.

Based upon the presence of residual VOCs in groundwater following the initial injection treatment event at Former Site D and residual VOCs in soil after excavation of impacted soil beneath Building 25A and in the courtyard, additional treatment utilizing ISCO will be completed to address these residual contaminants. Further details concerning the performance of these planned injections are discussed further in Section 4.4.2.

2.5.3 Soil Vapor

The RA addressed soil vapor through removal of soil containing CVOCs above the PoG SCOs and treatment of groundwater. New buildings with occupancy within the Former Site D property line are planned to have foundations extending below the water table and will have foundation waterproofing acting as a vapor barrier. A sub-slab depressurization system will not be feasible below the proposed building slab. The potential for soil vapor intrusion in new development structures will be evaluated with the collection and analysis of indoor air samples prior to occupation. See Section 4.6 of this SMP for the procedures to be followed for that evaluation.

3.0 INSTITUTIONAL AND ENGINEERING CONTROL PLAN

3.1 General

Since remaining contamination exists at Former Site D, Institutional Controls (ICs) and Engineering Controls (ECs) are required to protect human health and the environment. This IC/EC Plan describes the procedures for the implementation and management of all IC/ECs at Former Site D. The IC/EC Plan is one component of the SMP and is subject to revision by the NYSDEC.

This plan provides:

- A description of all IC/ECs on the site;
- The basic implementation and intended role of each IC/EC;
- A description of the key components of the ICs set forth in the Environmental Easement;
- A description of the controls to be evaluated during each required inspection and periodic review;
- A description of plans and procedures to be followed for implementation of IC/ECs, such as the implementation of the Excavation Work Plan (EWP) (as provided in Appendix F) for the proper handling of remaining contamination that may be disturbed during maintenance or redevelopment work on the site; and
- Any other provisions necessary to identify or establish methods for implementing the IC/ECs required by the site remedy, as determined by the NYSDEC.

3.2 Institutional Controls

A series of ICs is required by the Former Site D RAWP to: (1) implement, maintain and monitor Engineering Control systems; (2) prevent future exposure to remaining contamination; and, (3) limit the use and development of the site to Restricted Residential, Commercial and/or Industrial uses only. Adherence to these ICs on the Former Site D site is required by the Environmental Easement and will be implemented under this SMP. ICs identified in the Environmental Easement may not be discontinued without an amendment to or extinguishment of the Environmental Easement. The IC boundaries are shown on Figure 2 and described in the Appendix A- Environmental Easement. These ICs are:

- The property may be used for : restricted residential, commercial, or industrial use;
- All ECs must be operated and maintained as specified in this SMP;
- All ECs must be inspected at a frequency and in a manner defined in the SMP.
- The use of groundwater underlying the property is prohibited without necessary water quality treatment as determined by the NYSDOH (New York State Department of Health) or the New York City Department of Health to render it safe for use as drinking water or for industrial purposes, and the user must first notify and obtain written approval to do so from the Department.
- Groundwater and other environmental or public health monitoring must be performed as defined in this SMP;
- Data and information pertinent to site management must be reported at the frequency and in a manner as defined in this SMP;
- All future activities that will disturb remaining contaminated material must be conducted in accordance with this SMP;
- Monitoring to assess the performance and effectiveness of the remedy must be performed as defined in this SMP;
- Operation, maintenance, monitoring, inspection, and reporting of any mechanical or physical component of the remedy shall be performed as defined in this SMP;
- Access to the site must be provided to agents, employees or other representatives of the State of New York with reasonable prior notice to the property owner to assure compliance with the restrictions identified by the Environmental Easement.

- The potential for vapor intrusion must be evaluated for any buildings developed in the area within the IC boundaries noted in Appendix A – Environmental Easement following redevelopment, and any potential impacts that are identified must be monitored or mitigated; and
- Vegetable gardens and farming on the site are prohibited.

3.3 Engineering Controls

Procedures for maintaining the Former Site D cap are documented in the Operation and Maintenance Plan (Section 5.0 of this SMP). As-built drawings, signed and sealed by a professional engineer, of the Site cover system will be provided upon completion of the Former Site D development.

3.3.1 Cover (or Cap)

Exposure to remaining contamination at the site is prevented by a cover system placed over the Former Site D site. This cover system is currently comprised of a minimum of 24 inches of clean soil meeting the Part 375 PoG Criteria for VOCs and RRSCOs for non-VOCs in areas that are not paved or under a building slab, concrete cover, and concrete building slabs. Figure 3 presents the location of the current cover system. The proposed modifications to the Former Site D cover system will be provided to NYSDEC upon completion of site development design and prior to the start of development construction.

The Excavation Work Plan (EWP) provided in Appendix F outlines the procedures required to be implemented in the event the Former Site D cover system is breached, penetrated or temporarily removed, and any underlying remaining contamination is disturbed. Procedures for the inspection of this cover are provided in the Monitoring and Sampling Plan included in Section 4.0 of this SMP. Any work conducted pursuant to the EWP must also be conducted in accordance with the procedures defined in a Health and Safety Plan (HASP) and associated Community Air Monitoring Plan (CAMP) prepared for the site and provided in Appendix G.

3.3.2 ISCO Injections

An additional 2-phase ISCO injection program will be implemented at Former Site D based on the presence of residual CVOCs in groundwater and soil to follow up excavation of impacted soil and the initial ISCO injection round. The proposed chemical oxidants to be utilized are PersulfOx™ and PlumeStop®, both manufactured by Regenesis, Inc. These injection materials are different than the one used in the previous ISCO injection event, with the two materials to be used sequentially in two different phases of injections.

PersulfOx™ is a solid alkaline oxidant that is a solid powder that is mixed with water to produce an effective oxidant that is then injected into groundwater. The advantages of PersulfOx™ versus the previously utilized modified Fenton's reagent + extra free radical material is that the PersulfOx™ mixture is able to be injected at much higher concentrations (up to 20%) than the material utilized previously (approx. 7.5 to 10%), to react directly with the organic materials. This injection material also supports the degradation of target COCs for an extended period of time following completion of ISCO injections due to the generation of sulfate as a residual bi-product, which supports additional biodegradation processes.

As the PersulfOx™ is dissolved in water it creates an alkaline and oxidative environment that raises the pH of groundwater to values greater than 10. The radius of influence of the injection points will be verified during the injections by monitoring field parameters (i.e., pH and dissolved oxygen) at any adjacent monitoring wells to confirm the presence of the injection material.

The PersulfOx™ solution will be prepared on-Site and will be delivered to the subsurface at a controlled rate of either 15-percent or 20-percent (by weight) solution. The temporary injection points will be completed using a Geoprobe®. A 1.5-inch hollow steel rod with an end cap in place will be driven to the desired depths and a deployable 2-foot screened interval will be opened by pulling back on the rod. The injection solution will be pumped through the screened interval, and then the entire rod assembly will be raised to cover the entirety of the proposed injection depth.

The second phase of the ISCO injection will begin upon completion of the PersulfOx™ injection event and the subsequent groundwater monitoring event, utilizing a different Regenesis™ reagent called PlumeStop®. PlumeStop® Liquid Activated Carbon™ will be injected beneath the surface to create a continuous and robust passive barrier system. PlumeStop® is composed of very fine particles of activated carbon (1-2µm) that will be mixed in water to suspend the particles before injection. Upon injection, the material behaves as a colloidal biomatrix that binds to the aquifer matrix, rapidly removing contaminants from groundwater, and expediting permanent contaminant biodegradation. This material was chosen to be used in the Phase 2 of the ISCO injection due to its longevity and its ability to limit continued COC migration downgradient.

For these temporary points, the oxidant and reagent will be injected using an injection pump at a flow rate of 5 gallons per minute (gpm). During the injection process, the injection pump pressure will be maintained below 20 pounds per square inch to allow the aquifer to naturally dissipate any hydrostatic pressure build up. Higher pressures are generally not desirable due to the potential for the chemical oxidant solution to seep upwards around the injection rods (daylighting).

A Design Plan, which would show approximate injection point locations and material volume to be injected, will be submitted to NYSDEC prior to implementation for approval as necessary. Volume and density application rates for the chemical oxidant or alternative bioremediation reagent used in the injections will be based on the manufacturer's recommendations and baseline groundwater monitoring results completed in April 2017. The depth of injection will be based on exceedances of PoG SCOs in soil encountered during the RA or additional information to be collected when the site is being redeveloped.

Details pertaining to the ISCO monitoring post-implementation will be included in the submitted Design Plan, referenced above.

3.3.3 Criteria for Completion of Remediation/Termination of Remedial Systems

Generally, remedial processes are considered completed when monitoring indicates that the remedy has achieved the remedial action objectives identified by the decision document. The framework for determining when remedial processes are complete is provided in Section 6.4 of NYSDEC DER-10.

3.3.3.1 - Cover (or Cap)

The Former Site D composite cover system is a permanent control and the quality and integrity of this system will be inspected at defined, regular intervals in accordance with this SMP in perpetuity. The current cover system is comprised of a minimum of 24 inches of clean soil meeting the Part 375 PoG Criteria for VOCs and RRSCOs for non-VOCs in areas that are not paved or under a building slab, concrete cover, and concrete building slabs. Future development plans modifying the cover system will be submitted to NYSDEC prior to start of construction.

4.0 MONITORING AND SAMPLING PLAN

4.1 General

This Monitoring and Sampling Plan describes the measures for evaluating the overall performance and effectiveness of the remedy at Former Site D. This Monitoring and Sampling Plan may only be revised with the approval of the NYSDEC. Details regarding the sampling procedures, data quality usability objectives, analytical methods, etc. for all samples collected as part of site management for the site are included in the Quality Assurance Project Plan provided in Appendix H.

This Monitoring and Sampling Plan describes the methods to be used for:

- Sampling and analysis of all appropriate media (e.g., groundwater and/or indoor air); and
- Assessing compliance with applicable NYSDEC standards, criteria and guidance (SCGs), particularly groundwater standards and NYSDOH vapor intrusion guidance; and
- Assessing achievement of the remedial performance criteria; and
- Evaluating site information periodically to confirm that the remedy continues to be effective in protecting public health and the environment; and
- Preparing the necessary reports for the various monitoring and sampling activities.

To adequately address these issues, this Monitoring and Sampling Plan provides information on:

- Monitoring and sampling locations, protocol and frequency;
- Information on all designed monitoring systems (e.g., well logs);
- Analytical sampling program requirements;
- Reporting requirements;
- Quality Assurance/Quality Control (QA/QC);
- Monitoring well decommissioning procedures; and

- Annual inspection and periodic certification.

Monitoring of the performance of the remedy and overall reduction in contamination both on-and-off site of Former Site D will be conducted for the periods specified in Table 5, below. The frequency thereafter will be determined in consultation with NYSDEC and based on reports submitted showing contaminant trends. Trends in contaminant levels in groundwater will be evaluated to determine if the remedy continues to be effective in achieving remedial goals. Monitoring programs are outlined in detail in Section 4.0 below.

Table 5: Post-Remediation Inspection and Monitoring Schedule

Inspection/ Monitoring Task	**Goal of Inspection/Monitoring Task**	**Frequency of Inspection/ Monitoring Task**[1]
Inspection		
Site-wide Cover System	Confirm Site-Wide Cover System has not been compromised	Annually, First inspection to occur no more than 15 months after issuance of COC or upon completion of redevelopment, whichever occurs first
Site-wide Inspection	Confirm compliance with all ICs and effectiveness of ECs.	Annually, First inspection no more than 15 months after issuance of the COC
Monitoring		
Groundwater (MW-8, MW-9, MW-10, MW-16R, MW-18, MW-19, MW-20, MW-21, MW-22, MW-23, MW-24I, MW-25I, MW-D2, and MW-D2I)	Gauge Monitoring Wells and Obtain VOC Analytical Data per USEPA Method 8260 for NYSDEC (Target Compound List [TCL]) compounds to Assess effectiveness of remedy	Quarterly for a minimum of four Quarters following issuance of the COC - All Monitoring Wells
	Obtain Field Groundwater Parameters (PH, ORP, DO, Temperature & Conductivity) to assess effectiveness of ISCO injections	Bi-weekly for two months following completion of ISCO injections - Selected Monitoring Wells Per ISCO Injection Design Plan[2]
Indoor Air Locations to be confirmed as requested by NYSDEC	Obtain indoor air quality samples to determine the potential of vapor intrusion into the Site building For new development structures prior to occupancy	To be completed prior to building occupation and Annually thereafter

1. The frequency of events will be conducted as specified above until otherwise approved by NYSDEC and NYSDOH.
2. An area-specific ISCO Design Injection Plan, which will target residual contamination that could not be removed during the RAWP, will be submitted to the NYSDEC prior to implementation for approval.

A record of the findings of each monitoring/ inspection event and resulting maintenance activity performed, where applicable, will be kept in a dedicated log book and also documented on the Site Inspection Checklist (Appendix I). If at any time during the reporting period the Volunteer identifies a failure of one or more of the engineering controls or non-compliance with one or more of the institutional controls, the remedial party must notify the Department and implement corrective measures in accordance with a Corrective Measures Work Plan (CMWP) that will be submitted to and approved by NYSDEC and provide a periodic certification of the IC/ECs. Confirmation of the completion of maintenance activities will be documented in the subsequent Periodic Review Report.

4.2 Cover System Monitoring

Exposure to residual contaminated soil remaining at the Former Site D site is prevented by an engineered site cover system that is currently comprised of a minimum of 24 inches of clean soil meeting the Part 375 PoG Criteria for VOCs and RRSCOs for non-VOCs in areas that are not paved or under a building slab, concrete cover, and concrete building slabs.

The location and details of the Former Site D site cover system are shown on Figure 3.

Disturbance of the concrete floor slab and/or any of the underlying demarcation layers or EC components is governed by the Environmental Easement. In the unlikely event of an unanticipated accidental or required disturbance of the Former Site D site cover system, the response procedure is outlined in Appendix F.

Monitoring of the Former Site D site cover system will occur on an annual basis as long as the Environmental Easement is in effect to ensure the system’s integrity. Monitoring will consist of visual inspection, which shall evaluate the structural integrity of the concrete floor slab, support columns into the floors and the wall joints. If any penetrating cracks or openings are identified, they shall be screened for organic vapors with a PID and any readings shall be noted. In addition, any penetrating cracks or openings in the floor shall then be properly sealed. The results of the inspection will be included in the Periodic Review Report. In addition, the site cover system must be inspected and recertified any time a disturbance in the system occurs. The inspection frequency is subject to change with the approval of the NYSDEC. Unscheduled inspections and/or sampling may take place when a suspected failure of the site cover system has been reported or an emergency occurs that is deemed likely to affect the operation of the system.

4.3 Site-wide Inspection

Site-wide inspections of Former Site D will be performed at a minimum of once per year. Modification to the frequency or duration of the inspections will require approval from the NYSDEC. Site-wide inspections will also be performed after all severe weather conditions that may affect ECs or monitoring devices. During these inspections, an inspection form will be completed as provided in Appendix I – Site Management Forms. The form will compile sufficient information to assess the following:

- Compliance with all ICs, including site usage;
- An evaluation of the condition and continued effectiveness of ECs;
- General site conditions at the time of the inspection;
- The site management activities being conducted including, where appropriate, confirmation sampling and a health and safety inspection; and
- Confirm that site records are up to date.

Inspections of all remedial components installed at the Former Site D site will be conducted. A comprehensive site-wide inspection will be conducted and documented according to the SMP schedule, regardless of the frequency of the Periodic Review Report (PRR). The inspections will determine and document the following:

- Whether ECs continue to perform as designed;
- If these controls continue to be protective of human health and the environment;
- Compliance with requirements of this SMP and the Environmental Easement;
- Achievement of remedial performance criteria; and

- If site records are complete and up to date.

Inspections will also be performed in the event of an emergency. If an emergency, such as a natural disaster or an unforeseen failure of any of the ECs occurs that reduces or has the potential to reduce the effectiveness of ECs in place at the site, verbal notice to the NYSDEC must be given by noon of the following day. In addition, an inspection of the site will be conducted within 5 days of the event to verify the effectiveness of the IC/ECs implemented at the site by a qualified environmental professional, as determined by the NYSDEC. Written confirmation must be provided to the NYSDEC within 7 days of the event that includes a summary of actions taken, or to be taken, and the potential impact to the environment and the public.

4.4 Groundwater Monitoring

Groundwater monitoring will be performed quarterly to assess the performance of the ISCO used to treat CVOCs in groundwater underneath Building 25A and the courtyard, and to evaluate if remaining contamination continues to impact groundwater. Sampling locations, the required analytical parameters and schedule are provided in Table 5. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

Detailed sample collection and analytical procedures and protocols are provided in Appendix I – Field Sampling Plan.

4.4.1 Groundwater Sampling

Groundwater monitoring will be performed quarterly to assess the performance of the remedy. Modification to the frequency or sampling requirements will require approval from the NYSDEC.

Prior to sample collection, an electronic water level indicator will be utilized to gauge the water level and will be recorded in a field book and on the groundwater well sampling log (Appendix H). Samples will be collected from monitoring wells that are within the specified monitoring well network (as identified in Table 6 below). The monitoring wells will be sampled for TCL of VOCs using United States Environmental Protection Agency

(USEPA) SW846 Method 8260. Purge water and decontamination waste water generated during groundwater sampling will be containerized, properly labeled, and disposed of. The sampling, sample handling, decontamination, and field instrument calibration procedures will be performed in accordance with established procedures for the Site (Appendix I).

Table 6 shown below summarizes the wells identification number, as well as the purpose, location, depths, and diameter and screened intervals of the wells within the monitoring network. As part of the groundwater monitoring, 1 side-gradient well (MW-9), 2 on-site wells (MW-D2, and MW-D2I) and 11 downgradient wells (MW-8, MW-10, MW-16R, MW-18, MW-19, MW-20, MW-21, MW-22, MW-23, MW-24I, and MW-25I) will be sampled to evaluate the effectiveness of the remedial system. See Figure 2 for monitoring well locations.

Table 6– Monitoring Well Construction Details

Monitoring Well ID	Well Location		Well Diameter (inches)	Elevation (above mean sea level)			
	Coordinates (longitude)	Coordinates (latitude)		Casing	Surface	Screen Top	Screen Bottom
MW-8	40.7019332	-73.9473997	2	15.53	13.18	3.18	-6.82
MW-9	40.7012085	-73.9476864	2	11.42	11.70	3.70	-6.30
MW-10	40.7013913	-73.9473990	2	12.37	12.60	3.10	-6.90
MW-16R	40.7016647	-73.9484736	2	9.46	10.05	0.05	-9.95
MW-18	40.701857	-73.9482279	2	9.43	9.71	1.71	-10.29
MW-19	40.70165	-73.9473271	2	12.62	13.13	8.13	-6.87
MW-20	40.7013758	-73.9474441	2	12.30	12.48	7.48	-7.52
MW-21	40.7014328	-73.9476686	2	11.93	12.19	2.19	-12.81
MW-22	40.7015614	-73.9474625	2	12.60	12.88	2.88	-12.12
MW-23	40.701741	-73.9471738	2	12.98	13.24	3.24	-11.76
MW-24I	Monitoring well to be surveyed and details provided to NYSDEC						
MW-25I	Monitoring well to be surveyed and details provided to NYSDEC						
MW-D2	40.7012785	-73.9474665	2	12.73	12.92	3.92	-6.08
MW-D2I	40.7012711	-73.9474596	2	12.63	12.90	-7.10	-17.10

Monitoring well construction logs are included in Appendix E of this document.

New monitoring wells, MW-24I and MW-25I, were installed in April 2017 in close proximity to the property line of Former Site D to facilitate monitoring of potential compound of concern migration and as requested by NYSDEC. Documentation of well construction was provided to NYSDEC following installation, and monitoring well coordinates, once surveyed, will be included with the next quarterly groundwater sampling event report.

If biofouling or silt accumulation occurs in the on-site and/or off-site monitoring wells, the wells will be physically agitated/surged and redeveloped. Additionally, monitoring wells will be properly decommissioned and replaced, if an event renders the wells unusable.

Repairs and/or replacement of wells in the monitoring well network will be performed based on assessments of structural integrity and overall performance.

The NYSDEC will be notified prior to any repair or decommissioning of any monitoring well for the purpose of replacement, and the repair or decommissioning and replacement process will be documented in the subsequent Periodic Review Report. Well decommissioning without replacement will be done only with the prior approval of the NYSDEC. Well abandonment will be performed in accordance with NYSDEC's guidance entitled "CP-43: Groundwater Monitoring Well Decommissioning Procedures." Monitoring wells that are decommissioned because they have been rendered unusable will be replaced in kind in the nearest available location, unless otherwise approved by the NYSDEC.

The sampling frequency may only be modified with the approval of the NYSDEC. This SMP will be modified to reflect changes in sampling plans approved by the NYSDEC.

Deliverables for the groundwater monitoring program are specified in Section 7.0 – Reporting Requirements.

4.4.2 ISCO Injection Plan Monitoring and Sampling

Details pertaining to the ISCO monitoring and sampling post-implementation will be included in the submitted Design Plan, referenced above in Section 3.3.2.

4.5 Indoor Air Monitoring

New buildings with occupancy are planned to have foundations extending below the water table and will have foundation waterproofing acting as a vapor barrier. A sub-slab depressurization system will not be feasible below the proposed building slab. The potential for soil vapor intrusion in new development structures will be evaluated with the collection and analysis of indoor air samples prior to occupation.

Indoor air quality samples will be collected within the basement and first floor levels at the breathing zone to determine the potential of vapor intrusion into the Site building. Samples will be collected using batch-certified, vacuum canisters equipped with laboratory-supplied regulators calibrated to collect a sample over a 24-hour interval. Indoor air quality samples will be submitted for VOCs via USEPA Method TO 15.

In conjunction with the indoor air sampling, a minimum of one (1) ambient air quality sample will be collected at the breathing zone to characterize Site-specific background outdoor air conditions. Ambient air samples will accompany each of the indoor air samples in tandem to utilize the NYSDOH matrix to determine the course of action, if warranted.

Samples will be collected using batch-certified, vacuum canisters equipped with laboratory-supplied regulators calibrated to collect a sample over an 8-hour interval. Indoor air quality samples will be submitted for VOCs via USEPA Method TO 15.

5.0 OPERATION AND MAINTENANCE PLAN

5.1 General

The Former Site D site remedy does not rely on any mechanical systems, such as groundwater treatment systems, sub-slab depressurization systems or air sparge/soil vapor extraction systems to protect public health and the environment. Therefore, the operation and maintenance of such components is not included in this SMP.

6.0 PERIODIC ASSESSMENTS/EVALUATIONS

6.1 Climate Change Vulnerability Assessment

Increases in both the severity and frequency of storms/weather events, an increase in sea level elevations along with accompanying flooding impacts, shifting precipitation patterns and wide temperature fluctuation, resulting from global climactic change and instability, have the potential to significantly impact the performance, effectiveness and protectiveness of a given site and associated remedial systems. Vulnerability assessments provide information so that the site and associated remedial systems are prepared for the impacts of the increasing frequency and intensity of severe storms/weather events and associated flooding.

This section provides a summary of vulnerability assessments that will be conducted for the site during periodic assessments, and briefly summarizes the vulnerability of the site and/or engineering controls to severe storms/weather events and associated flooding.

6.1.1 Site Drainage and Stormwater Management

Prior to the RA, Former Site D was covered by impervious material. Following completion of the RA, Former Site D is temporarily capped with sand inside Building 25A, which was graded away from Site buildings. Former Site D drainage will be modified by redevelopment; however, there will still be no increase in impermeable area from pre-development conditions.

6.1.2 Erosion

Former Site D will be covered by sand, or buildings for temporary cover, and primarily buildings, and concrete following completion of redevelopment. As Former Site D will be covered, erosion is not likely to be an issue.

6.2 Green Remediation Evaluation

NYSDEC's DER-31 Green Remediation requires that green remediation concepts and techniques be considered during all stages of the remedial program including site management, with the goal of improving the sustainability of the cleanup and summarizing the net environmental benefit of any implemented green technology. This section of the SMP provides a summary of any green remediation evaluations to be completed for the site during site management, and as reported in the PRR. The assessment will include a discussion of several components of sustainability, including waste generation, energy usage, emissions, water usage, and land and/or ecosystems. A preliminary summary of each component as it relates to the Site is provided below:

- Waste Generation
    - The quarterly groundwater sampling will generate drums of listed-hazardous groundwater as a waste product. To minimize the amount of drums disposed of, groundwater may be transferred between drums (i.e. if two drums are half full and combined into one drum – only one drum needs to be disposed of and replaced).

Methods proposed to reduce energy consumption, resource usage, waste generation, and water usage etc. will be included in the PRR.

6.2.1 Timing of Green Remediation Evaluations

For major remedial system components, green remediation evaluations and corresponding modifications will be undertaken as part of a formal Remedial System Optimization (RSO), or at any time that the Project Manager feels appropriate, e.g. during significant maintenance events or in conjunction with storm recovery activities.

Modifications resulting from green remediation evaluations will be routinely implemented and scheduled to occur during planned/routine operation and maintenance activities. Reporting of these modifications will be presented in the PRR.

6.2.2 Frequency of System Checks, Sampling and Other Periodic Activities

Transportation to and from the Former Site D and use of consumables in relation to visiting the Site in order to conduct system checks and or collect samples and shipping samples to a laboratory for analyses have direct and/or inherent energy costs. The schedule and/or means of these periodic activities have been prepared so that these tasks can be accomplished in a manner that does not impact remedy protectiveness but reduces expenditure of energy or resources.

Consideration shall be given to:

- Utilizing ISCO injection material with a sustainable lifetime, to reduce the need for additional injection events or increased volume application.
- Reduced sampling frequencies;
- Reduced Site visits and system checks; and
- Use of mass transit for Site visits, when feasible.

6.3 Remedial System Optimization

A RSO study will be conducted any time that the NYSDEC or the remedial party requests in writing that an in-depth evaluation of the remedy is needed. An RSO may be appropriate if any of the following occur:

- The remedial actions have not met or are not expected to meet RAOs in the time frame estimated in the Decision Document;
- The management and operation of the remedial system is exceeding the estimated costs;
- The remedial system is not performing as expected or as designed;
- Previously unidentified source material may be suspected;
- Plume shift has potentially occurred;
- Site conditions change due to development, change of use, change in groundwater use, etc.;
- There is an anticipated transfer of the site management to another remedial party or agency; and
- A new and applicable remedial technology becomes available.

An RSO will provide a critique of a site's conceptual model, give a summary of past performance, document current cleanup practices, summarize progress made toward the site's cleanup goals, gather additional performance or media specific data and information and provide recommendations for improvements to enhance the ability of the present system to reach RAOs or to provide a basis for changing the remedial strategy.

The RSO study will focuses on overall site cleanup strategy, process optimization and management with the intent of identifying impediments to cleanup and improvements to site operations to increase efficiency, cost effectiveness and remedial time frames. Green remediation technology and principals are to be considered when performing the RSO.

7.0 REPORTING REQUIREMENTS

7.1 Site Management Reports

All Former Site D site management inspection, maintenance and monitoring events will be recorded on the appropriate site management forms provided in Appendix I. These forms are subject to NYSDEC revision.

All applicable inspection forms and other records, including media sampling data and system maintenance reports, generated for the site during the reporting period will be provided in electronic format to the NYSDEC in accordance with the requirements of Table 7 below and summarized in the PRR.

Table 7: Schedule of Interim Monitoring/Inspection Reports

Task/Report	**Reporting Frequency***
Monthly Progress Report (Ongoing, as necessary)	Monthly through issuance of COC
Inspection and Groundwater Monitoring Report	Quarterly
Periodic Review Report	Annually, or as otherwise determined by the Department

* The frequency of events will be conducted as specified until otherwise approved by the NYSDEC.

All interim monitoring/inspections reports will include, at a minimum:

- Date of event or reporting period;
- Name, company, and position of person(s) conducting monitoring/inspection activities;
- Description of the activities performed;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents noted (included either on the checklist/form or on an attached sheet);
- Type of samples collected (e.g., sub-slab vapor, indoor air, outdoor air, etc);

- Copies of all field forms completed (e.g., well sampling logs, chain-of-custody documentation, etc.);
- Sampling results in comparison to appropriate standards/criteria;
- A figure illustrating sample type and sampling locations;
- Copies of all laboratory data sheets and the required laboratory data deliverables required for all points sampled (to be submitted electronically in the NYSDEC-identified format);
- Any observations, conclusions, or recommendations; and
- A determination as to whether contaminant conditions have changed since the last reporting event.

Routine maintenance event reporting forms will include, at a minimum:

- Date of event;
- Name, company, and position of person(s) conducting maintenance activities;
- Description of maintenance activities performed;
- Any modifications to the system;
- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents noted (included either on the checklist/form or on an attached sheet); and,
- Other documentation such as copies of invoices for maintenance work, receipts for replacement equipment, etc., (attached to the checklist/form).

Non-routine maintenance event reporting forms will include, at a minimum:

- Date of event;
- Name, company, and position of person(s) conducting non-routine maintenance/repair activities;
- Description of non-routine activities performed;

- Where appropriate, color photographs or sketches showing the approximate location of any problems or incidents (included either on the form or on an attached sheet); and
- Other documentation such as copies of invoices for repair work, receipts for replacement equipment, etc. (attached to the checklist/form).

Data will be reported in digital format as determined by the NYSDEC. Currently, data is to be supplied electronically and submitted to the NYSDEC EQuIS^{TM} database in accordance with the requirements found at this link http://www.dec.ny.gov/chemical/62440.html.

7.2 Monthly Reports

Monthly reports will be submitted to NYSDEC and NYSDOH Project Managers within one week following the end of the month of the reporting period, as necessary during active implementation of remediation activities. Upon issuance of the COC, progress reports will be submitted on an as-needed basis. The progress reports will include:

- Activities relative to Former 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.

7.3 Periodic Review Report

A PRR will be submitted to the Department beginning sixteen (16) months after the Certificate of Completion is issued or upon completion of Former Site D development, as otherwise determined by the NYSDEC. After submittal of the initial Periodic Review Report, the next PRR shall be submitted annually to the Department or at another frequency as may be required by the Department. In the event that the site is subdivided into separate parcels with different ownership, a single Periodic Review Report will be prepared that addresses the site described in Appendix A -Environmental Easement. The report will be prepared in accordance with NYSDEC's DER-10 and submitted within 30 days of the end of each certification period. Media sampling results will also be incorporated into the Periodic Review Report. The report will include:

- Identification, assessment and certification of all ECs/ICs required by the remedy for the site.
- Results of the required annual site inspections and severe condition inspections, if applicable.
- All applicable site management forms and other records generated for the site during the reporting period in the NYSDEC-approved electronic format, if not previously submitted.
- A summary of any discharge monitoring data and/or information generated during the reporting period, with comments and conclusions.
- Data summary tables and graphical representations of contaminants of concern by media (groundwater, soil vapor, etc.), which include a listing of all compounds analyzed, along with the applicable standards, with all exceedances highlighted. These will include a presentation of past data as part of an evaluation of contaminant concentration trends.
- Results of all analyses, copies of all laboratory data sheets, and the required laboratory data deliverables for all samples collected during the reporting period will be submitted in digital format as determined by the NYSDEC. Currently, data is supplied electronically and submitted to the NYSDEC EQuIS^{TM} database in accordance with the requirements found at this link: http://www.dec.ny.gov/chemical/62440.html.
- A site evaluation, which includes the following:
  - The compliance of the remedy with the requirements of the site-specific RAWP, ROD or Decision Document;

- The operation and the effectiveness of all treatment units, etc., including identification of any needed repairs or modifications;
- Any new conclusions or observations regarding site contamination based on inspections or data generated by the Monitoring and Sampling Plan for the media being monitored;
- Recommendations regarding any necessary changes to the remedy and/or Monitoring and Sampling Plan; and
- Trends in contaminant levels in the affected media will be evaluated to determine if the remedy continues to be effective in achieving remedial goals as specified by the Decision Document.
- The overall performance and effectiveness of the remedy.

7.3.1 Certification of Institutional and Engineering Controls

Following the last inspection of the reporting period, a Professional Engineer licensed to practice in New York State will prepare, and include in the PRR, the following certification as per the requirements of NYSDEC DER-10:

"For each institutional or engineering control identified for the site, I certify that all of the following statements are true:

- *The inspection of the site to confirm the effectiveness of the institutional and engineering controls required by the remedial program was performed under my direction;*
- *The institutional control and/or engineering control employed at this site is unchanged from the date the control was put in place, or last approved by the Department;*
- *Nothing has occurred that would impair the ability of the control to protect the public health and environment;*
- *Nothing has occurred that would constitute a violation or failure to comply with any site management plan for this control;*

- *Access to the site will continue to be provided to the Department to evaluate the remedy, including access to evaluate the continued maintenance of this control;*
- *If a financial assurance mechanism is required under the oversight document for the site, the mechanism remains valid and sufficient for the intended purpose under the document;*
- *Use of the site is compliant with the environmental easement;*
- *The engineering control systems are performing as designed and are effective;*
- *To the best of my knowledge and belief, the work and conclusions described in this certification are in accordance with the requirements of the site remedial program and generally accepted engineering practices; and*
- *The information presented in this report is accurate and complete.*

I certify that all information and statements in this certification form are true. I understand that a false statement made herein is punishable as a Class "A" misdemeanor, pursuant to Section 210.45 of the Penal Law. I, Charles J. McGuckin, of Roux Environmental Engineering and Geology, D.P.C., 209 Shafter St. Islandia, NY 11749, am certifying as Remedial Party's Designated Site Representative and I have been authorized and designated by all site owners/remedial parties to sign this certification for the site."

The signed certification will be included in the PRR.

The PRR will be submitted, in electronic format, to the NYSDEC Central Office, Regional Office in which the site is located and the NYSDOH Bureau of Environmental Exposure Investigation. The PRR may need to be submitted in hard-copy format, as requested by the NYSDEC project manager.

7.3 Corrective Measures Work Plan

If any component of the Former Site D remedy is found to have failed, or if the periodic certification cannot be provided due to the failure of an institutional or engineering control, a CMWP will be submitted to the NYSDEC for approval. This plan will explain the failure and provide the details and schedule for performing work necessary to correct the failure. Unless an emergency condition exists, no work will be performed pursuant to the CMWP until it has been approved by the NYSDEC.

7.4 Remedial Site Optimization Report

In the event that an RSO is to be performed (see Section 6.3), upon completion of an RSO, an RSO report must be submitted to the Department for approval. The RSO report will document the research/ investigation and data gathering that was conducted, evaluate the results and facts obtained, present a revised conceptual site model and present recommendations. RSO recommendations are to be implemented upon approval from the NYSDEC. Additional work plans, design documents, HASPs etc., may still be required to implement the recommendations, based upon the actions that need to be taken. A final engineering report and update to the SMP may also be required.

The RSO report will be submitted, in electronic format, to the NYSDEC Central Office, Regional Office in which the site is located, Site Control and the NYSDOH Bureau of Environmental Exposure Investigation.

8.0 REFERENCES

Roux Associates, 2010. Expanded Delineation Investigation Work Plan. March 26, 2010.

Roux Associates, 2011. Remedial Investigation Work Plan. January 17, 2012;

Roux Associates, 2013. Supplemental Remedial Investigation Work Plan. January 30, 2013.

Roux Associates, 2013. Supplemental Soil Vapor Investigation Work Plan. June 25, 2013.

Roux Associates, 2014. Remedial Investigation Report. March 27, 2014

Remedial Engineering, P.C., 2015. Remedial Action Work Plan. February, 2015.

6NYCRR Part 375, Environmental Remediation Programs. December 14, 2006.

NYSDEC DER-10 – "Technical Guidance for Site Investigation and Remediation".

NYSDEC, 1998. Ambient Water Quality Standards and Guidance Values and Groundwater Effluent Limitations Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1. June 1998 (April 2000 addendum).

TABLES

1. Notifications (*Embedded in Text in Section 1.3*)
2. Groundwater Elevation Measurements – October 2016
3. Remaining Soil Sample Exceedances
4. Remaining Groundwater Sample Exceedances
5. Post-Remediation Inspection and Monitoring Schedule (*Embedded in Text in Section 4.1*)
6. Monitoring Well Construction Details (*Embedded in Text in Section 4.4.1*)
7. Interim Reporting Summary/Schedule (*Embedded in Text in Section 7.1*)

Table 2. Groundwater Elevation Measurements - October 2016
Former Pfizer Inc Site D, Brooklyn, New York

October 11, 2016

Well Number	Elevation of Grade (ft msl)[1]	Elevation of Measuring Point (ft msl)[1]	Depth to Water (ft below measuring point)	Groundwater Elevation (ft msl)[1]
MW-3	13.64	13.37	--	--
MW-5	13.12	12.98	--	--
MW-6R	13.18	12.79	--	--
MW-7	12.64	12.26	--	--
MW-8[2]	13.18	13.93	12.44	1.49
MW-9	11.70	11.42	7.70	3.72
MW-10	12.60	12.37	9.03	3.34
MW-11	9.26	8.54	--	--
MW-12	10.64	10.32	--	--
MW-13	11.89	11.39	--	--
MW-14	13.22	12.98	--	--
MW-15	12.67	12.38	--	--
MW-16R[3]	10.05	9.46	6.14	3.32
MW-17	12.72	11.78	--	--
MW-18	9.71	9.43	6.40	3.03
MW-19[4]	13.13	12.62	9.11	--
MW-20	12.48	12.30	8.80	3.50
MW-21	12.19	11.93	8.48	3.45
MW-22	12.88	12.60	9.28	3.32
MW-23	13.24	12.98	9.79	3.19
MW-D1	13.01	12.68	--	--
MW-D1I	12.92	12.52	--	--
MW-D2	12.92	12.73	9.31	3.42
MW-D2I	12.9	12.63	21.22	-8.59

Note:

[1] Elevation data is reported in feet relative to mean sea level (ft msl) using the Borough of Brooklyn Datum.

[2] Monitoring well MW-8 was repaired with a stickup PVC extension following construction activities; the survey datum has been modified to show the change in elevation.

[3] Monitoring well MW-16R was installed on August 12, 2015. Survey datum from MW-16 used for contouring purposes.

[4] Elevation data for MW-19 has not been surveyed following partial-damages of surrounding sidewalk and PVC

Table 3. Summary of Remaining Soil Sample Exceedances
Former Pfizer Inc Site Site D, Brooklyn, New York

Parameter (Concentrations in mg/kg)	NYSDEC Part 375 Protection of Groundwater	**Sample Designation:** **Sample Date:** **Sample Depth (ft bls):**	PE-BLDG-SW-N-12 4/1/2015 12	PE-BLDG-SW-NE-11 4/14/2015 11	PE-BLDG-SW-NNE-11 4/13/2015 11
1,1,1,2-Tetrachloroethane	--		0.0025 U	0.34 U	0.0018 U
1,1,1-Trichloroethane	0.68		0.0025 U	0.34 U	0.0018 U
1,1,2,2-Tetrachloroethane	--		0.0025 U	0.34 U	0.0018 U
1,1,2-Trichloroethane	--		0.0038 U	0.51 U	0.0027 U
1,1-Dichloroethane	0.27		0.0038 U	0.51 U	0.0027 U
1,1-Dichloroethene	0.33		0.0025 U	0.34 U	0.0018 U
1,1-Dichloropropene	--		0.013 U	1.7 U	0.0091 U
1,2,3-Trichlorobenzene	--		0.013 U	1.7 U	0.0091 U
1,2,3-Trichloropropane	--		0.025 U	3.4 U	0.018 U
1,2,4,5-Tetramethylbenzene	--		0.01 U	1.4 U	0.0072 U
1,2,4-Trichlorobenzene	--		0.013 U	1.7 U	0.0091 U
1,2,4-Trimethylbenzene	3.6		0.013 U	1.7 U	0.0091 U
1,2-Dibromoethane	--		0.01 U	1.4 U	0.0072 U
1,2-Dichlorobenzene	1.1		0.013 U	1.7 U	0.0091 U
1,2-Dichloroethane	0.02		0.0025 U	0.34 U	0.0018 U
1,2-Dichloroethene (total)	--		0.16	20	0.026 J
1,2-Dichloropropane	--		0.0088 U	1.2 U	0.0064 U
1,3,5-Trimethylbenzene	8.4		0.0019 J	1.7 U	0.0091 U
1,3-Dichlorobenzene	2.4		0.013 U	1.7 U	0.0091 U
1,3-Dichloropropane	--		0.013 U	1.7 U	0.0091 U
1,3-Dichloropropene	--		0.0025 U	0.34 U	0.0018 U
1,4-Dichlorobenzene	1.8		0.013 U	1.7 U	0.0091 U
1,4-Diethylbenzene	--		0.0011 J	1.4 U	0.0072 U
1,4-Dioxane	0.1		RV	RV	RV
2,2-Dichloropropane	--		0.013 U	1.7 U	0.0091 U
2-Butanone (MEK)	0.12		0.025 U	3.4 U	0.048
2-Hexanone	--		0.025 U	3.4 U	0.018 U
4-Ethyltoluene	--		0.01 U	1.4 U	0.0072 U
4-Methyl-2-pentanone (MIBK)	--		0.025 U	3.4 U	0.018 U
Acetone	0.05		0.021 J	3.4 U	**0.26**
Acrylonitrile	--		0.025 U	3.4 U	0.018 U

Table 3. Summary of Remaining Soil Sample Exceedances
Former Pfizer Inc Site Site D, Brooklyn, New York

Parameter (Concentrations in mg/kg)	NYSDEC Part 375 Protection of Groundwater	**Sample Designation:** **Sample Date:** **Sample Depth (ft bls):**	PE-BLDG-SW-N-12 4/1/2015 12	PE-BLDG-SW-NE-11 4/14/2015 11	PE-BLDG-SW-NNE-11 4/13/2015 11
Benzene	0.06		0.0025 U	0.34 U	0.0018 U
Bromobenzene	--		0.013 U	1.7 U	0.0091 U
Bromochloromethane	--		0.013 U	1.7 U	0.0091 U
Bromodichloromethane	--		0.0025 U	0.34 U	0.0018 U
Bromoform	--		0.01 U	1.4 U	0.0072 U
Bromomethane	--		0.005 U	0.68 U	0.0036 U
Carbon disulfide	--		0.025 U	3.4 U	0.0044 J
Carbon tetrachloride	0.76		0.0025 U	0.34 U	0.0018 U
Chlorobenzene	1.1		0.0025 U	0.34 U	0.0018 U
Chloroethane	--		0.005 U	0.68 U	0.0036 U
Chloroform	0.37		0.0038 U	0.51 U	0.0027 U
Chloromethane	--		0.013 U	1.7 U	0.0091 U
cis-1,2-Dichloroethene	0.25		0.16	**20**	0.025
cis-1,3-Dichloropropene	--		0.0025 U	0.34 U	0.0018 U
Dibromochloromethane	--		0.0025 U	0.34 U	0.0018 U
Dibromochloropropane	--		0.013 U	1.7 U	0.0091 U
Dibromomethane	--		0.025 U	3.4 U	0.018 U
Dichlorodifluoromethane	--		0.025 U	3.4 U	0.018 U
Diethyl Ether	--		0.013 U	1.7 U	0.0091 U
Ethylbenzene	1		0.0025 U	0.34 U	0.0018 U
Hexachlorobutadiene	--		0.013 U	1.7 U	0.0091 U
Isopropylbenzene	--		0.0025 U	0.34 U	0.0018 U
m+p-Xylene	--		0.005 U	0.68 U	0.0036 U
Methylene chloride	0.05		0.025 U	3.4 U	0.018 U
MTBE	0.93		0.005 U	0.68 U	0.0036 U
Naphthalene	12		0.0018 J	1.7 U	0.0091 U
n-Butylbenzene	12		0.0025 U	0.34 U	0.0018 U
n-Propylbenzene	3.9		0.0025 U	0.34 U	0.0018 U
o-Chlorotoluene	--		0.013 U	1.7 U	0.0091 U
o-Xylene	--		0.005 U	0.68 U	0.0036 U
p-Chlorotoluene	--		0.013 U	1.7 U	0.0091 U

Table 3. Summary of Remaining Soil Sample Exceedances
Former Pfizer Inc Site Site D, Brooklyn, New York

Parameter (Concentrations in mg/kg)	NYSDEC Part 375 Protection of Groundwater	**Sample Designation:**	PE-BLDG-SW-N-12	PE-BLDG-SW-NE-11	PE-BLDG-SW-NNE-11
		Sample Date:	4/1/2015	4/14/2015	4/13/2015
		Sample Depth (ft bls):	12	11	11
p-Isopropyltoluene	--		0.0025 U	0.34 U	0.0018 U
sec-Butylbenzene	11		0.0025 U	0.34 U	0.0018 U
Styrene	--		0.005 U	0.68 U	0.0036 U
tert-Butylbenzene	5.9		0.013 U	1.7 U	0.0091 U
Tetrachloroethene	1.3		0.76	0.87	0.011
Toluene	0.7		0.0038 U	0.51 U	0.0027 U
trans-1,2-Dichloroethene	0.19		0.0038 U	0.51 U	0.0011 J
trans-1,3-Dichloropropene	--		0.0025 U	0.34 U	0.0018 U
trans-1,4-Dichloro-2-butene	--		0.013 U	1.7 U	0.0091 U
Trichloroethene	0.47		0.017	0.34 U	0.0024
Trichlorofluoromethane	--		0.013 U	1.7 U	0.0091 U
Vinyl acetate	--		0.025 U	3.4 U	0.018 U
Vinyl chloride	0.02		**0.14**	**0.94**	**0.41**
Xylenes (total)	1.6		0.005 U	0.68 U	0.0036 U

J - Estimated value

U - Indicates that the compound was analyzed for but not detected

DUP - Duplicate sample

mg/kg - Milligrams per kilogram

ft bls - Feet below land surface

NYSDEC - New York State Department of Environmental Conservation

-- No NYSDEC Protection of Groundwater Standards available

Bold data indicates that parameter was detected above the NYSDEC Protection of Groundwater Standards

V - Value altered or qualifier added during data validation

R - Sample results rejected by validator

UJ - Analyte was not detected. The associated reported quantitation limit is an estimate

Table 3. Summary of Remaining Soil Sample Exceedances
Former Pfizer Inc Site Site D, Brooklyn, New York

Parameter (Concentrations in mg/kg)	NYSDEC Part 375 Protection of Groundwater	**Sample Designation:** **Sample Date:** **Sample Depth (ft bls):**	PE-BLDG-SW-NNW-10 4/13/2015 10	PE-BLDG-SW-NW-10.5 4/14/2015 10.5	PE-BLDG-SW-SSE-12 4/17/2015 12
1,1,1,2-Tetrachloroethane	--		0.16 U	0.13 U	0.064 U
1,1,1-Trichloroethane	0.68		0.16 U	0.13 U	0.064 U
1,1,2,2-Tetrachloroethane	--		0.16 U	0.13 U	0.064 U
1,1,2-Trichloroethane	--		0.24 U	0.2 U	0.095 U
1,1-Dichloroethane	0.27		0.24 U	0.2 U	0.095 U
1,1-Dichloroethene	0.33		0.16 U	0.13 U	0.064 U
1,1-Dichloropropene	--		0.79 U	0.65 U	0.32 U
1,2,3-Trichlorobenzene	--		0.79 U	0.65 U	0.32 U
1,2,3-Trichloropropane	--		1.6 U	1.3 U	0.64 U
1,2,4,5-Tetramethylbenzene	--		0.63 UJV	0.52 U	0.25 U
1,2,4-Trichlorobenzene	--		0.79 U	0.65 U	0.32 U
1,2,4-Trimethylbenzene	3.6		1.9	0.65 U	0.32 U
1,2-Dibromoethane	--		0.63 U	0.52 U	0.25 U
1,2-Dichlorobenzene	1.1		0.11 J	0.65 U	0.32 U
1,2-Dichloroethane	0.02		0.16 U	0.13 U	0.064 U
1,2-Dichloroethene (total)	--		44	12	0.66
1,2-Dichloropropane	--		0.55 U	0.46 U	0.22 U
1,3,5-Trimethylbenzene	8.4		0.17 J	0.65 U	0.32 U
1,3-Dichlorobenzene	2.4		0.79 U	0.65 U	0.32 U
1,3-Dichloropropane	--		0.79 U	0.65 U	0.32 U
1,3-Dichloropropene	--		0.16 U	0.13 U	0.064 U
1,4-Dichlorobenzene	1.8		0.79 U	0.65 U	0.32 U
1,4-Diethylbenzene	--		0.33 J	0.52 U	0.25 U
1,4-Dioxane	0.1		RV	RV	RV
2,2-Dichloropropane	--		0.79 U	0.65 U	0.32 U
2-Butanone (MEK)	0.12		1.6 U	1.3 U	**0.48 J**
2-Hexanone	--		1.6 U	1.3 U	0.64 U
4-Ethyltoluene	--		0.7	0.032 J	0.25 U
4-Methyl-2-pentanone (MIBK)	--		1.6 U	1.3 U	0.64 U
Acetone	0.05		1.6 UJV	1.3 U	**0.7**
Acrylonitrile	--		1.6 U	1.3 U	0.64 U

Table 3. Summary of Remaining Soil Sample Exceedances
Former Pfizer Inc Site Site D, Brooklyn, New York

Parameter (Concentrations in mg/kg)	NYSDEC Part 375 Protection of Groundwater	**Sample Designation:** **Sample Date:** **Sample Depth (ft bls):**	PE-BLDG-SW-NNW-10 4/13/2015 10	PE-BLDG-SW-NW-10.5 4/14/2015 10.5	PE-BLDG-SW-SSE-12 4/17/2015 12
Benzene	0.06		0.16 U	0.13 U	0.064 U
Bromobenzene	--		0.79 U	0.65 U	0.32 U
Bromochloromethane	--		0.79 U	0.65 U	0.32 U
Bromodichloromethane	--		0.16 U	0.13 U	0.064 U
Bromoform	--		0.63 U	0.52 U	0.25 U
Bromomethane	--		0.32 U	0.26 UJV	0.13 U
Carbon disulfide	--		1.6 U	1.3 U	0.64 U
Carbon tetrachloride	0.76		0.16 U	0.13 U	0.064 UJV
Chlorobenzene	1.1		0.16 U	0.13 U	0.064 U
Chloroethane	--		0.32 U	0.26 U	0.13 U
Chloroform	0.37		0.24 U	0.2 U	0.095 U
Chloromethane	--		0.79 U	0.65 U	0.32 UJV
cis-1,2-Dichloroethene	0.25		**44**	**12**	**0.66**
cis-1,3-Dichloropropene	--		0.16 U	0.13 U	0.064 U
Dibromochloromethane	--		0.16 U	0.13 U	0.064 U
Dibromochloropropane	--		0.79 U	0.65 U	0.32 U
Dibromomethane	--		1.6 U	1.3 U	0.64 U
Dichlorodifluoromethane	--		1.6 U	1.3 U	0.64 U
Diethyl Ether	--		0.79 U	0.65 U	0.32 U
Ethylbenzene	1		0.16 U	0.13 U	0.064 U
Hexachlorobutadiene	--		0.79 U	0.65 U	0.32 U
Isopropylbenzene	--		0.24	0.13 U	0.064 U
m+p-Xylene	--		0.32 U	0.26 U	0.13 U
Methylene chloride	0.05		1.6 U	1.3 U	0.64 U
MTBE	0.93		0.32 U	0.26 U	0.13 U
Naphthalene	12		0.79 U	0.65 U	0.32 U
n-Butylbenzene	12		0.16	0.13 U	0.064 U
n-Propylbenzene	3.9		0.23	0.13 U	0.064 U
o-Chlorotoluene	--		0.79 U	0.65 U	0.32 U
o-Xylene	--		0.32 U	0.26 U	0.13 U
p-Chlorotoluene	--		0.79 U	0.65 U	0.32 U

Table 3. Summary of Remaining Soil Sample Exceedances
Former Pfizer Inc Site Site D, Brooklyn, New York

Parameter (Concentrations in mg/kg)	NYSDEC Part 375 Protection of Groundwater	**Sample Designation:** **Sample Date:** **Sample Depth (ft bls):**	PE-BLDG-SW-NNW-10 4/13/2015 10	PE-BLDG-SW-NW-10.5 4/14/2015 10.5	PE-BLDG-SW-SSE-12 4/17/2015 12
p-Isopropyltoluene	--		0.22	0.13 U	0.064 U
sec-Butylbenzene	11		0.33	0.13 U	0.064 U
Styrene	--		0.32 U	0.26 U	0.13 U
tert-Butylbenzene	5.9		0.18 J	0.65 U	0.32 U
Tetrachloroethene	1.3		**13**	**1.6**	**7.2**
Toluene	0.7		0.24 U	0.2 U	0.095 U
trans-1,2-Dichloroethene	0.19		0.24 U	0.2 U	0.095 U
trans-1,3-Dichloropropene	--		0.16 U	0.13 U	0.064 U
trans-1,4-Dichloro-2-butene	--		0.79 U	0.65 U	0.32 U
Trichloroethene	0.47		**1.6**	0.13 U	0.068
Trichlorofluoromethane	--		0.79 U	0.65 U	0.32 U
Vinyl acetate	--		1.6 U	1.3 U	0.64 U
Vinyl chloride	0.02		**2.3**	0.26 U	0.13 U
Xylenes (total)	1.6		0.32 U	0.26 U	0.13 U

J - Estimated value

U - Indicates that the compound was analyzed for but not detected

DUP - Duplicate sample

mg/kg - Milligrams per kilogram

ft bls - Feet below land surface

NYSDEC - New York State Department of Environmental Conservation

-- No NYSDEC Protection of Groundwater Standards available

Bold data indicates that parameter was detected above the NYSDEC Protection of Groundwater Standards

V - Value altered or qualifier added during data validation

R - Sample results rejected by validator

UJ - Analyte was not detected. The associated reported quantitation limit is an estimate

Table 3. Summary of Remaining Soil Sample Exceedances
Former Pfizer Inc Site Site D, Brooklyn, New York

Parameter (Concentrations in mg/kg)	NYSDEC Part 375 Protection of Groundwater	**Sample Designation:**	PE-C-SW-E-14	PE-C-SW-N-14	PE-C-SW-N2-14	PE-C-SW-N3-15	PE-C-SW-N3-7
		Sample Date:	5/12/2015	5/12/2015	5/18/2015	5/21/2015	5/21/2015
		Sample Depth (ft bls):	14	14	14	15	7
1,1,1,2-Tetrachloroethane	--		0.064 U	0.29 U	0.062 U	0.06 U	0.0012 U
1,1,1-Trichloroethane	0.68		0.064 U	0.29 U	0.062 U	0.06 U	0.0012 U
1,1,2,2-Tetrachloroethane	--		0.064 U	0.29 U	0.062 U	0.06 U	0.0012 U
1,1,2-Trichloroethane	--		0.096 U	0.44 U	0.093 U	0.09 U	0.0017 U
1,1-Dichloroethane	0.27		0.096 U	0.44 U	0.093 U	0.09 U	0.0017 U
1,1-Dichloroethene	0.33		0.064 U	0.29 U	0.062 U	0.06 U	0.0012 U
1,1-Dichloropropene	--		0.32 U	1.5 U	0.31 U	0.3 U	0.0058 U
1,2,3-Trichlorobenzene	--		0.32 U	1.5 U	0.31 U	0.3 U	0.0058 U
1,2,3-Trichloropropane	--		0.64 U	2.9 U	0.62 U	0.6 U	0.012 U
1,2,4,5-Tetramethylbenzene	--		0.26 U	1.2 U	0.25 U	0.24 U	0.0046 U
1,2,4-Trichlorobenzene	--		0.32 U	1.5 U	0.31 U	0.3 U	0.0058 U
1,2,4-Trimethylbenzene	3.6		0.32 U	1.5 U	0.31 U	0.3 U	0.0058 U
1,2-Dibromoethane	--		0.26 U	1.2 U	0.25 U	0.24 U	0.0046 U
1,2-Dichlorobenzene	1.1		0.32 U	1.5 U	0.31 U	0.3 U	0.0058 U
1,2-Dichloroethane	0.02		0.064 U	0.29 U	0.062 U	0.06 U	0.0012 U
1,2-Dichloroethene (total)	--		0.87	0.91	3.3	1.5	0.33 J
1,2-Dichloropropane	--		0.22 U	1 U	0.22 U	0.21 U	0.0041 U
1,3,5-Trimethylbenzene	8.4		0.32 U	1.5 U	0.31 U	0.3 U	0.0058 U
1,3-Dichlorobenzene	2.4		0.32 U	1.5 U	0.31 U	0.3 U	0.0058 U
1,3-Dichloropropane	--		0.32 U	1.5 U	0.31 U	0.3 U	0.0058 U
1,3-Dichloropropene	--		0.064 U	0.29 U	0.062 U	0.06 U	0.0012 U
1,4-Dichlorobenzene	1.8		0.32 U	1.5 U	0.31 U	0.3 U	0.0058 U
1,4-Diethylbenzene	--		0.26 U	1.2 U	0.25 U	0.24 U	0.0046 U
1,4-Dioxane	0.1		RV	RV	RV	RV	RV
2,2-Dichloropropane	--		0.32 U	1.5 U	0.31 U	0.3 U	0.0058 U
2-Butanone (MEK)	0.12		0.64 U	2.9 U	0.62 U	0.072 J	0.0016 J
2-Hexanone	--		0.64 U	2.9 U	0.62 U	0.6 U	0.012 U
4-Ethyltoluene	--		0.26 U	0.071 J	0.25 U	0.24 U	0.0046 U
4-Methyl-2-pentanone (MIBK)	--		0.64 U	2.9 U	0.62 U	0.6 U	0.012 U
Acetone	0.05		0.64 U	2.9 U	0.62 U	0.6 UV	0.012 UV
Acrylonitrile	--		0.64 U	2.9 U	0.62 U	0.6 U	0.012 U

Table 3. Summary of Remaining Soil Sample Exceedances
Former Pfizer Inc Site Site D, Brooklyn, New York

Parameter (Concentrations in mg/kg)	NYSDEC Part 375 Protection of Groundwater	**Sample Designation:** **Sample Date:** **Sample Depth (ft bls):**	PE-C-SW-E-14 5/12/2015 14	PE-C-SW-N-14 5/12/2015 14	PE-C-SW-N2-14 5/18/2015 14	PE-C-SW-N3-15 5/21/2015 15	PE-C-SW-N3-7 5/21/2015 7
Benzene	0.06		0.064 U	0.29 U	0.062 U	0.06 U	0.0012 U
Bromobenzene	--		0.32 U	1.5 U	0.31 U	0.3 U	0.0058 U
Bromochloromethane	--		0.32 U	1.5 U	0.31 U	0.3 U	0.0058 U
Bromodichloromethane	--		0.064 U	0.29 U	0.062 U	0.06 U	0.0012 U
Bromoform	--		0.26 U	1.2 U	0.25 U	0.24 U	0.0046 U
Bromomethane	--		0.13 U	0.59 U	0.12 U	0.12 U	0.0023 U
Carbon disulfide	--		0.64 U	2.9 U	0.62 U	0.6 U	0.012 U
Carbon tetrachloride	0.76		0.064 U	0.29 U	0.062 U	0.06 U	0.0012 U
Chlorobenzene	1.1		0.064 U	0.29 U	0.062 U	0.06 U	0.0012 U
Chloroethane	--		0.13 U	0.59 U	0.12 U	0.12 U	0.0023 U
Chloroform	0.37		0.096 U	0.44 U	0.093 U	0.09 U	0.0017 U
Chloromethane	--		0.32 U	1.5 U	0.31 U	0.3 U	0.0058 U
cis-1,2-Dichloroethene	0.25		**0.87**	**0.91**	**3.3**	**1.5**	**0.33**
cis-1,3-Dichloropropene	--		0.064 U	0.29 U	0.062 U	0.06 U	0.0012 U
Dibromochloromethane	--		0.064 U	0.29 U	0.062 U	0.06 U	0.0012 U
Dibromochloropropane	--		0.32 U	1.5 U	0.31 U	0.3 U	0.0058 U
Dibromomethane	--		0.64 U	2.9 U	0.62 U	0.6 U	0.012 U
Dichlorodifluoromethane	--		0.64 U	2.9 U	0.62 U	0.6 U	0.012 U
Diethyl Ether	--		0.32 U	1.5 U	0.31 U	0.3 U	0.0058 U
Ethylbenzene	1		0.064 U	0.29 U	0.062 U	0.06 U	0.0012 U
Hexachlorobutadiene	--		0.32 U	1.5 U	0.31 U	0.3 U	0.0058 U
Isopropylbenzene	--		0.064 U	0.29 U	0.062 U	0.06 U	0.0012 U
m+p-Xylene	--		0.13 U	0.59 U	0.12 U	0.12 U	0.0023 U
Methylene chloride	0.05		0.64 U	2.9 U	0.62 U	0.6 U	0.012 U
MTBE	0.93		0.13 U	0.59 U	0.12 U	0.12 U	0.0023 U
Naphthalene	12		0.32 U	1.5 U	0.31 U	0.3 U	0.0058 U
n-Butylbenzene	12		0.064 U	0.29 U	0.062 U	0.06 U	0.0012 U
n-Propylbenzene	3.9		0.064 U	0.29 U	0.062 U	0.06 U	0.0012 U
o-Chlorotoluene	--		0.32 U	1.5 U	0.31 U	0.3 U	0.0058 U
o-Xylene	--		0.13 U	0.59 U	0.12 U	0.12 U	0.0023 U
p-Chlorotoluene	--		0.32 U	1.5 U	0.31 U	0.3 U	0.0058 U

Table 3. Summary of Remaining Soil Sample Exceedances
Former Pfizer Inc Site Site D, Brooklyn, New York

Parameter (Concentrations in mg/kg)	NYSDEC Part 375 Protection of Groundwater	**Sample Designation:**	PE-C-SW-E-14	PE-C-SW-N-14	PE-C-SW-N2-14	PE-C-SW-N3-15	PE-C-SW-N3-7
		Sample Date:	5/12/2015	5/12/2015	5/18/2015	5/21/2015	5/21/2015
		Sample Depth (ft bls):	14	14	14	15	7
p-Isopropyltoluene	--		0.064 U	0.29 U	0.062 U	0.06 U	0.0012 U
sec-Butylbenzene	11		0.064 U	0.29 U	0.062 U	0.06 U	0.0012 U
Styrene	--		0.13 U	0.59 U	0.12 U	0.12 U	0.0023 U
tert-Butylbenzene	5.9		0.32 U	1.5 U	0.31 U	0.3 U	0.0058 U
Tetrachloroethene	1.3		**12**	**62**	**7**	**3**	0.0021
Toluene	0.7		0.096 U	0.44 U	0.093 U	0.012 J	0.0017 U
trans-1,2-Dichloroethene	0.19		0.096 U	0.44 U	0.093 U	0.09 U	0.00058 J
trans-1,3-Dichloropropene	--		0.064 U	0.29 U	0.062 U	0.06 U	0.0012 U
trans-1,4-Dichloro-2-butene	--		0.32 U	1.5 U	0.31 U	0.3 U	0.0058 U
Trichloroethene	0.47		0.2	**0.66**	**0.65**	0.33	0.00085 J
Trichlorofluoromethane	--		0.32 U	1.5 U	0.31 U	0.3 U	0.0058 U
Vinyl acetate	--		0.64 U	2.9 U	0.62 U	0.6 U	0.012 U
Vinyl chloride	0.02		**0.097 J**	0.59 U	**0.49**	**0.088 J**	0.0077
Xylenes (total)	1.6		0.13 U	0.59 U	0.12 U	0.12 U	0.0023 U

J - Estimated value

U - Indicates that the compound was analyzed for but not detected

DUP - Duplicate sample

mg/kg - Milligrams per kilogram

ft bls - Feet below land surface

NYSDEC - New York State Department of Environmental Conservation

-- No NYSDEC Protection of Groundwater Standards available

Bold data indicates that parameter was detected above the NYSDEC Protection of Groundwater Standards

V - Value altered or qualifier added during data validation

R - Sample results rejected by validator

UJ - Analyte was not detected. The associated reported quantitation limit is an estimate

Table 4. Summary of Remaining Volatile Organic Compound Eceedances in Groundwater
Former Pfizer Inc Site D, Brooklyn, New York

Parameter	NYSDEC AWQSGVs	**Sample Designation:**	MW-D2	D-2	MW-D2I	D-2I	D-2I DUP	MW-8	MW-8	MW-9	MW-9	MW-10
(Concentrations in µg/L)	(µg/L)	**Sample Date:**	7/19/2016	10/11/2016	7/19/2016	10/11/2016	10/11/2016	7/20/2016	10/11/2016	7/19/2016	10/11/2016	7/19/2016
1,1,1,2-Tetrachloroethane	5		620 U	NA	500 U	NA	NA	25 U	NA	2.5 U	NA	2.5 U
1,1,1-Trichloroethane	5		620 U	620 U	500 U	500 U	500 U	25 U	25 U	2.5 U	2.5 U	2.5 U
1,1,2,2-Tetrachloroethane	5		120 U	NA	100 U	NA	NA	5.0 U	NA	0.50 U	NA	0.50 U
1,1,2-Trichloroethane	1		380 U	NA	300 U	NA	NA	15 U	NA	1.5 U	NA	1.5 U
1,1-Dichloroethane	5		620 U	620 U	500 U	500 U	500 U	25 U	25 U	2.5 U	2.5 U	2.5 U
1,1-Dichloroethene	5		120 U	120 U	100 U	100 U	100 U	1.4 J	5.0 U	0.50 U	0.50 U	0.50 U
1,1-Dichloropropene	5		620 U	NA	500 U	NA	NA	25 U	NA	2.5 U	NA	2.5 U
1,2,3-Trichlorobenzene	5		620 U	NA	500 U	NA	NA	25 U	NA	2.5 U	NA	2.5 U
1,2,3-Trichloropropane	0.04		620 U	NA	500 U	NA	NA	25 U	NA	2.5 U	NA	2.5 U
1,2,4,5-Tetramethylbenzene	5		500 U	NA	400 U	NA	NA	20 U	NA	2.0 U	NA	2.0 U
1,2,4-Trichlorobenzene	5		620 U	NA	500 U	NA	NA	25 U	NA	2.5 U	NA	2.5 U
1,2,4-Trimethylbenzene	5		620 U	620 U	500 U	500 U	500 U	25 U	25 U	2.5 U	2.5 U	2.5 U
1,2-Dibromoethane	--		500 U	NA	400 U	NA	NA	20 U	NA	2.0 U	NA	2.0 U
1,2-Dichlorobenzene	3		620 U	620 U	500 U	500 U	500 U	25 U	25 U	2.5 U	2.5 U	2.5 U
1,2-Dichloroethane	0.6		120 U	120 U	100 U	100 U	100 U	5.0 U	5.0 U	0.50 U	0.50 U	0.50 U
1,2-Dichloroethene (total)	5		**15000**	**14000**	**8700**	**14000**	**14000**	**810**	**750**	2.5 U	2.5 U	**18**
1,2-Dichloropropane	1		250 U	NA	200 U	NA	NA	10 U	NA	1.0 U	NA	1.0 U
1,3,5-Trimethylbenzene	5		620 U	620 U	500 U	500 U	500 U	25 U	25 U	2.5 U	2.5 U	2.5 U
1,3-Dichlorobenzene	3		620 U	620 U	500 U	500 U	500 U	25 U	25 U	2.5 U	2.5 U	2.5 U
1,3-Dichloropropane	5		620 U	NA	500 U	NA	NA	25 U	NA	2.5 U	NA	2.5 U
1,3-Dichloropropene	0.4		120 U	NA	100 U	NA	NA	5.0 U	NA	0.50 U	NA	0.50 U
1,4-Dichlorobenzene	3		620 U	620 U	500 U	500 U	500 U	25 U	25 U	2.5 U	2.5 U	2.5 U
1,4-Diethylbenzene	--		500 U	NA	400 U	NA	NA	20 U	NA	2.0 U	NA	2.0 U
1,4-Dioxane	--		62000 U	62000 U	50000 U	50000 U	50000 U	2500 U	2500 U	250 U	250 U	250 U
2,2-Dichloropropane	5		620 U	NA	500 U	NA	NA	25 U	NA	2.5 U	NA	2.5 U
2-Butanone (MEK)	50		1200 U	1200 U	1000 U	1000 U	1000 U	50 U	50 U	5.0 U	5.0 U	5.0 U
2-Hexanone	50		1200 U	NA	1000 U	NA	NA	50 U	NA	5.0 U	NA	5.0 U
4-Ethyltoluene	--		500 U	NA	400 U	NA	NA	20 U	NA	2.0 U	NA	2.0 U
4-Methyl-2-pentanone (MIBK)	--		1200 U	NA	1000 U	NA	NA	50 U	NA	5.0 U	NA	5.0 U
Acetone	50		**360 J**	1200 U	1000 U	1000 U	1000 U	50 U	50 U	5.0 U	5.0 U	5.0 U
Acrylonitrile	5		1200 U	NA	1000 U	NA	NA	50 U	NA	5.0 U	NA	5.0 U
Benzene	1		120 U	120 U	100 U	100 U	100 U	5.0 U	5.0 U	0.50 U	0.50 U	0.50 U
Bromobenzene	5		620 U	NA	500 U	NA	NA	25 U	NA	2.5 U	NA	2.5 U
Bromochloromethane	5		620 U	NA	500 U	NA	NA	25 U	NA	2.5 U	NA	2.5 U
Bromodichloromethane	50		120 U	NA	100 U	NA	NA	5.0 U	NA	0.50 U	NA	0.50 U
Bromoform	50		500 U	NA	400 U	NA	NA	20 U	NA	2.0 U	NA	2.0 U
Bromomethane	5		620 U	NA	500 U	NA	NA	25 U	NA	2.5 U	NA	2.5 U
Carbon disulfide	60		1200 U	NA	1000 U	NA	NA	50 U	NA	5.0 U	NA	5.0 U
Carbon tetrachloride	5		120 U	120 U	100 U	100 U	100 U	5.0 U	5.0 U	0.50 U	0.50 U	0.50 U

Table 4. Summary of Remaining Volatile Organic Compound Eceedances in Groundwater
Former Pfizer Inc Site D, Brooklyn, New York

Parameter (Concentrations in µg/L)	NYSDEC AWQSGVs (µg/L)	**Sample Designation:**	MW-D2	D-2	MW-D2I	D-2I	D-2I DUP	MW-8	MW-8	MW-9	MW-9	MW-10
		Sample Date:	7/19/2016	10/11/2016	7/19/2016	10/11/2016	10/11/2016	7/20/2016	10/11/2016	7/19/2016	10/11/2016	7/19/2016
Chlorobenzene	5		620 U	620 U	500 U	500 U	500 U	25 U	25 U	2.5 U	2.5 U	2.5 U
Chloroethane	5		620 U	NA	500 U	NA	NA	25 U	NA	2.5 U	NA	2.5 U
Chloroform	7		620 U	620 U	500 U	500 U	500 U	25 U	25 U	2.5 U	2.5 U	2.5 U
Chloromethane	--		620 U	NA	500 U	NA	NA	25 U	NA	2.5 U	NA	2.5 U
cis-1,2-Dichloroethene	5		**15000**	**14000**	**8700**	**14000**	**14000**	**810**	**750**	2.5 U	2.5 U	**18**
cis-1,3-Dichloropropene	5		120 U	NA	100 U	NA	NA	5.0 U	NA	0.50 U	NA	0.50 U
Dibromochloromethane	50		120 U	NA	100 U	NA	NA	5.0 U	NA	0.50 U	NA	0.50 U
Dibromochloropropane	0.04		620 U	NA	500 U	NA	NA	25 U	NA	2.5 U	NA	2.5 U
Dibromomethane	5		1200 U	NA	1000 U	NA	NA	50 U	NA	5.0 U	NA	5.0 U
Dichlorodifluoromethane	5		1200 U	NA	1000 U	NA	NA	50 U	NA	5.0 U	NA	5.0 U
Diethyl Ether	--		620 U	NA	500 U	NA	NA	25 U	NA	2.5 U	NA	2.5 U
Ethylbenzene	5		620 U	620 U	500 U	500 U	500 U	25 U	25 U	2.5 U	2.5 U	2.5 U
Hexachlorobutadiene	0.5		620 U	NA	500 U	NA	NA	25 U	NA	2.5 U	NA	2.5 U
Isopropylbenzene	5		620 U	NA	500 U	NA	NA	25 U	NA	2.5 U	NA	2.5 U
m+p-Xylene	5		620 U	620 U	500 U	500 U	500 U	25 U	25 U	2.5 U	2.5 U	2.5 U
Methylene chloride	5		620 U	620 U	500 U	500 U	500 U	25 U	25 U	2.5 U	2.5 U	2.5 U
MTBE	10		620 U	620 U	500 U	500 U	500 U	25 U	25 U	1.1 J	1.2 J	2.5 U
Naphthalene	10		620 U	NA	500 U	NA	NA	25 U	NA	2.5 U	NA	2.5 U
n-Butylbenzene	5		620 U	620 U	500 U	500 U	500 U	25 U	25 U	2.5 U	2.5 U	2.5 U
n-Propylbenzene	5		620 U	620 U	500 U	500 U	500 U	25 U	25 U	2.5 U	2.5 U	2.5 U
o-Chlorotoluene	--		620 U	NA	500 U	NA	NA	25 U	NA	2.5 U	NA	2.5 U
o-Xylene	5		620 U	620 U	500 U	500 U	500 U	25 U	25 U	2.5 U	2.5 U	2.5 U
p-Chlorotoluene	--		620 U	NA	500 U	NA	NA	25 U	NA	2.5 U	NA	2.5 U
p-Isopropyltoluene	5		620 U	NA	500 U	NA	NA	25 U	NA	2.5 U	NA	2.5 U
sec-Butylbenzene	5		620 U	620 U	500 U	500 U	500 U	25 U	25 U	2.5 U	2.5 U	2.5 U
Styrene	5		620 U	NA	500 U	NA	NA	25 U	NA	2.5 U	NA	2.5 U
tert-Butylbenzene	5		620 U	620 U	500 U	500 U	500 U	25 U	25 U	2.5 U	2.5 U	2.5 U
Tetrachloroethene	5		120 U	**97 J**	**45 J**	100 U	100 U	**36**	**20**	0.50 U	0.50 U	0.59
Toluene	5		620 U	620 U	500 U	500 U	500 U	25 U	25 U	2.5 U	2.5 U	2.5 U
trans-1,2-Dichloroethene	5		620 U	620 U	500 U	500 U	500 U	25 U	25 U	2.5 U	2.5 U	2.5 U
trans-1,3-Dichloropropene	--		120 U	NA	100 U	NA	NA	5.0 U	NA	0.50 U	NA	0.50 U
trans-1,4-Dichloro-2-butene	--		620 U	NA	500 U	NA	NA	25 U	NA	2.5 U	NA	2.5 U
Trichloroethene	5		120 U	120 U	**68 J**	100 U	100 U	**68**	**38**	0.50 U	0.50 U	0.55
Trichlorofluoromethane	5		620 U	NA	500 U	NA	NA	25 U	NA	2.5 U	NA	2.5 U
Vinyl acetate	--		1200 U	NA	1000 U	NA	NA	50 U	NA	5.0 U	NA	5.0 U
Vinyl chloride	2		**1500**	**2000**	**1200**	**2700**	**2800**	**11**	**19**	1.0 U	1.0 U	**11**
Xylenes (total)	5		620 U	NA	500 U	NA	NA	25 U	NA	2.5 U	NA	2.5 U

NYSDEC - New York State Department of Environmental Conservation
AWQSGVs - Ambient Water-Quality Standards and Guidance Values
µg/L -Micrograms per liter
J - Estimated Value
U - Compound was analyzed for but not detected
DUP - Duplicate
- - No NYSDEC AWQSGV available
Bold data indicates that parameter was detected above the NYSDEC AWQSGVs

Table 4. Summary of Remaining Volatile Organic Compound Eceedances in Groundwater
Former Pfizer Inc Site D, Brooklyn, New York

Parameter (Concentrations in µg/L)	NYSDEC AWQSGVs (µg/L)	**Sample Designation:** **Sample Date:**	MW-10 10/11/2016	MW-16R 7/20/2016	MW-16R 10/11/2016	MW-18 7/20/2016	MW-18 10/11/2016	MW-19 7/19/2016	MW-19 10/11/2016	MW-20 7/19/2016
1,1,1,2-Tetrachloroethane	5		NA	10 U	NA	2.5 U	NA	2.5 U	NA	25 U
1,1,1-Trichloroethane	5		25 U	10 U	6.2 U	2.5 U	2.5 U	2.5 U	2.5 U	25 U
1,1,2,2-Tetrachloroethane	5		NA	2.0 U	NA	0.50 U	NA	0.50 U	NA	5.0 U
1,1,2-Trichloroethane	1		NA	6.0 U	NA	1.5 U	NA	1.5 U	NA	15 U
1,1-Dichloroethane	5		25 U	**5.4 J**	**5.1 J**	2.5 U	2.5 U	2.5 U	2.5 U	25 U
1,1-Dichloroethene	5		5.0 U	0.64 J	0.64 J	0.50 U	0.50 U	0.50 U	0.50 U	5.0 U
1,1-Dichloropropene	5		NA	10 U	NA	2.5 U	NA	2.5 U	NA	25 U
1,2,3-Trichlorobenzene	5		NA	10 U	NA	2.5 U	NA	2.5 U	NA	25 U
1,2,3-Trichloropropane	0.04		NA	10 U	NA	2.5 U	NA	2.5 U	NA	25 U
1,2,4,5-Tetramethylbenzene	5		NA	8.0 U	NA	2.0 U	NA	2.0 U	NA	20 U
1,2,4-Trichlorobenzene	5		NA	10 U	NA	2.5 U	NA	2.5 U	NA	25 U
1,2,4-Trimethylbenzene	5		25 U	10 U	6.2 U	2.5 U	2.5 U	2.5 U	2.5 U	25 U
1,2-Dibromoethane	--		NA	8.0 U	NA	2.0 U	NA	2.0 U	NA	20 U
1,2-Dichlorobenzene	3		25 U	10 U	6.2 U	2.5 U	2.5 U	2.5 U	2.5 U	25 U
1,2-Dichloroethane	0.6		5.0 U	**1.0 J**	**1.0 J**	0.50 U	0.50 U	0.50 U	0.50 U	5.0 U
1,2-Dichloroethene (total)	5		**630**	**210**	**220**	**63**	**36**	**14**	2.4 J	**330**
1,2-Dichloropropane	1		NA	4.0 U	NA	1.0 U	NA	1.0 U	NA	10 U
1,3,5-Trimethylbenzene	5		25 U	10 U	6.2 U	2.5 U	2.5 U	2.5 U	2.5 U	25 U
1,3-Dichlorobenzene	3		25 U	10 U	6.2 U	2.5 U	2.5 U	2.5 U	2.5 U	25 U
1,3-Dichloropropane	5		NA	10 U	NA	2.5 U	NA	2.5 U	NA	25 U
1,3-Dichloropropene	0.4		NA	2.0 U	NA	0.50 U	NA	0.50 U	NA	5.0 U
1,4-Dichlorobenzene	3		25 U	10 U	6.2 U	2.5 U	2.5 U	2.5 U	2.5 U	25 U
1,4-Diethylbenzene	--		NA	8.0 U	NA	2.0 U	NA	2.0 U	NA	20 U
1,4-Dioxane	--		2500 U	1000 U	620 U	250 U	250 U	250 U	250 U	2500 U
2,2-Dichloropropane	5		NA	10 U	NA	2.5 U	NA	2.5 U	NA	25 U
2-Butanone (MEK)	50		50 U	20 U	12 U	5.5	5.0 U	5.0 U	5.0 U	50 U
2-Hexanone	50		NA	20 U	NA	5.0 U	NA	5.0 U	NA	50 U
4-Ethyltoluene	--		NA	8.0 U	NA	2.0 U	NA	2.0 U	NA	20 U
4-Methyl-2-pentanone (MIBK)	--		NA	20 U	NA	5.0 U	NA	5.0 U	NA	50 U
Acetone	50		50 U	20 U	12 U	**89**	**66**	5.0 U	5.0 U	50 U
Acrylonitrile	5		NA	20 U	NA	5.0 U	NA	5.0 U	NA	50 U
Benzene	1		5.0 U	2.0 U	1.2 U	0.67	0.39 J	0.50 U	0.50 U	5.0 U
Bromobenzene	5		NA	10 U	NA	2.5 U	NA	2.5 U	NA	25 U
Bromochloromethane	5		NA	10 U	NA	2.5 U	NA	2.5 U	NA	25 U
Bromodichloromethane	50		NA	2.0 U	NA	0.50 U	NA	0.50 U	NA	5.0 U
Bromoform	50		NA	8.0 U	NA	2.0 U	NA	2.0 U	NA	20 U
Bromomethane	5		NA	10 U	NA	1.7 J	NA	2.5 U	NA	25 U
Carbon disulfide	60		NA	20 U	NA	5.0 U	NA	5.0 U	NA	50 U
Carbon tetrachloride	5		5.0 U	2.0 U	1.2 U	0.50 U	0.50 U	0.50 U	0.50 U	5.0 U

Table 4. Summary of Remaining Volatile Organic Compound Eceedances in Groundwater
Former Pfizer Inc Site D, Brooklyn, New York

Parameter (Concentrations in µg/L)	NYSDEC AWQSGVs (µg/L)	**Sample Designation:**	MW-10	MW-16R	MW-16R	MW-18	MW-18	MW-19	MW-19	MW-20
		Sample Date:	10/11/2016	7/20/2016	10/11/2016	7/20/2016	10/11/2016	7/19/2016	10/11/2016	7/19/2016
Chlorobenzene	5		25 U	10 U	6.2 U	2.5 U	2.5 U	2.5 U	2.5 U	25 U
Chloroethane	5		NA	10 U	NA	2.5 U	NA	2.5 U	NA	25 U
Chloroform	7		25 U	10 U	6.2 U	2.5 U	2.5 U	2.5 U	2.5 U	25 U
Chloromethane	--		NA	10 U	NA	1.0 J	NA	2.5 U	NA	25 U
cis-1,2-Dichloroethene	5		**630**	**210**	**220**	**60**	**33**	**14**	2.4 J	**330**
cis-1,3-Dichloropropene	5		NA	2.0 U	NA	0.50 U	NA	0.50 U	NA	5.0 U
Dibromochloromethane	50		NA	2.0 U	NA	0.50 U	NA	0.50 U	NA	5.0 U
Dibromochloropropane	0.04		NA	10 U	NA	2.5 U	NA	2.5 U	NA	25 U
Dibromomethane	5		NA	20 U	NA	5.0 U	NA	5.0 U	NA	50 U
Dichlorodifluoromethane	5		NA	20 U	NA	5.0 U	NA	5.0 U	NA	50 U
Diethyl Ether	--		NA	10 U	NA	2.5 U	NA	2.5 U	NA	25 U
Ethylbenzene	5		25 U	10 U	6.2 U	2.5 U	2.5 U	2.5 U	2.5 U	25 U
Hexachlorobutadiene	0.5		NA	10 U	NA	2.5 U	NA	2.5 U	NA	25 U
Isopropylbenzene	5		NA	10 U	NA	2.5 U	NA	2.5 U	NA	25 U
m+p-Xylene	5		25 U	10 U	6.2 U	2.5 U	2.5 U	2.5 U	2.5 U	25 U
Methylene chloride	5		25 U	10 U	6.2 U	2.5 U	2.5 U	2.5 U	2.5 U	25 U
MTBE	10		25 U	10 U	6.2 U	2.5 U	2.5 U	2.5 U	2.5 U	25 U
Naphthalene	10		NA	10 U	NA	2.5 U	NA	2.5 U	NA	25 U
n-Butylbenzene	5		25 U	10 U	6.2 U	2.5 U	2.5 U	2.5 U	2.5 U	25 U
n-Propylbenzene	5		25 U	10 U	6.2 U	2.5 U	2.5 U	2.5 U	2.5 U	25 U
o-Chlorotoluene	--		NA	10 U	NA	2.5 U	NA	2.5 U	NA	25 U
o-Xylene	5		25 U	10 U	6.2 U	2.5 U	2.5 U	2.5 U	2.5 U	25 U
p-Chlorotoluene	--		NA	10 U	NA	2.5 U	NA	2.5 U	NA	25 U
p-Isopropyltoluene	5		NA	10 U	NA	2.5 U	NA	2.5 U	NA	25 U
sec-Butylbenzene	5		25 U	10 U	6.2 U	2.5 U	2.5 U	2.5 U	2.5 U	25 U
Styrene	5		NA	10 U	NA	2.5 U	NA	2.5 U	NA	25 U
tert-Butylbenzene	5		25 U	10 U	6.2 U	2.5 U	2.5 U	2.5 U	2.5 U	25 U
Tetrachloroethene	5		5.0 U	2.0 U	1.2 U	0.50 U	0.50 U	0.50 U	0.50 U	5.0 U
Toluene	5		25 U	10 U	6.2 U	2.5 U	2.5 U	2.5 U	2.5 U	25 U
trans-1,2-Dichloroethene	5		25 U	10 U	6.2 U	2.9	3.4	2.5 U	2.5 U	25 U
trans-1,3-Dichloropropene	--		NA	2.0 U	NA	0.50 U	NA	0.50 U	NA	5.0 U
trans-1,4-Dichloro-2-butene	--		NA	10 U	NA	2.5 U	NA	2.5 U	NA	25 U
Trichloroethene	5		5.0 U	2.0 U	1.2 U	0.32 J	0.26 J	0.45 J	0.50 U	5.0 U
Trichlorofluoromethane	5		NA	10 U	NA	2.5 U	NA	2.5 U	NA	25 U
Vinyl acetate	--		NA	20 U	NA	5.0 U	NA	5.0 U	NA	50 U
Vinyl chloride	2		**130**	**350**	**310**	**7.7**	1.1	**6.9**	1.1	**80**
Xylenes (total)	5		NA	10 U	NA	2.5 U	NA	2.5 U	NA	25 U

NYSDEC - New York State Department of Environmental Conservation
AWQSGVs - Ambient Water-Quality Standards and Guidance Values
µg/L -Micrograms per liter
J - Estimated Value
U - Compound was analyzed for but not detected
DUP - Duplicate
- - No NYSDEC AWQSGV available
Bold data indicates that parameter was detected above the NYSDEC AWQSGVs

Table 4. Summary of Remaining Volatile Organic Compound Eceedances in Groundwater
Former Pfizer Inc Site D, Brooklyn, New York

Parameter (Concentrations in µg/L)	NYSDEC AWQSGVs (µg/L)	**Sample Designation:**	MW-20	MW-21	MW-21	MW-22	MW-22	MW-23	MW-23 DUP	MW-23
		Sample Date:	10/11/2016	7/19/2016	10/11/2016	7/19/2016	10/11/2016	7/20/2016	7/20/2016	10/11/2016
1,1,1,2-Tetrachloroethane	5		NA	10 U	NA	25 U	NA	25 U	25 U	NA
1,1,1-Trichloroethane	5		25 U	10 U	12 U	25 U	50 U	25 U	25 U	25 U
1,1,2,2-Tetrachloroethane	5		NA	2.0 U	NA	5.0 U	NA	5.0 U	5.0 U	NA
1,1,2-Trichloroethane	1		NA	6.0 U	NA	15 U	NA	15 U	15 U	NA
1,1-Dichloroethane	5		25 U	10 U	12 U	25 U	50 U	25 U	25 U	25 U
1,1-Dichloroethene	5		5.0 U	2.0 U	2.5 U	5.0 U	10 U	5.0 U	5.0 U	5.0 U
1,1-Dichloropropene	5		NA	10 U	NA	25 U	NA	25 U	25 U	NA
1,2,3-Trichlorobenzene	5		NA	10 U	NA	25 U	NA	25 U	25 U	NA
1,2,3-Trichloropropane	0.04		NA	10 U	NA	25 U	NA	25 U	25 U	NA
1,2,4,5-Tetramethylbenzene	5		NA	8.0 U	NA	20 U	NA	20 U	20 U	NA
1,2,4-Trichlorobenzene	5		NA	10 U	NA	25 U	NA	25 U	25 U	NA
1,2,4-Trimethylbenzene	5		25 U	10 U	12 U	25 U	50 U	25 U	25 U	25 U
1,2-Dibromoethane	--		NA	8.0 U	NA	20 U	NA	20 U	20 U	NA
1,2-Dichlorobenzene	3		25 U	10 U	12 U	25 U	50 U	25 U	25 U	25 U
1,2-Dichloroethane	0.6		5.0 U	2.0 U	2.5 U	5.0 U	10 U	5.0 U	5.0 U	5.0 U
1,2-Dichloroethene (total)	5		**1000**	**300**	**300**	**500**	**1000**	**850**	**890**	**1200**
1,2-Dichloropropane	1		NA	4.0 U	NA	10 U	NA	10 U	10 U	NA
1,3,5-Trimethylbenzene	5		25 U	10 U	12 U	25 U	50 U	25 U	25 U	25 U
1,3-Dichlorobenzene	3		25 U	10 U	12 U	25 U	50 U	25 U	25 U	25 U
1,3-Dichloropropane	5		NA	10 U	NA	25 U	NA	25 U	25 U	NA
1,3-Dichloropropene	0.4		NA	2.0 U	NA	5.0 U	NA	5.0 U	5.0 U	NA
1,4-Dichlorobenzene	3		25 U	10 U	12 U	25 U	50 U	25 U	25 U	25 U
1,4-Diethylbenzene	--		NA	8.0 U	NA	20 U	NA	20 U	20 U	NA
1,4-Dioxane	--		2500 U	1000 U	1200 U	2500 U	8200	2500 U	2500 U	2500 U
2,2-Dichloropropane	5		NA	10 U	NA	25 U	NA	25 U	25 U	NA
2-Butanone (MEK)	50		50 U	20 U	25 U	50 U	100 U	50 U	50 U	50 U
2-Hexanone	50		NA	20 U	NA	50 U	NA	50 U	50 U	NA
4-Ethyltoluene	--		NA	8.0 U	NA	20 U	NA	20 U	20 U	NA
4-Methyl-2-pentanone (MIBK)	--		NA	20 U	NA	50 U	NA	50 U	50 U	NA
Acetone	50		50 U	20 U	25 U	50 U	100 U	50 U	50 U	50 U
Acrylonitrile	5		NA	20 U	NA	50 U	NA	50 U	50 U	NA
Benzene	1		5.0 U	2.0 U	2.5 U	5.0 U	10 U	5.0 U	5.0 U	5.0 U
Bromobenzene	5		NA	10 U	NA	25 U	NA	25 U	25 U	NA
Bromochloromethane	5		NA	10 U	NA	25 U	NA	25 U	25 U	NA
Bromodichloromethane	50		NA	2.0 U	NA	5.0 U	NA	5.0 U	5.0 U	NA
Bromoform	50		NA	8.0 U	NA	20 U	NA	20 U	20 U	NA
Bromomethane	5		NA	10 U	NA	25 U	NA	25 U	25 U	NA
Carbon disulfide	60		NA	20 U	NA	50 U	NA	50 U	50 U	NA
Carbon tetrachloride	5		5.0 U	2.0 U	2.5 U	5.0 U	10 U	5.0 U	5.0 U	5.0 U

Table 4. Summary of Remaining Volatile Organic Compound Eceedances in Groundwater
Former Pfizer Inc Site D, Brooklyn, New York

Parameter (Concentrations in µg/L)	NYSDEC AWQSGVs (µg/L)	**Sample Designation:**	MW-20	MW-21	MW-21	MW-22	MW-22	MW-23	MW-23 DUP	MW-23
		Sample Date:	10/11/2016	7/19/2016	10/11/2016	7/19/2016	10/11/2016	7/20/2016	7/20/2016	10/11/2016
Chlorobenzene	5		25 U	10 U	12 U	25 U	50 U	25 U	25 U	25 U
Chloroethane	5		NA	10 U	NA	25 U	NA	25 U	25 U	NA
Chloroform	7		25 U	10 U	12 U	25 U	50 U	25 U	25 U	25 U
Chloromethane	--		NA	10 U	NA	25 U	NA	25 U	25 U	NA
cis-1,2-Dichloroethene	5		**1000**	**300**	**300**	**500**	**1000**	**850**	**890**	**1200**
cis-1,3-Dichloropropene	5		NA	2.0 U	NA	5.0 U	NA	5.0 U	5.0 U	NA
Dibromochloromethane	50		NA	2.0 U	NA	5.0 U	NA	5.0 U	5.0 U	NA
Dibromochloropropane	0.04		NA	10 U	NA	25 U	NA	25 U	25 U	NA
Dibromomethane	5		NA	20 U	NA	50 U	NA	50 U	50 U	NA
Dichlorodifluoromethane	5		NA	20 U	NA	50 U	NA	50 U	50 U	NA
Diethyl Ether	--		NA	10 U	NA	25 U	NA	25 U	25 U	NA
Ethylbenzene	5		25 U	10 U	12 U	25 U	50 U	25 U	25 U	25 U
Hexachlorobutadiene	0.5		NA	10 U	NA	25 U	NA	25 U	25 U	NA
Isopropylbenzene	5		NA	10 U	NA	25 U	NA	25 U	25 U	NA
m+p-Xylene	5		25 U	10 U	12 U	25 U	50 U	25 U	25 U	25 U
Methylene chloride	5		25 U	10 U	12 U	25 U	50 U	25 U	25 U	25 U
MTBE	10		25 U	10 U	12 U	25 U	50 U	25 U	25 U	25 U
Naphthalene	10		NA	10 U	NA	25 U	NA	25 U	25 U	NA
n-Butylbenzene	5		25 U	10 U	12 U	25 U	50 U	25 U	25 U	25 U
n-Propylbenzene	5		25 U	10 U	12 U	25 U	50 U	25 U	25 U	25 U
o-Chlorotoluene	--		NA	10 U	NA	25 U	NA	25 U	25 U	NA
o-Xylene	5		25 U	10 U	12 U	25 U	50 U	25 U	25 U	25 U
p-Chlorotoluene	--		NA	10 U	NA	25 U	NA	25 U	25 U	NA
p-Isopropyltoluene	5		NA	10 U	NA	25 U	NA	25 U	25 U	NA
sec-Butylbenzene	5		25 U	10 U	12 U	25 U	50 U	25 U	25 U	25 U
Styrene	5		NA	10 U	NA	25 U	NA	25 U	25 U	NA
tert-Butylbenzene	5		25 U	10 U	12 U	25 U	50 U	25 U	25 U	25 U
Tetrachloroethene	5		5.0 U	1.7 J	2.1 J	4.9 J	4.5 J	**6.3**	**6.3**	**8.4**
Toluene	5		25 U	10 U	12 U	25 U	50 U	25 U	25 U	25 U
trans-1,2-Dichloroethene	5		25 U	10 U	12 U	25 U	50 U	25 U	25 U	25 U
trans-1,3-Dichloropropene	--		NA	2.0 U	NA	5.0 U	NA	5.0 U	5.0 U	NA
trans-1,4-Dichloro-2-butene	--		NA	10 U	NA	25 U	NA	25 U	25 U	NA
Trichloroethene	5		5.0 U	4.8	**5.2**	**9.8**	**14**	**13**	**13**	**17**
Trichlorofluoromethane	5		NA	10 U	NA	25 U	NA	25 U	25 U	NA
Vinyl acetate	--		NA	20 U	NA	50 U	NA	50 U	50 U	NA
Vinyl chloride	2		**660**	**20**	**58**	**59**	**110**	0.94 J	0.93 J	**2.3 J**
Xylenes (total)	5		NA	10 U	NA	25 U	NA	25 U	25 U	NA

NYSDEC - New York State Department of Environmental Conservation
AWQSGVs - Ambient Water-Quality Standards and Guidance Values
µg/L -Micrograms per liter
J - Estimated Value
U - Compound was analyzed for but not detected
DUP - Duplicate
 - - No NYSDEC AWQSGV available
Bold data indicates that parameter was detected above the NYSDEC AWQSGVs

Table 4. Summary of Remaining Volatile Organic Compound Eceedances in Groundwater
Former Pfizer Inc Site D, Brooklyn, New York

Parameter (Concentrations in µg/L)	NYSDEC AWQSGVs (µg/L)	**Sample Designation:**	FIELD BLANK 07192016	FIELD BLANK 07202016	FIELD BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK
		Sample Date:	7/19/2016	7/20/2016	10/11/2016	7/19/2016	7/20/2016	10/10/2016
1,1,1,2-Tetrachloroethane	5		2.5 U	2.5 U	NA	2.5 U	2.5 U	NA
1,1,1-Trichloroethane	5		2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
1,1,2,2-Tetrachloroethane	5		0.50 U	0.50 U	NA	0.50 U	0.50 U	NA
1,1,2-Trichloroethane	1		1.5 U	1.5 U	NA	1.5 U	1.5 U	NA
1,1-Dichloroethane	5		2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
1,1-Dichloroethene	5		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,1-Dichloropropene	5		2.5 U	2.5 U	NA	2.5 U	2.5 U	NA
1,2,3-Trichlorobenzene	5		2.5 U	2.5 U	NA	2.5 U	2.5 U	NA
1,2,3-Trichloropropane	0.04		2.5 U	2.5 U	NA	2.5 U	2.5 U	NA
1,2,4,5-Tetramethylbenzene	5		2.0 U	2.0 U	NA	2.0 U	2.0 U	NA
1,2,4-Trichlorobenzene	5		2.5 U	2.5 U	NA	2.5 U	2.5 U	NA
1,2,4-Trimethylbenzene	5		2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
1,2-Dibromoethane	--		2.0 U	2.0 U	NA	2.0 U	2.0 U	NA
1,2-Dichlorobenzene	3		2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
1,2-Dichloroethane	0.6		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
1,2-Dichloroethene (total)	5		2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
1,2-Dichloropropane	1		1.0 U	1.0 U	NA	1.0 U	1.0 U	NA
1,3,5-Trimethylbenzene	5		2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
1,3-Dichlorobenzene	3		2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
1,3-Dichloropropane	5		2.5 U	2.5 U	NA	2.5 U	2.5 U	NA
1,3-Dichloropropene	0.4		0.50 U	0.50 U	NA	0.50 U	0.50 U	NA
1,4-Dichlorobenzene	3		2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
1,4-Diethylbenzene	--		2.0 U	2.0 U	NA	2.0 U	2.0 U	NA
1,4-Dioxane	--		250 U	250 U	250 U	250 U	250 U	250 U
2,2-Dichloropropane	5		2.5 U	2.5 U	NA	2.5 U	2.5 U	NA
2-Butanone (MEK)	50		5.0 U	5.0 U	5.0 U	5.0 U	5.0 U	5.0 U
2-Hexanone	50		5.0 U	5.0 U	NA	5.0 U	5.0 U	NA
4-Ethyltoluene	--		2.0 U	2.0 U	NA	2.0 U	2.0 U	NA
4-Methyl-2-pentanone (MIBK)	--		5.0 U	5.0 U	NA	5.0 U	5.0 U	NA
Acetone	50		5.0 U	2.2 J	5.0 U	5.0 U	5.0 U	5.0 U
Acrylonitrile	5		5.0 U	5.0 U	NA	5.0 U	5.0 U	NA
Benzene	1		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Bromobenzene	5		2.5 U	2.5 U	NA	2.5 U	2.5 U	NA
Bromochloromethane	5		2.5 U	2.5 U	NA	2.5 U	2.5 U	NA
Bromodichloromethane	50		0.50 U	0.50 U	NA	0.50 U	0.50 U	NA
Bromoform	50		2.0 U	2.0 U	NA	2.0 U	2.0 U	NA
Bromomethane	5		2.5 U	2.5 U	NA	2.5 U	2.5 U	NA
Carbon disulfide	60		5.0 U	5.0 U	NA	5.0 U	5.0 U	NA
Carbon tetrachloride	5		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U

Table 4. Summary of Remaining Volatile Organic Compound Eceedances in Groundwater
Former Pfizer Inc Site D, Brooklyn, New York

Parameter (Concentrations in µg/L)	NYSDEC AWQSGVs (µg/L)	**Sample Designation:**	FIELD BLANK 07192016	FIELD BLANK 07202016	FIELD BLANK	TRIP BLANK	TRIP BLANK	TRIP BLANK
		Sample Date:	7/19/2016	7/20/2016	10/11/2016	7/19/2016	7/20/2016	10/10/2016
Chlorobenzene	5		2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Chloroethane	5		2.5 U	2.5 U	NA	2.5 U	2.5 U	NA
Chloroform	7		2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Chloromethane	--		2.5 U	2.5 U	NA	2.5 U	2.5 U	NA
cis-1,2-Dichloroethene	5		2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
cis-1,3-Dichloropropene	5		0.50 U	0.50 U	NA	0.50 U	0.50 U	NA
Dibromochloromethane	50		0.50 U	0.50 U	NA	0.50 U	0.50 U	NA
Dibromochloropropane	0.04		2.5 U	2.5 U	NA	2.5 U	2.5 U	NA
Dibromomethane	5		5.0 U	5.0 U	NA	5.0 U	5.0 U	NA
Dichlorodifluoromethane	5		5.0 U	5.0 U	NA	5.0 U	5.0 U	NA
Diethyl Ether	--		2.5 U	2.5 U	NA	2.5 U	2.5 U	NA
Ethylbenzene	5		2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Hexachlorobutadiene	0.5		2.5 U	2.5 U	NA	2.5 U	2.5 U	NA
Isopropylbenzene	5		2.5 U	2.5 U	NA	2.5 U	2.5 U	NA
m+p-Xylene	5		2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Methylene chloride	5		2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
MTBE	10		2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Naphthalene	10		2.5 U	1.3 J	NA	2.5 U	0.80 J	NA
n-Butylbenzene	5		2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
n-Propylbenzene	5		2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
o-Chlorotoluene	--		2.5 U	2.5 U	NA	2.5 U	2.5 U	NA
o-Xylene	5		2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
p-Chlorotoluene	--		2.5 U	2.5 U	NA	2.5 U	2.5 U	NA
p-Isopropyltoluene	5		2.5 U	2.5 U	NA	2.5 U	2.5 U	NA
sec-Butylbenzene	5		2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Styrene	5		2.5 U	2.5 U	NA	2.5 U	2.5 U	NA
tert-Butylbenzene	5		2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
Tetrachloroethene	5		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Toluene	5		2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
trans-1,2-Dichloroethene	5		2.5 U	2.5 U	2.5 U	2.5 U	2.5 U	2.5 U
trans-1,3-Dichloropropene	--		0.50 U	0.50 U	NA	0.50 U	0.50 U	NA
trans-1,4-Dichloro-2-butene	--		2.5 U	2.5 U	NA	2.5 U	2.5 U	NA
Trichloroethene	5		0.50 U	0.50 U	0.50 U	0.50 U	0.50 U	0.50 U
Trichlorofluoromethane	5		2.5 U	2.5 U	NA	2.5 U	2.5 U	NA
Vinyl acetate	--		5.0 U	5.0 U	NA	5.0 U	5.0 U	NA
Vinyl chloride	2		1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U
Xylenes (total)	5		2.5 U	2.5 U	NA	2.5 U	2.5 U	NA

NYSDEC - New York State Department of Environmental Conservation
AWQSGVs - Ambient Water-Quality Standards and Guidance Values
µg/L -Micrograms per liter
J - Estimated Value
U - Compound was analyzed for but not detected
DUP - Duplicate
- - No NYSDEC AWQSGV available
Bold data indicates that parameter was detected above the NYSDEC AWQSGVs

FIGURES

1. Site Location Map
2. Site Layout Map
3. Engineering Controls Location – Composite Cover System
4. Geologic Cross Section
5. Groundwater Contour Map October 2016
6. Remaining Soil Sample Exceedances – Post-Remedial Excavation
7. Remaining Groundwater Sample Exceedances – Post-ISCO Injections

QUADRANGLE LOCATION

N

0 2000'

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

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Title:

SITE LOCATION MAP

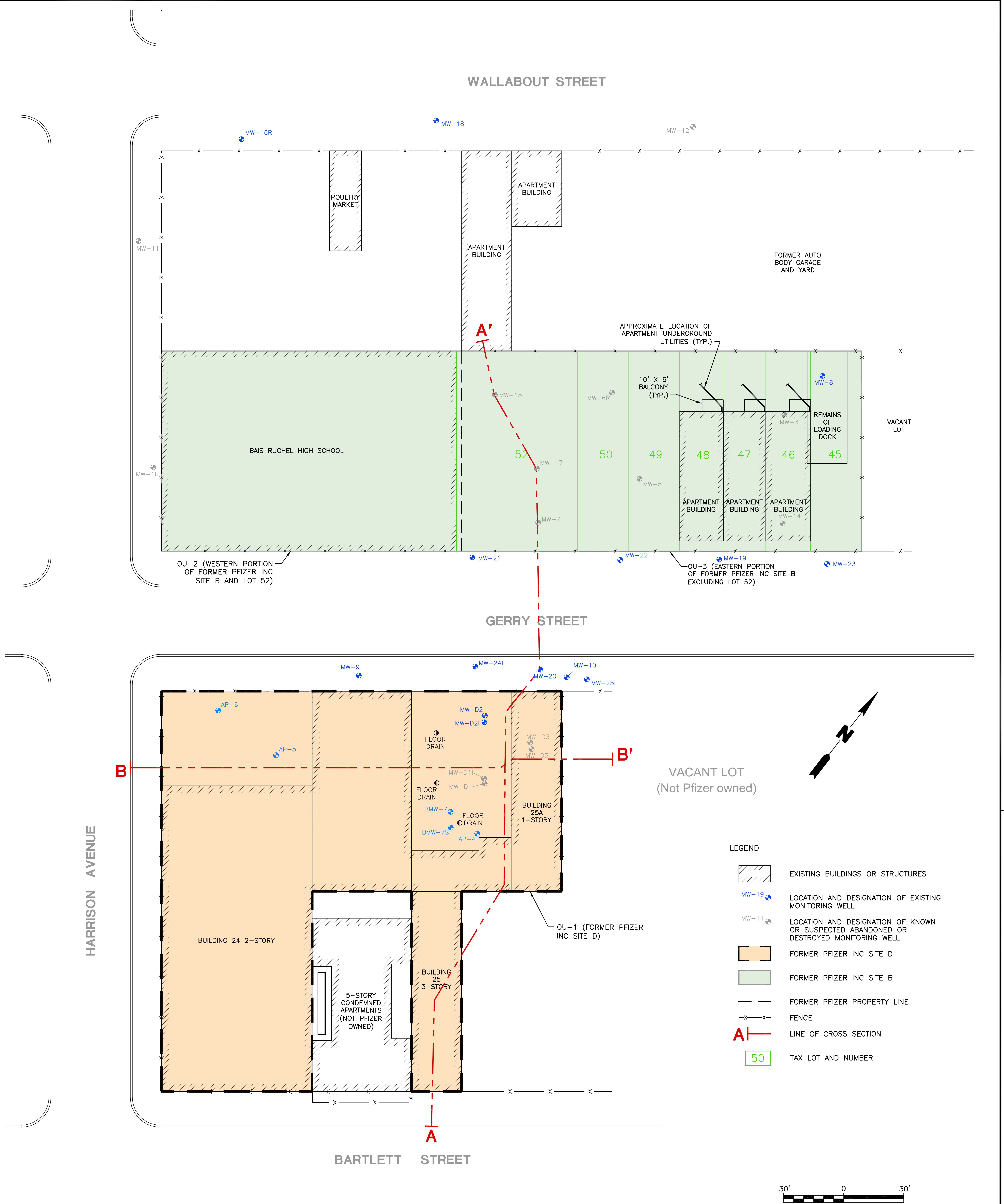
SITE MANAGEMENT PLAN
FORMER PFIZER INC SITE D
BROOKLYN, NEW YORK

Prepared for:

PFIZER INC

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: J.K.	Date: 04MAY17	FIGURE
Prepared by: J.A.D.	Scale: AS SHOWN	1
Project Mgr.: J.K.	Project No.: 0047.0044Y045	
File: 0047.0044Y681.01.CDR		



NOTES

1. MONITORING WELLS MW–11 AND MW–16 WERE ABANDONED ON JANUARY 18, 2015. MONITORING WELL MW–1R WAS ABANDONED ON MARCH 9, 2015.
2. MONITORING WELLS MW–D1, MW–D1I, MW–3D AND MW–D3I WERE DESTROYED DURING COMPLETION OF THE REMEDIAL ACTION EXCAVATION.
3. MONITORING WELLS MW–3, MW–12 AND MW–14 WERE DESTROYED DUE TO ADJACENT CONSTRUCTION ACTIVITIES.

Title:

SITE LAYOUT MAP

SITE MANAGEMENT PLAN
FORMER PFIZER INC SITE D
BROOKLYN, NEW YORK

Prepared For:

PFIZER INC

ROUX ROUX ASSOCIATES, INC. *Environmental Consulting and Management*	Compiled by: J.K.	Date: 04MAY17	FIGURE
	Prepared by: J.A.D.	Scale: AS SHOWN	**2**
	Project Mgr: J.K.	Project: 0047.0044Y045	
	File: 0047.0044Y681.02.DWG		

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N

Title:

ENGINEERING CONTROLS LOCATION
COMPOSITE COVER SYSTEM

SITE MANAGEMENT PLAN
FORMER PFIZER INC SITE D
BROOKLYN, NEW YORK

Prepared For:

PFIZER INC

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: J.K.	Date: 04MAY17	FIGURE
Prepared by: J.A.D.	Scale: AS SHOWN	3
Project Mgr: J.K.	Project: 0047.0044Y045	
File: 0047.0044Y681.03.DWG		

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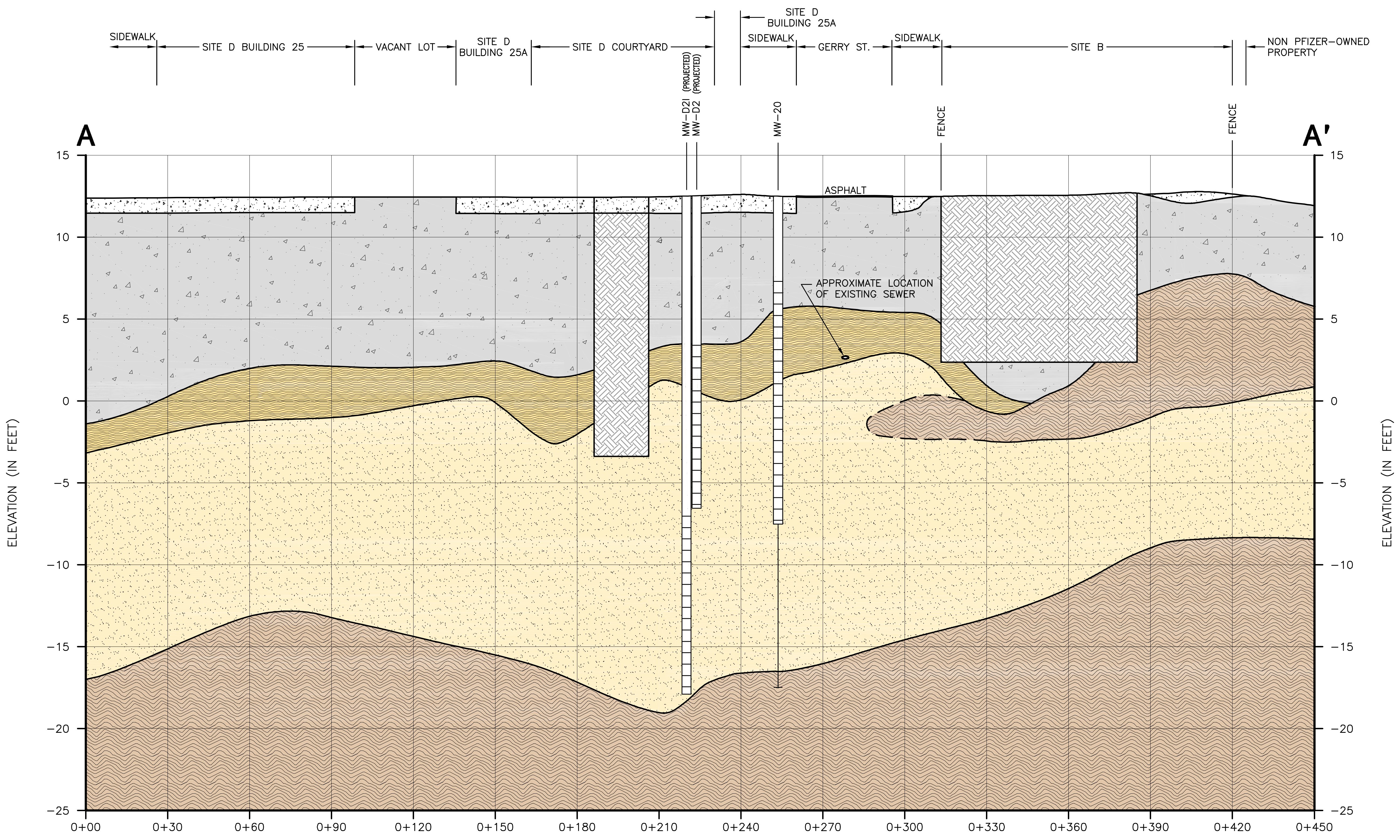
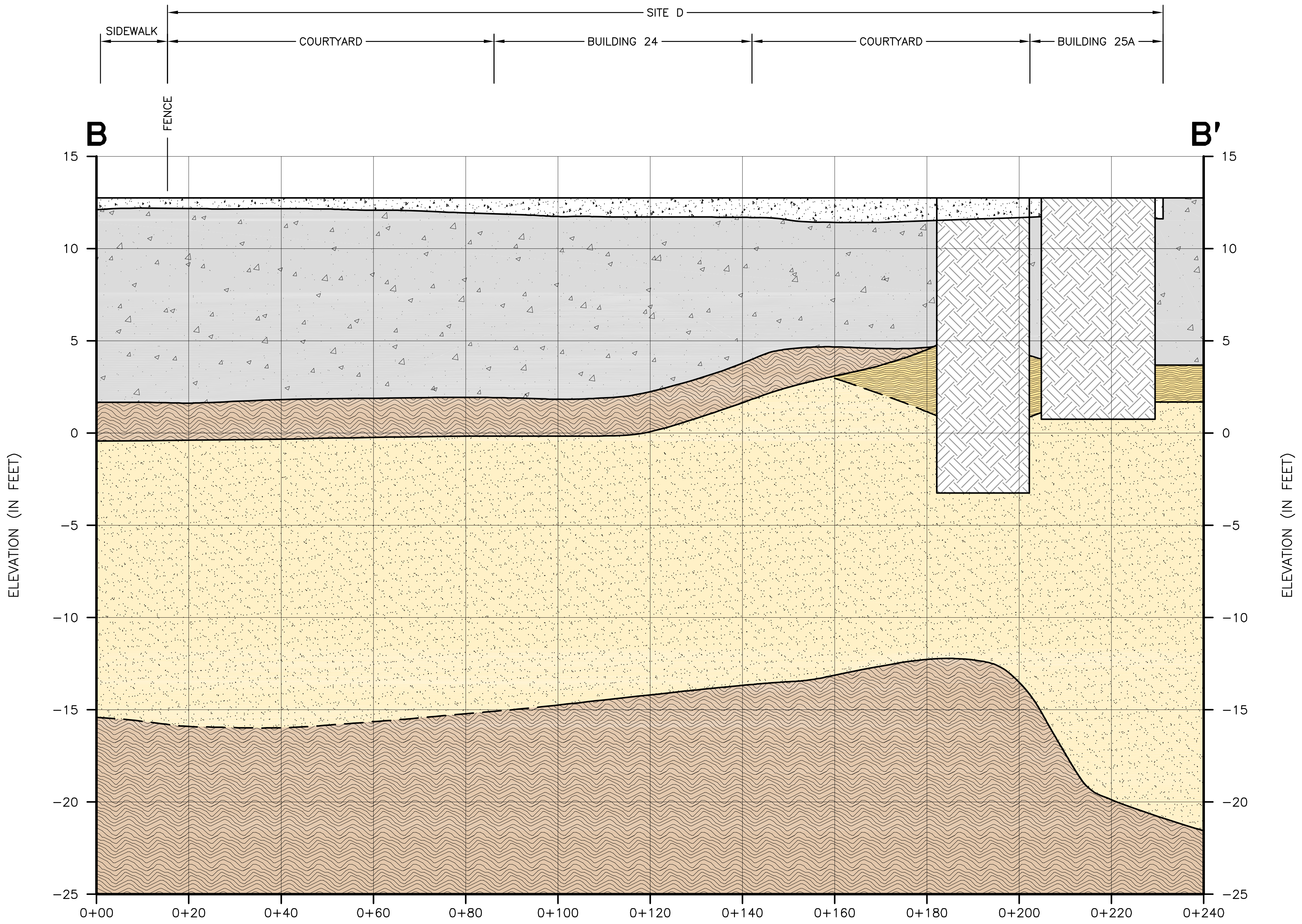


SECTION A–A'

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 AND REMEDIAL ACTION ACTIVITIES
▨	SILT/CLAY
▨	SILT/SAND
▨	CONCRETE
▯	WELL SCREEN INTERVAL

NOTES

1. DASHED LINES INDICATE INFERRED DELINEATION BETWEEN LAYERS.
2. ELEVATION IN FEET RELATIVE TO BOROUGH OF BROOKLYN HIGHWAY DATUM.
3. PROJECTED LOCATIONS WERE PROJECTED THE SHORTEST DISTANCE (PERPENDICULAR) TO SECTION LINES.

Title:

GEOLOGICAL CROSS SECTIONS

SITE MANAGEMENT PLAN
FORMER PFIZER INC SITE D
BROOKLYN, NEW YORK

Prepared For:

PFIZER INC

ROUX ROUX ASSOCIATES, INC. *Environmental Consulting and Management*	Compiled by: W.K.	Date: 04MAY17	FIGURE **4**
	Prepared by: J.A.D.	Scale: AS SHOWN	
	Project Mgr: W.K.	Project: 0047.0044Y045	
	File: 0047.0044Y681.04.DWG		

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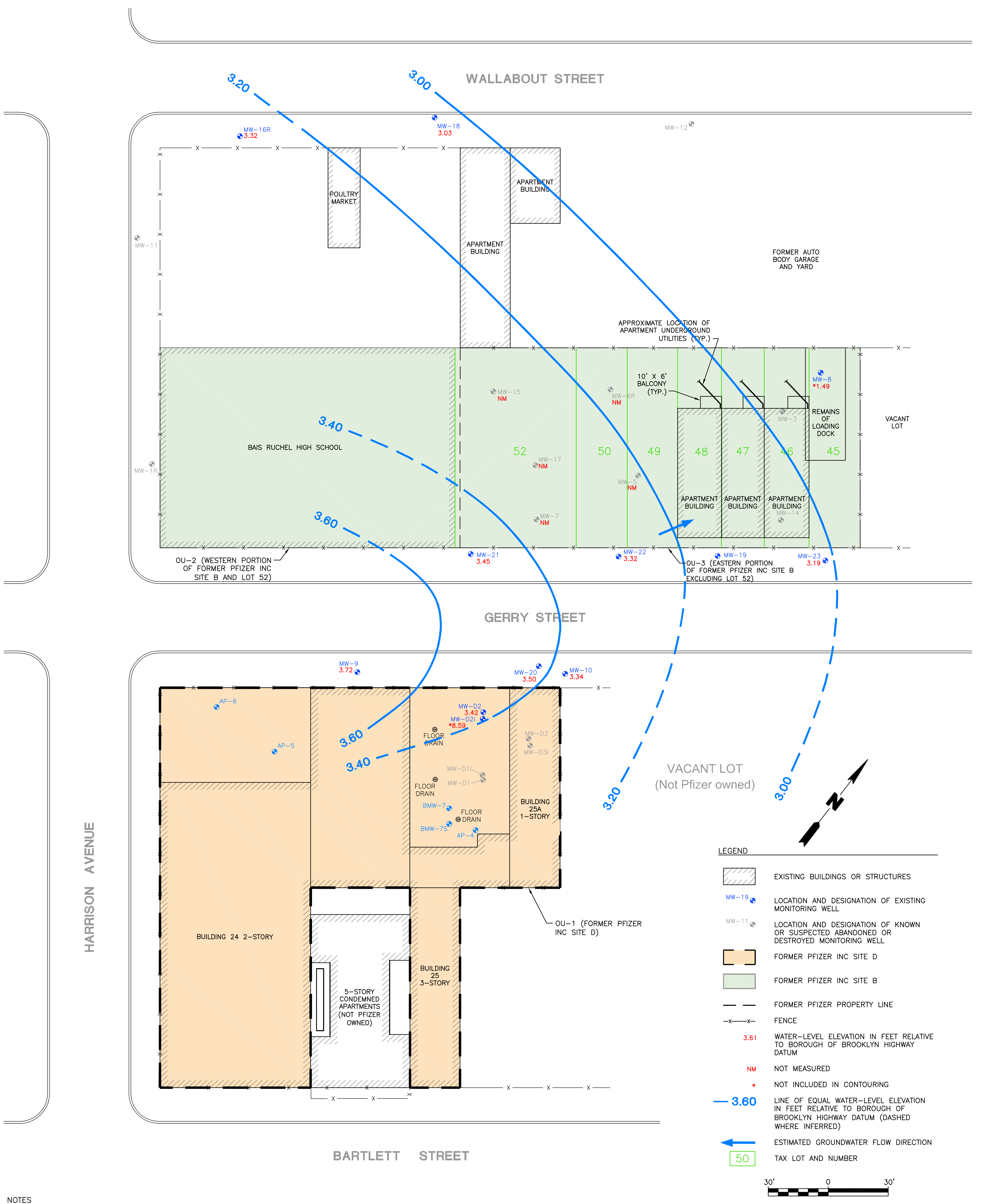

NOTES

1. MONITORING WELLS MW–11 AND MW–16 WERE ABANDONED ON JANUARY 18, 2015. MONITORING WELL MW–1R WAS ABANDONED ON MARCH 9, 2015.
2. MONITORING WELLS MW–D1, MW–D1I, MW–3D AND MW–D3I WERE DESTROYED DURING COMPLETION OF THE REMEDIAL ACTION EXCAVATION.
3. MONITORING WELL MW–19 WAS PARTIALLY DAMAGED DURING NEARBY CONSTRUCTION WORK. IT HAS BEEN REPAIRED AND GAUGED BUT HAS NOT BEEN SURVEYED AND THEREFORE WAS EXCLUDED FROM THE GROUNDWATER ELEVATION CONTOUR.
4. MONITORING WELLS MW–3, MW–12 AND MW–14 WERE DESTROYED DUE TO ADJACENT CONSTRUCTION ACTIVITIES.
5. MONITORING WELLS MW–8 AND MW–D2I WERE EXCLUDED FROM THE GROUNDWATER ELEVATION CONTOUR DUE TO ERRONEOUS ELEVATION DATA.

Title:

GROUNDWATER CONTOUR MAP
OCTOBER 2016

SITE MANAGEMENT PLAN
FORMER PFIZER INC SITE D
BROOKLYN, NEW YORK

Prepared For:

PFIZER INC

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting and Management

Compiled by: J.K.	Date: 04MAY17	FIGURE
Prepared by: J.A.D.	Scale: AS SHOWN	5
Project Mgr: J.K.	Project: 0047.0044Y045	
File: 0047.0044Y681.05.DWG		

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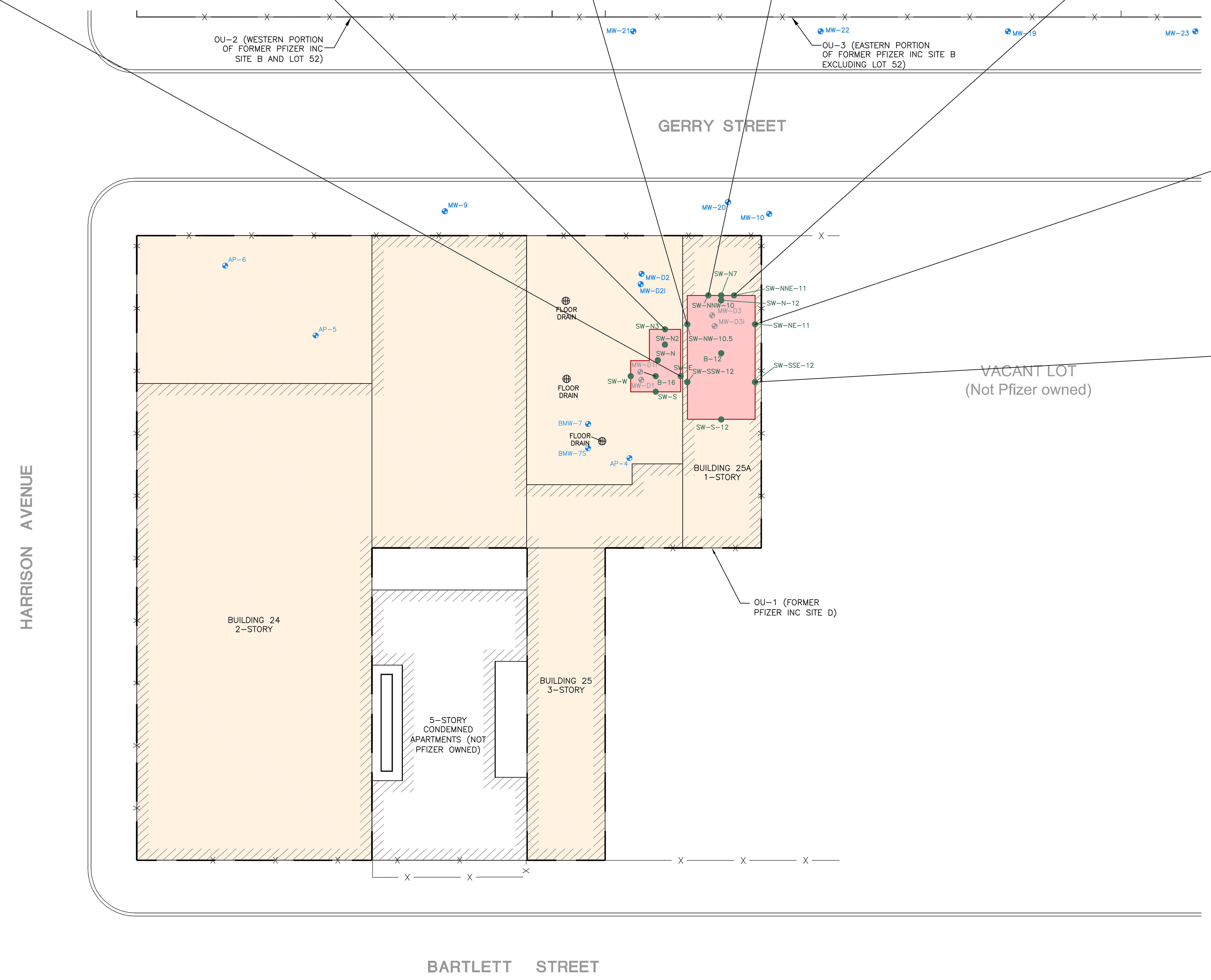
PE-C-SW-E	4/29/15	5/12/15
Analyte	7	14
Acetone	0.0035 J	0.64 U
cis-1,2-Dichloroethene	0.0054	**0.87**
Tetrachloroethene	0.034	**12**
Trichloroethene	0.0045	0.2
Vinyl chloride	0.0024 U	**0.097 J**

PE-C-SW-N3	5/21/15	5/21/15
Analyte	7	15
2-Butanone (MEK)	0.0016 J	0.072 J
Acetone	0.011 J	**0.16 J**
cis-1,2-Dichloroethene	**0.33**	**1.5**
Tetrachloroethene	0.0021	**3**
Trichloroethene	0.00085 J	0.33
Vinyl chloride	0.0077	**0.088 J**

PE-BLDG-SW-NW-10.5	4/14/15
Analyte	10.5
cis-1,2-Dichloroethene	**12**
Tetrachloroethene	**1.6**

PE-BLDG-SW-NNW-10	4/13/15
Analyte	10
2-Butanone (MEK)	1.6
Acetone	**0.54 J**
cis-1,2-Dichloroethene	**44**
Tetrachloroethene	**13**
Trichloroethene	**1.6**
Vinyl chloride	**2.3**

PE-BLDG-SW-NNE-11	4/13/15
Analyte	11
2-Butanone (MEK)	0.048
Acetone	**0.26**
cis-1,2-Dichloroethene	0.025
Tetrachloroethene	0.011
Trichloroethene	0.0024
Vinyl chloride	**0.41**



PE-BLDG-SW-NE-11	4/14/15
Analyte	11
cis-1,2-Dichloroethene	**20**
Tetrachloroethene	0.87
Vinyl chloride	**0.94**

PE-BLDG-SW-SSE-12	4/17/15
Analyte	12
2-Butanone (MEK)	**0.48 J**
Acetone	**0.7**
cis-1,2-Dichloroethene	**0.66**
Tetrachloroethene	**7.2**
Trichloroethene	0.068

LEGEND

▨	EXISTING BUILDINGS OR STRUCTURES
MW–19 ●	LOCATION AND DESIGNATION OF EXISTING MONITORING WELL
MW–D3 ●	LOCATION AND DESIGNATION OF KNOWN OR SUSPECTED ABANDONED OR DESTROYED MONITORING WELL
SW–N7 ●	LOCATION AND DESIGNATION OF POST–EXCAVATION SOIL SAMPLING POINT
▭	FORMER PFIZER INC SITE D
— —	FORMER PFIZER PROPERTY LINE
—x——x—	FENCE
🟥	APPROXIMATE FINAL EXTENT OF SITE D REMEDIAL EXCAVATION
50	TAX LOT AND NUMBER

TYPICAL DATABOX INFORMATION

SAMPLE DESIGNATION

SAMPLING DATE

PE-BLDG-SW-NNW-10	4/13/15
Analyte	10
2-Butanone (MEK)	1.6
Acetone	**0.54 J**
cis-1,2-Dichloroethene	**44**
Tetrachloroethene	**13**
Trichloroethene	**1.6**
Vinyl chloride	**2.3**

APPROXIMATE SAMPLE DEPTH (FT BLS)

CONCENTRATIONS IN MILLIGRAMS PER KILOGRAM (mg/kg)

Parameter (Concentrations in mg/kg)	NYSDEC Part 375 (mg/kg)
VOCs	
2-Butanone (MEK)	0.12
Acetone	0.05
cis-1,2-Dichloroethene	0.25
Tetrachloroethene	1.3
Trichloroethene	0.47
Vinyl chloride	0.02

mg/kg – MILLIGRAMS PER KILOGRAM

NYSDEC – NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION

PART 375 – 6 NYCRR PART 375 PROTECTION OF GROUNDWATER CRITERIA

J – ESTIMATED VALUE

U – INDICATES THAT THE COMPOUND WAS ANALYZED FOR BUT NOT DETECTED

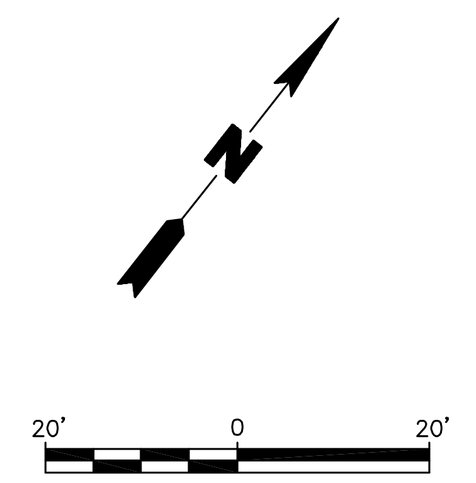
VOCs – VOLATILE ORGANIC COMPOUNDS

BOLD – CONCENTRATION EXCEEDS NYSDEC PART 375 PROTECTION OF GROUNDWATER CRITERIA

FT BLS – FEET BELOW LAND SURFACE

NOTES

1. NOMENCLATURE OF SAMPLE DESIGNATIONS MODIFIED IN MAP AREA DUE TO SPACE CONSTRAINTS. SAMPLE DESIGNATIONS ARE CORRECTLY DISPLAYED IN THE RESPECTIVE DATA BOX.
2. DATA SHOWN ONLY FOR FINAL POST–EXCAVATION SAMPLE LOCATIONS WITH EXCEEDANCES. INTERIM POST–EXCAVATION SAMPLE LOCATIONS ARE SHOWN WITHOUT DATA BOXES.



Title:

REMAINING SOIL SAMPLE EXCEEDANCES POST-REMEDIAL EXCAVATION

SITE MANAGEMENT PLAN
FORMER PFIZER INC SITE D
BROOKLYN, NEW YORK

Prepared For:

PFIZER INC

ROUX ROUX ASSOCIATES, INC. *Environmental Consulting & Management*	Compiled by: J.K.	Date: 04MAY17	FIGURE
	Prepared by: J.A.D.	Scale: AS SHOWN	**6**
	Project Mgr: J.K.	Project: 0047.0044Y045	
	File: 0047.0044Y681.06.DWG		

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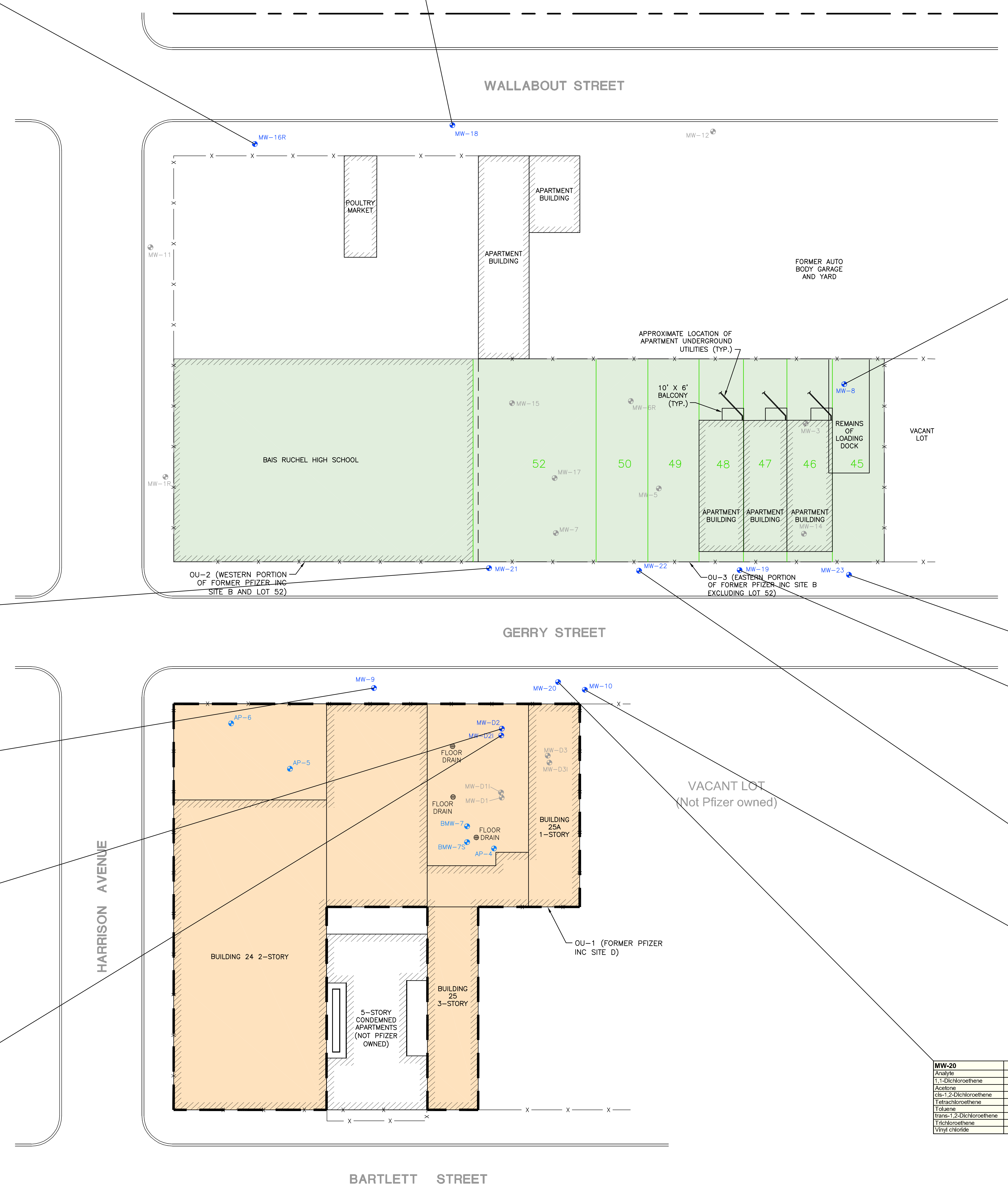


MW-16R	Jul-16	Oct-16
Analyte		
1,1-Dichloroethane	**5.4 J**	**5.1 J**
1,1-Dichloroethene	0.64 J	0.64 J
1,2-Dichloroethane	**1.0 J**	**1.0 J**
Acetone	20 U	12 U
cis-1,2-Dichloroethene	**210**	**220**
MTBE	10 U	6.2 U
Tetrachloroethene	2.0 U	1.2 U
Toluene	10 U	6.2 U
trans-1,2-Dichloroethene	10 U	6.2 U
Trichloroethene	2.0 U	1.2 U
Vinyl chloride	**350**	**310**

MW-18	Jul-16	Oct-16
Analyte		
1,1-Dichloroethene	0.50 U	2.5 U
1,2-Dichloroethane	0.50 U	0.50 U
Acetone	**89**	**66**
Benzene	0.67	0.39 J
cis-1,2-Dichloroethene	**60**	**33**
MTBE	2.5 U	2.5 U
trans-1,2-Dichloroethene	2.9	3.4
Vinyl chloride	**7.7**	1.1

MW-8	Jul-16	Oct-16
Analyte		
1,1-Dichloroethene	1.4 J	5.0 U
Benzene	5.0 U	5.0 U
cis-1,2-Dichloroethene	**810**	**750**
Cyclohexane	NA	NA
MTBE	25 U	25 U
Tetrachloroethene	**36**	**20**
Toluene	25 U	25 U
trans-1,2-Dichloroethene	25 U	25 U
Trichloroethene	**68**	**38**
Vinyl chloride	**11**	**19**

MW-21	Jul-16	Oct-16
Analyte		
cis-1,2-Dichloroethene	**300**	**300**
Tetrachloroethene	1.7 J	2.1 J
Trichloroethene	4.8	**5.2**
Vinyl chloride	**20**	**58**

MW-23	Jul-16	Oct-16
Analyte		
cis-1,2-Dichloroethene	**850**	**1200**
Tetrachloroethene	**6.3**	**8.4**
Trichloroethene	**13**	**17**
Vinyl chloride	0.94 J	**2.3 J**

MW-19	Jul-16	Oct-16
Analyte		
1,2,4-Trimethylbenzene	2.5 U	2.5 U
Acetone	5.0 U	5.0 U
Benzene	0.50 U	0.50 U
cis-1,2-Dichloroethene	**14**	2.4 J
Cyclohexane	NA	NA
Isopropylbenzene	2.5 U	NA
Tetrachloroethene	0.50 U	0.50 U
trans-1,2-Dichloroethene	2.5 U	2.5 U
Trichloroethene	0.45 J	0.50 U
Vinyl chloride	**6.9**	1.1

MW-9	Jul-16	Oct-16
Analyte		
1,1-Dichloroethane	2.5 U	2.5 U
Acetone	5.0 U	5.0 U
MTBE	1.1 J	1.2 J

MW-22	Jul-16	Oct-16
Analyte		
cis-1,2-Dichloroethene	**500**	**1000**
Tetrachloroethene	4.9 J	4.5 J
Trichloroethene	**9.8**	**14**
Vinyl chloride	**59**	**110**

MW-D2	Jul-16	Oct-16
Analyte		
1,1-Dichloroethene	120 U	620 U
Acetone	**360 J**	1200 U
cis-1,2-Dichloroethene	**15000**	**14000**
Tetrachloroethene	120 U	**97 J**
trans-1,2-Dichloroethene	620 U	620 U
Trichloroethene	120 U	120 U
Vinyl chloride	**1500**	**2000**

MW-10	Jul-16	Oct-16
Analyte		
1,1-Dichloroethene	0.50 U	5.0 U
cis-1,2-Dichloroethene	**18**	**630**
Tetrachloroethene	0.59	5.0 U
Trichloroethene	0.55	5.0 U
Vinyl chloride	**11**	**130**

MW-D2I	Jul-16	Oct-16
Analyte		
cis-1,2-Dichloroethene	**8700**	**14000**
Tetrachloroethene	**45 J**	100 U
trans-1,2-Dichloroethene	500 U	500 U
Trichloroethene	**68 J**	100 U
Vinyl chloride	**1200**	**2700**

MW-20	Jul-16	Oct-16
Analyte		
1,1-Dichloroethene	5.0 U	5.0 U
Acetone	50 U	50 U
cis-1,2-Dichloroethene	**330**	**1000**
Tetrachloroethene	5.0 U	5.0 U
Toluene	25 U	25 U
trans-1,2-Dichloroethene	25 U	25 U
Trichloroethene	5.0 U	5.0 U
Vinyl chloride	**80**	**660**

LEGEND

▨	EXISTING BUILDINGS OR STRUCTURES
MW−19 ●	LOCATION AND DESIGNATION OF EXISTING MONITORING WELL
MW−11 ●	LOCATION AND DESIGNATION OF KNOWN OR SUSPECTED ABANDONED OR DESTROYED MONITORING WELL
🟧	FORMER PFIZER INC SITE D
🟩	FORMER PFIZER INC SITE B
— —	FORMER PFIZER PROPERTY LINE
—x——x—	FENCE
ISCO	IN SITU CHEMICAL OXIDATION
50	TAX LOT AND NUMBER

TYPICAL DATABOX INFORMATION

SAMPLE DESIGNATION

SAMPLING DATE

MW-D2	Sep-13	Mar-14	Sep-14	Mar-15	Aug-15	Apr-16
Analyte						
1,1-Dichloroethene	49.8 J	200 U	47.3 J	71 J	250 U	250 U
cis-1,2-Dichloroethene	24700	29300	20100	32000	21000	25000
Tetrachloroethene	1440	200 U	2550	250 U	170 J	250 U
trans-1,2-Dichloroethene	96.8	200 U	47 J	1200 U	1200 U	1200 U
Trichloroethene	552	200 U	743	250 U	250 U	250 U
Vinyl chloride	2370	3120	2340	3600	2000	1800

ANALYTES

CONCENTRATIONS IN MICROGRAMS PER LITER (µg/L)

Parameter	Standards* (µg/L)
1,1-Dichloroethane	5
1,1-Dichloroethene	5
1,2,4-Trimethylbenzene	5
1,2-Dichloroethane	0.6
1,3,5-Trimethylbenzene	5
2-Butanone (MEK)	50
4-Isopropyltoluene	5
Acetone	50
Benzene	1
Carbon Disulfide	60
Chloroform	7
cis-1,2-Dichloroethene	5
Ethylbenzene	5
Isopropylbenzene	5
MTBE	10
n-Butylbenzene	5
n-Propylbenzene	5
sec-Butylbenzene	5
Tetrachloroethene	5
Toluene	5
trans-1,2-Dichloroethene	5
Trichloroethene	5
Vinyl chloride	2
Xylenes (total)	5

CONCENTRATIONS IN µg/L

µg/L – MICROGRAMS PER LITER
* – NYSDEC AWQSGVs
NYSDEC – NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
AWQSGVs – AMBIENT WATER–QUALITY STANDARDS AND GUIDANCE VALUES
J – ESTIMATED VALUE
U – NOT DETECTED
V – VALUE ALTERED OR QUALIFIER ADDED DURING DATA VALIDATION
NA – NOT ANALYZED
NS – NOT SAMPLED
MTBE – METHYL TERTIARY BUTYL ETHER

NOTES

1. MONITORING WELLS MW−11 AND MW−16 WERE ABANDONED ON JANUARY 18, 2015. MONITORING WELL MW−1R WAS ABANDONED ON MARCH 9, 2015.
2. MONITORING WELLS MW−D1, MW−D1I, MW−3D AND MW−D3I WERE DESTROYED DURING COMPLETION OF THE REMEDIAL ACTION EXCAVATION.
3. MONITORING WELLS MW−3, MW−12 AND MW−14 WERE DESTROYED DUE TO ADJACENT CONSTRUCTION ACTIVITIES.
4. ISCO INJECTIONS WERE COMPLETED ON APRIL 26, 2016 TO MAY 11, 2016.

30' 0 30'

Title:

REMAINING GROUNDWATER SAMPLE EXCEEDANCES - POST-ISCO INJECTIONS

SITE MANAGEMENT PLAN
FORMER PFIZER INC SITE D
BROOKLYN, NEW YORK

Prepared For:

PFIZER INC

ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: J.K.	Date: 04MAY17	FIGURE
Prepared by: J.A.D.	Scale: AS SHOWN	7
Project Mgr: J.K.	Project: 0047.0044Y045	
File: 0047.0044Y681.05.DWG		

V:\CAD\PROJECTS\0047Y\0044Y\681\0047.0044Y681.05.DWG

APPENDICES

A. Environmental Easement
B. List of Site Contacts
C. Survey Map, Metes and Bounds
D. Responsibilities of Owner and Remedial Party
E. Monitoring Well Boring and Construction Logs
F. Excavation Work Plan
G. Health and Safety Plan & Site-Specific Community Air Monitoring Plan
H. Quality Assurance Project Plan
I. Site Management Forms
J. Field Sampling Plan

APPENDIX A

Environmental Easement

NYC DEPARTMENT OF FINANCE
OFFICE OF THE CITY REGISTER

This page is part of the instrument. The City Register will rely on the information provided by you on this page for purposes of indexing this instrument.The information on this page will control for indexing purposes in the event of any conflict with the rest of the document.

2018032800731001002E80AB

RECORDING AND ENDORSEMENT COVER PAGE

PAGE 1 OF 7

Document ID: **2018032800731001** Document Date: 02-15-2018 Preparation Date: 04-02-2018
Document Type: SUNDRY MISCELLANEOUS
Document Page Count: 6

PRESENTER:

CHASE ABSTRACT, LLC
84-86 COLUMBIA AVENUE
CHA-11215772K
CEDARHURST, NY 11516
718-484-0631
LAURENF@CHASEABSTRACT.NET

RETURN TO:

ALLEN HERMAN ESQ
614 HEMPSTEAD GARDENS DRIVE
STE 100
WEST HEMPSTEAD, NY 11552

PROPERTY DATA

Borough	Block	Lot	Unit	Address
BROOKLYN	2269	1 Entire Lot		191 HARRISON AVENUE

Property Type: COMMERCIAL REAL ESTATE

CROSS REFERENCE DATA

CRFN_______ *or* DocumentID________ *or* _______ Year_____ Reel____ Page_____ *or* File Number__________

PARTIES

PARTY 1:
58 GERRY ST LLC
58 GERRY STREET
BROOKLYN, NY 11206

FEES AND TAXES

Mortgage :

Mortgage Amount:	$	0.00
Taxable Mortgage Amount:	$	0.00
Exemption:		
TAXES: County (Basic):	$	0.00
City (Additional):	$	0.00
Spec (Additional):	$	0.00
TASF:	$	0.00
MTA:	$	0.00
NYCTA:	$	0.00
Additional MRT:	$	0.00
TOTAL:	$	0.00
Recording Fee:	$	67.00
Affidavit Fee:	$	0.00

Filing Fee:	$	0.00
NYC Real Property Transfer Tax:	$	0.00
NYS Real Estate Transfer Tax:	$	0.00

RECORDED OR FILED IN THE OFFICE OF THE CITY REGISTER OF THE CITY OF NEW YORK

Recorded/Filed 04-04-2018 09:38
City Register File No.(CRFN):
2018000111646

1625

Annette M Hill

City Register Official Signature

CHA-11215772K

B-2269
L-1

DECLARATION of COVENANTS and RESTRICTIONS

THIS COVENANT is made the 15 day of February 2018, by 58 Gerry ST LLC, a limited liability company organized and existing under the laws of the State of New York and having an office for the transaction of business at 58 Gerry Street, Brooklyn, NY. 11206

WHEREAS, 58 Gerry is the subject of a Voluntary Cleanup Agreement executed by Pfizer Inc. as part of the New York State Department of Environmental Conservation's (the "Department's) Voluntary Cleanup Program, namely that parcel of real property located on 58 Gerry Street, Brooklyn, NY in the City of Brooklyn, New York, County of Kings, State of New York, which is part of lands conveyed by Pfizer Inc. to 58 Gerry ST LLC by deed dated 12/26/2016 and recorded in the Kings County Clerk's Office in Instrument No. 2017000022147, and being more particularly described in Appendix "A," attached to this declaration and made a part hereof, and hereinafter referred to as "the Property"; and

WHEREAS, the Department approved a remedy to eliminate or mitigate all significant threats to the environment presented by the contamination disposed at the Property and such remedy requires that the Property be subject to restrictive covenants.

NOW, THEREFORE, 58 Gerry ST LLC, for itself and its successors and/or assigns, covenants that:

First, the Property subject to this Declaration of Covenants and Restrictions is as shown on a map attached to this declaration as Appendix "B" and made a part hereof.

Second, unless prior written approval by the Department or, if the Department shall no longer exist, any New York State agency or agencies subsequently created to protect the environment of the State and the health of the State's citizens, hereinafter referred to as "the Relevant Agency," is first obtained, where contamination remains at the Property subject to the provisions of the Site Management Plan ("SMP"), there shall be no construction, use or occupancy of the Property that results in the disturbance or excavation of the Property which threatens the integrity of the engineering controls or which results in unacceptable human exposure to contaminated soils.

Third, the owner of the Property shall not disturb, remove, or otherwise interfere with the installation, use, operation, and maintenance of engineering controls required for the Remedy, which are described in the SMP, unless in each instance the owner first obtains a written waiver of such prohibition from the Department or Relevant Agency.

Fourth, the owner of the Property shall prohibit the Property from ever being used for purposes other than for Restricted Residential, Commercial or Industrial use if current land use is selected, enter current use without the express written waiver of such prohibition by the Department or Relevant Agency.

Fifth, the owner of the Property shall prohibit the use of the groundwater underlying the Property without treatment rendering it safe for drinking water or industrial purposes, as appropriate, unless the user first obtains permission to do so from the Department or Relevant Agency.

Sixth, the owner of the Property shall provide a periodic certification, prepared and submitted by a professional engineer or environmental professional acceptable to the Department or Relevant Agency, which will certify that the institutional and engineering controls put in place are unchanged from the previous certification, comply with the SMP, and have not been impaired.

Seventh, the owner of the Property shall continue in full force and effect any institutional and engineering controls required for the Remedy and maintain such controls, unless the owner first obtains permission to discontinue such controls from the Department or Relevant Agency, in compliance with the approved SMP, which is incorporated and made enforceable hereto, subject to modifications as approved by the Department or Relevant Agency.

Eighth, this Declaration is and shall be deemed a covenant that shall run with the land and shall be binding upon all future owners of the Property, and shall provide that the owner and its successors and assigns consent to enforcement by the Department or Relevant Agency of the prohibitions and restrictions that the Voluntary Cleanup Agreement requires to be recorded, and hereby covenant not to contest the authority of the Department or Relevant Agency to seek enforcement.

Ninth, any deed of conveyance of the Property, or any portion thereof, shall recite, unless the Department or Relevant Agency has consented to the termination of such covenants and restrictions, that said conveyance is subject to this Declaration of Covenants and Restrictions.

IN WITNESS WHEREOF, the undersigned has executed this instrument the day written below.

By: ______________________

Print Name: ABRAHAM [illegible]

Title: MEMBER Date: 2/15/18

STATE OF NEW YORK)

) s.s.:

COUNTY OF Kings)

On the 15th day of February, in the year 2018, before me, the undersigned, personally appeared Abraham Brach, personally known to me or proved to me on the basis of satisfactory evidence to be the individual(s) whose name is (are) subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their capacity(ies), and that by his/her/their signature(s) on the instrument, the individual(s), or the person upon behalf of which the individual(s) acted, executed the instrument.

Notary Public State of New York

CHAYA ABELESZ
NOTARY PUBLIC, State of New York
No. 01AB6139487
Qualified in Kings County
Commission Expires January 09, 2022

Exhibit A

LEGAL DESCRIPTION

PARCEL I

ALL THAT LOT, OR PARCEL OF LAND, IN THE BOROUGH OF BROOKLYN, COUNTY OF KINGS, CITY AND STATE OF NEW YORK, BOUNDED AND DESCRIBED AS FOLLOWS:

BEGINNING AT THE CORNER FORMED BY THE INTERSECTION OF THE NORTHWESTERLY SIDE OF BARTLETT STREET WITH THE NORTHEASTERLY SIDE OF HARRISON AVENUE;

RUNNING THENCE NORTHEASTERLY ALONG THE NORTHWESTERLY SIDE OF BARTLETT STREET, SEVENTY-FIVE (75) FEET;

THENCE NORTHWESTERLY PARALLEL WITH HARRISON AVENUE, ONE HUNDRED (100) FEET;

THENCE NORTHEASTERLY, PARALLEL WITH BARTLETT STREET, FIFTY (50) FEET;

THENCE AGAIN NORTHWESTERLY, PARALLEL WITH HARRISON AVENUE, ONE HUNDRED (100) FEET TO THE SOUTHEASTERLY SIDE OF GERRY STREET;

THENCE SOUTHWESTERLY, ALONG THE SOUTHEASTERLY SIDE OF GERRY STREET, TWENTY-FIVE (25) FEET;

THENCE SOUTHEASTERLY, AGAIN PARALLEL WITH HARRISON AVENUE, FIFTY (50) FEET;

THENCE SOUTHWESTERLY, PARALLEL WITH GERRY STREET, ONE HUNDRED (100) FEET TO THE NORTHEASTERLY SIDE OF HARRISON AVENUE; AND

THENCE SOUTHEASTERLY, ALONG THE NORTHEASTERLY SIDE OF HARRISON AVENUE, ONE HUNDRED AND FIFTY (150) FEET TO THE CORNER, THE POINT OR PLACE OF BEGINNING.

PARCEL II

ALL THAT LOT OR PARCEL OF LAND, IN THE BOROUGH OF BROOKLYN, COUNTY OF KINGS, CITY AND STATE OF NEW YORK, BOUNDED AND DESCRIBED AS FOLLOWS:

BEGINNING AT THE CORNER FORMED BY THE INTERSECTION OF THE SOUTHEASTERLY SIDE OF GERRY STREET WITH THE NORTHEASTERLY SIDE OF HARRISON AVENUE;

RUNNING THENCE NORTHEASTERLY, ALONG THE SOUTHEASTERLY SIDE OF GERRY STREET, ONE HUNDRED (100) FEET;

THENCE SOUTHEASTERLY, PARALLEL WITH HARRISON AVENUE, FIFTY (50) FEET;

THENCE SOUTHWESTERLY, PARALLEL WITH GERRY STREET, ONE HUNDRED (100) FEET TO THE NORTHEASTERLY SIDE OF HARRISON AVENUE; AND

THENCE NORTHWESTERLY, ALONG THE NORTHEASTERLY SIDE OF HARRISON AVENUE, FIFTY(50) FEET TO THE CORNER, THE POINT OR PLACE OF BEGINNING.

PARCEL IIIA

ALL THAT CERTAIN LOT (HEREINAFTER REFERRED TO AS "PARCEL IIIA"), PIECE OR PARCEL OF LAND, SITUATE, LYING AND BEING IN THE BOROUGH OF BROOKLYN, COUNTY OF KINGS, CITY AND STATE OF NEW YORK, BOUNDED AND DESCRIBED AS FOLLOWS, TO WIT:

BEGINNING AT A POINT ON THE NORTHWESTERLY SIDE OF BARTLETT STREET, DISTANT ONE HUNDRED AND TWENTY-FIVE (125) FEET NORTHEASTERLY FROM THE CORNER FORMED BY THE INTERSECTION OF THE NORTHWESTERLY SIDE OF BARTLETT STREET WITH THE NORTHEASTERLY SIDE OF HARRISON AVENUE;

RUNNING THENCE NORTHWESTERLY, PARALLEL WITH HARRISON AVENUE, ONE HUNDRED (100) FEET;

THENCE NORTHEASTERLY, PARALLEL WITH BARTLETT STREET TWENTY-FIVE (25) FEET;

THENCE SOUTHEASTERLY, AGAIN PARALLEL WITH HARRISON AVENUE ONE HUNDRED (100) FEET TO THE NORTHWESTERLY SIDE OF BARTLETT STREET, AND

THENCE SOUTHWESTERLY, ALONG THE NORTHWESTERLY SIDE OF BARTLETT STREET, TWENTY-FIVE (25) FEET TO THE POINT OR PLACE OF BEGINNING.

PARCEL IIIB

ALL THAT CERTAIN LOT (HEREINAFTER REFERRED TO AS "PARCEL IIIB"), PIECE OR PARCEL OF LAND, SITUATE, LYING AND BEING IN THE BOROUGH OF BROOKLYN, COUNTY OF KINGS, CITY AND STATE OF NEW YORK, BOUNDED AND DESCRIBED AS FOLLOWS, TO WIT:

BEGINNING AT A POINT ON THE SOUTHERLY SIDE OF GERRY STREET, DISTANT ONE HUNDRED AND TWENTY-FIVE (125) FEET EASTERLY FROM THE CORNER FORMED BY THE INTERSECTION OF THE EASTERLY SIDE OF HARRISON AVENUE, WITH THE SOUTHERLY SIDE OF GERRY STREET;

RUNNING THENCE SOUTHERLY PARALLEL WITH HARRISON AVENUE ONE HUNDRED (100) FEET;

THENCE EASTERLY PARALLEL WITH GERRY STREET TWENTY-FIVE (25) FEET;

THENCE NORTHERLY PARALLEL WITH HARRISON AVENUE ONE HUNDRED (100) FEET TO THE SOUTHERLY SIDE OF GERRY STREET; AND

THENCE WESTERLY ALONG THE SOUTHERLY SIDE OF GERRY STREET TWENTY-FIVE (25) FEET TO THE POINT OR PLACE OF BEGINNING.

PARCEL IV

ALL THAT CERTAIN PLOT, PIECE OR PARCEL OF LAND, SITUATE, LYING AND BEING IN THE BOROUGH OF BROOKLYN, COUNTY OF KINGS, CITY AND STATE OF NEW YORK, BOUNDED AND DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT ON THE SOUTHERLY SIDE OF GERRY STREET DISTANT ONE HUNDRED FIFTY (150) FEET EASTERLY FROM THE CORNER FORMED BY THE INTERSECTION OF THE SOUTHERLY SIDE OF GERRY STREET WITH THE EASTERLY SIDE OF HARRISON AVENUE;

RUNNING THENCE SOUTHERLY PARALLEL WITH HARRISON AVENUE ONE HUNDRED (100) FEET;

THENCE EASTERLY PARALLEL WITH GERRY STREET TWENTY-FIVE (25) FEET;

THENCE NORTHERLY PARALLEL WITH HARRISON AVENUE ONE HUNDRED (100) FEET TO THE SOUTHERLY SIDE OF GERRY STREET; AND

THENCE WESTERLY ALONG THE SOUTHERLY SIDE OF GERRY STREET TWENTY-FIVE (25) FEET TO THE POINT OR PLACE OF BEGINNING.

PARCEL V

ALL THAT CERTAIN PLOT, PIECE OR PARCEL OF LAND, SITUATE, LYING AND BEING IN THE BOROUGH OF BROOKLYN, COUNTY OF KINGS, CITY AND STATE OF NEW YORK, BOUNDED AND DESCRIBED AS FOLLOWS:

BEGINNING AT A POINT ON THE SOUTHERLY SIDE OF GERRY STREET DISTANT ONE HUNDRED SEVENTY-FIVE (175) FEET EASTERLY FROM THE SOUTHEASTERLY CORNER OF GERRY STREET AND HARRISON AVENUE;

RUNNING THENCE SOUTHERLY PARALLEL WITH HARRISON AVENUE ONE HUNDRED (100) FEET;

THENCE EASTERLY PARALLEL WITH GERRY STREET TWENTY-FIVE (25) FEET;

THENCE NORTHERLY AGAIN PARALLEL WITH HARRISON AVENUE ONE HUNDRED (100) FEET TO THE SOUTHERLY SIDE OF GERRY STREET; AND

THENCE WESTERLY ALONG THE SOUTHERLY SIDE OF GERRY STREET TWENTY-FIVE (25) FEET TO THE POINT OR PLACE OF BEGINNING.

Being the same land conveyed to the parties by those certain deeds recorded on: April 5, 1941 in Liber 6004 Cp 98 as to Parcel I; September 12, 1944 in Liber 6585 Cp 539 as to Parcel II; July 13, 1945 in Liber 6741 Cp 17 as to Parcels IIIA & IIIB; August 28, 1959 in Liber 8755 Cp 41 as to Parcel IV; and February 25, 1965 in Liber 9357 Cp 106 as to Parcel V.

APPENDIX B

List of Site Contacts

APPENDIX B – LIST OF SITE CONTACTS

Name	**Phone/Email Address**
Site Owner: Howard Schneider, Esq. (58 Gerry St LLC)	(917) 561-2289 Hschneider4@aol.com (email)
Owner Representative/Consultant: David M. Winslow (GZA GeoEnvironmental, Inc.)	(973) 774-3307 (office) (347) 242-7107 (mobile) david.winslow@gza.com (email)
Remedial Party: Pfizer Inc	(917) 375-2319 (mobile) barbara.wong@pfizer.com(email)
Qualified Environmental Professional: Charlie McGuckin, P.E. (Remedial Engineering, P.C.)	(631) 232-2600 (office) (631) 921-6857 (mobile) cmcguckin@rouxinc.com (email)
Project Manager: Jordanna Kendrot (Remedial Engineering, P.C.)	(631) 232-2600 (office) (631) 741-7142 (mobile) jkendrot@rouxinc.com (email)
NYSDEC DER Project Manager: Man-tsz Yau	(718) 482-4897 (office) man-tzyu.yau@dec.ny.gov (email)
NYSDEC Regional Remediation Engineer: Jane O’Connell	(718) 482-4995 (office) jane.oconnell@dec.ny.gov (email)
NYSDEC Site Control: Kelly Lewandowski	(518) 402-9553 (office) kelly.lewandowski@dec.ny.gov (email)

* Note: Contact numbers are subject to change and should be updated as necessary.

APPENDIX C

Survey Map, Metes and Bounds

DESCRIPTION OF REAL PROPERTY

KNOWN AS

KINGS COUNTY TAX MAP, BLOCK 2269, LOT 1

SITE D

All that certain piece or parcel of land situated at Williamsburg, Borough of Brooklyn, County of Kings and State of New York, said parcel being more particularly bounded and described as follows:

BEGINNING at the corner formed by the intersection of the southerly line of Gerry Street with the easterly line of Harrison Avenue;

RUNNING THENCE from said point of beginning the following ten (10) courses, the first course being along the southerly line of Gerry Street;

1. Easterly a distance of 200.00 feet;
2. THENCE southerly and at right angles to Gerry Street, a distance of 100.00 feet
3. THENCE westerly and at right angles to the previous course, a distance of 50.00 feet;
4. THENCE southerly and at right angles to Bartlett Street, a distance of 100.00 feet to the northerly line of Bartlett Street;
5. THENCE westerly along the northerly line of Bartlett Street, a distance of 25.00 feet;
6. THENCE northerly and at right angles to Bartlett Street, a distance of 100.00 feet;
7. THENCE westerly and at right angles to the previous course, a distance of 49.67 feet;
8. THENCE southerly and at right angles to Bartlett Street, a distance of 100.00 feet to the northerly line of Bartlett Street;
9. THENCE westerly along the northerly line of Bartlett Street, a distance of 75.33 feet to the corner formed by the intersection of the northerly line of Bartlett Street and the easterly line of Harrison Avenue;
10. THENCE northerly along the easterly line of Harrison Avenue, a distance of 200.00 feet to the point or place of BEGINNING.

Containing within said bounds 30,033 Sq. Ft. or 0.689 Acres, more or less.

APPENDIX D

Responsibilities of Owner and Remedial Party

APPENDIX D – RESPONSIBILITIES of OWNER and REMEDIAL PARTY

Responsibilities

The responsibilities for implementing the Site Management Plan ("SMP") for the Former Pfizer Inc Site D site (the "site"), number V00350, are divided between the site owner(s) and a Remedial Party, as defined below. The owner(s) is currently listed as (the "owner"):

58 Gerry St LLC
Howard Schneider, Esq.
173 Wallabout Street
Brooklyn, New York 11206
Phone 917-561-2289
Facsimile 718-599-3892
E-Mail Address: Hschneider4@aol.com

Solely for the purposes of this document and based upon the facts related to a particular site and the remedial program being carried out, the term Remedial Party ("RP") refers to any of the following: certificate of completion holder, volunteer, applicant, responsible party, and, in the event the New York State Department of Environmental Conservation ("NYSDEC") is carrying out remediation or site management, the NYSDEC and/or an agent acting on its behalf. The RP is:

Pfizer Inc
100 Route 206 North - MS401
Peapack, New Jersey 07977
(917) 375-2319 (mobile)
barbara.wong@pfizer.com

Nothing on this page shall supersede the provisions of an Environmental Easement, Consent Order, Consent Decree, agreement, or other legally binding document that affects rights and obligations relating to the site.

Site Owner's Responsibilities:

1) The owner shall follow the provisions of the SMP as they relate to future construction and excavation at the site.

2) In accordance with a periodic time frame determined by the NYSDEC, the owner shall periodically certify, in writing, that all Institutional Controls set forth in a(n)

Deed Restriction remain in place and continue to be complied with. The owner shall provide a written certification to the RP, upon the RP's request, in order to allow the RP to include the certification in the site's Periodic Review Report (PRR) certification to the NYSDEC.

3) In the event the site is delisted, the owner remains bound by the Deed Restriction and shall submit, upon request by the NYSDEC, a written certification that the Deed Restriction is still in place and has been complied with.

4) The owner shall grant access to the site to the RP and the NYSDEC and its agents for the purposes of performing activities required under the SMP and assuring compliance with the SMP.

5) The owner is responsible for assuring the security of the remedial components located on its property to the best of its ability. In the event that damage to the remedial components or vandalism is evident, the owner shall notify the site's RP and the NYSDEC in accordance with the timeframes indicated in Section 1.3-Notifications.

6) In the event some action or inaction by the owner adversely impacts the site, the owner must notify the site's RP and the NYSDEC in accordance with the time frame indicated in Section 1.3- Notifications and (ii) coordinate the performance of necessary corrective actions with the RP.

7) The owner must notify the RP and the NYSDEC of any change in ownership of the site property (identifying the tax map numbers in any correspondence) and provide contact information for the new owner of the site property. 6 NYCRR Part contains notification requirements applicable to any construction or activity changes and changes in ownership. Among the notification requirements is the following: Sixty days prior written notification must be made to the NYSDEC. Notification is to be submitted to the NYSDEC Division of Environmental Remediation's Site Control Section. Notification requirements for a change in use are detailed in Section 2.4 of the SMP. A 60-Day Advance Notification Form and Instructions are found at http://www.dec.ny.gov/chemical/76250.html.

8) Prior to a change in use that impacts the remedial system or requirements and/or responsibilities for implementing the SMP, the site owner shall submit to the NYSDEC for approval an amended SMP.

9) In accordance with the tenant notification law, within 15 days of receipt, the owner must supply a copy of any vapor intrusion data, that is produced with respect to structures and that exceeds NYSDOH or OSHA guidelines on the site, whether produced by the NYSDEC, RP, or owner, to the tenants on the property. The owner must otherwise comply with the tenant and occupant notification provisions of Environmental Conservation Law Article 27, Title 24.

10) If the NYSDEC determines that an update of the SMP is necessary, the site owner shall update the SMP and obtain final approval from the NYSDEC. Within 5 business days after NYSDEC approval, the site owner shall submit a copy of the approved SMP to the RP.

11) The site owner shall report to the NYSDEC all activities required for remediation, operation, maintenance, monitoring, and reporting. Such reporting includes, but is not limited to, periodic review reports and certifications, electronic data deliverables, corrective action work plans and reports, and updated SMPs.

Remedial Party Responsibilities

1) The RP must follow the SMP provisions regarding any construction and/or excavation it undertakes at the site.

2) The RP shall report to the NYSDEC all activities required for groundwater remediation, monitoring, and reporting as detailed in Section 4.4 of the SMP. Such reporting includes, but is not limited to, electronic data deliverables, ISCO injection work plans and reports, and other reporting associated with the treatment of residuals in groundwater at Former Site D. Before accessing the site property to undertake a specific activity, the RP shall provide the owner advance notification that shall include an explanation of the work expected to be completed. The RP shall provide to (i) the owner, upon the owner's request, (ii) the NYSDEC, and (iii) other entities, if

required by the SMP, a copy of any data generated during the site visit and/or any final report produced.

Change in RP ownership and/or control and/or site ownership does not affect the RP's obligations with respect to the site unless a legally binding document executed by the NYSDEC releases the RP of its obligations.

Future site owners and RPs and their successors and assigns are required to carry out the activities set forth above.

APPENDIX E

Monitoring Well Boring and Construction Logs

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting
& Management

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898

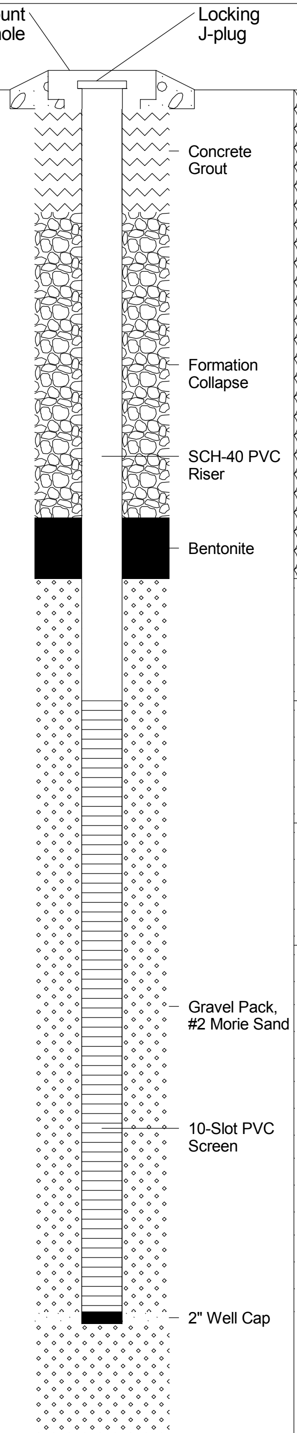
Page **1** of **1**

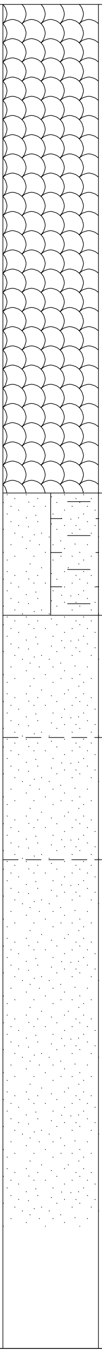
WELL CONSTRUCTION LOG

WELL LOCATION SKETCH MAP

N

WELL NO. **MW-8**	NORTHING **5685.7**	EASTING **5817.1**		
PROJECT NO./NAME **04744Y08 / Site B**		LOCATION **Gerry Street and Harrison Avenue** **Brooklyn, New York**		
APPROVED BY **O. Ramotar**	LOGGED BY **B. Ben-Eliezer**			
DRILLING CONTRACTOR/DRILLER **ADT / Jeremy Meyers**		GEOGRAPHIC AREA **Site B**		
DRILL BIT DIAMETER/TYPE **4.25-in. / Auger**	BOREHOLE DIAMETER **8-inches**	DRILLING EQUIPMENT/METHOD **F-10 / HSA**	SAMPLING METHOD **2" Split Spoon**	START-FINISH DATE **3/25/04-3/26/04**
CASING MAT./DIA. **SCH 40 PVC / 2-inch**	SCREEN: TYPE **Slotted**	MAT. **SCH 40 PVC** TOTAL LENGTH **10.0**ft	DIA. **2-inch**	SLOT SIZE **10-Slot**
ELEVATION OF: (Feet)	GROUND SURFACE **13.18**	TOP OF WELL CASING **12.93**	TOP & BOTTOM SCREEN **3.2 / -6.8**	GRAVEL PACK SIZES **Morie #02**





Depth, feet	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
5	Brown fine to coarse Sand and Silt and red Brick, some Cinders, some Gravel (Fill); moist			Lithology for 0 to 8 ft bls recorded from auger cuttings.
10	Brown and gray mottled fine to medium SAND, some Silt; moist		0.7	
	Brown medium to coarse SAND, trace fine Sand; wet		1.4	
	Brown medium to coarse SAND, trace fine Sand, trace Silt; wet		4.9	
15 20	Brown medium to coarse SAND, trace fine Sand; wet		5.3	
				Bottom of borehole at 22 ft bls.

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management

209 Shafter Street
Islandia, NY 11749
Telephone: (631) 232-2600
Fax: (631) 232-9898

Page **1** of **1**

WELL CONSTRUCTION LOG

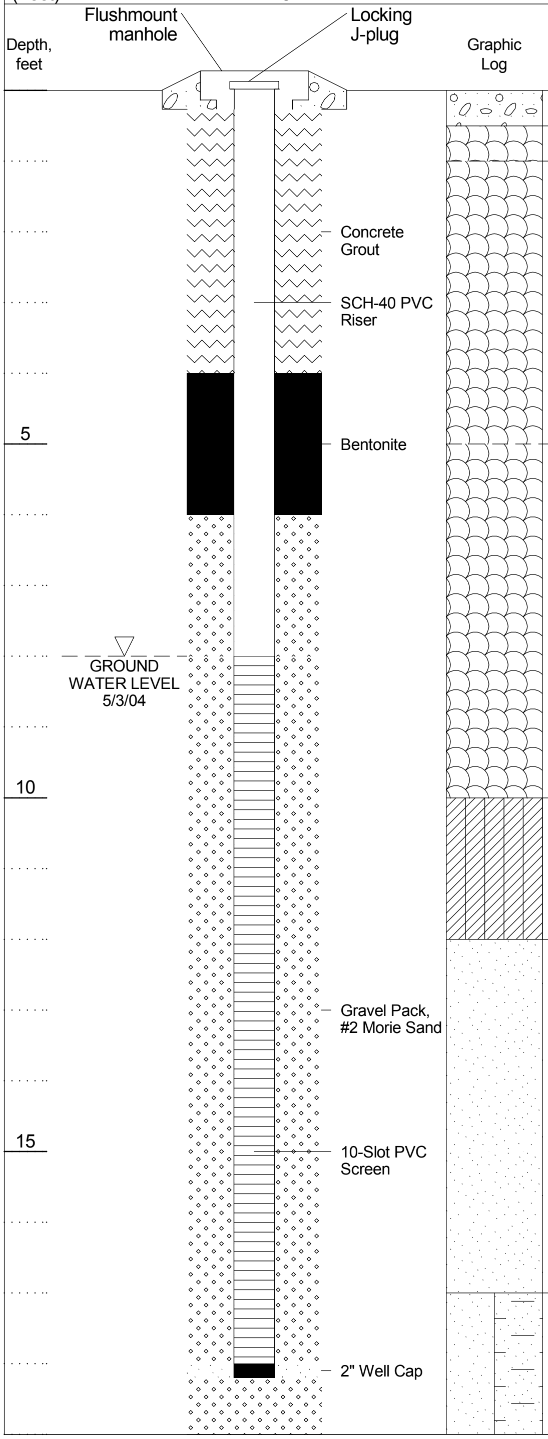
WELL NO. **MW-9**	NORTHING **5436.5**	EASTING **5699.2**	
PROJECT NO./NAME **04744Y08 / Site B**		LOCATION **Gerry Street and Harrison Avenue** **Brooklyn, New York**	
APPROVED BY **O. Ramotar**	LOGGED BY **M. Maltese**		
DRILLING CONTRACTOR/DRILLER **ADT / Jeremy Meyers**		GEOGRAPHIC AREA **Site B**	
DRILL BIT DIAMETER/TYPE **4.25-in. / Auger**	BOREHOLE DIAMETER **10-inches**	DRILLING EQUIPMENT/METHOD **CME-75 / HSA**	SAMPLING METHOD **2" Split Spoon**
START-FINISH DATE **5/3/04-5/3/04**			

WELL LOCATION SKETCH MAP

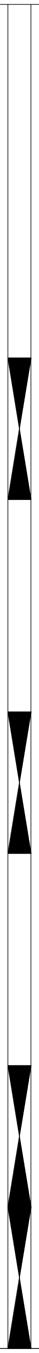
N

CASING MAT./DIA. **SCH 40 PVC / 2-inch**
SCREEN: TYPE **Slotted** MAT. **SCH 40 PVC** TOTAL LENGTH **10.0**ft DIA. **2-inch** SLOT SIZE **10-Slot**

ELEVATION OF: (Feet)	GROUND SURFACE	TOP OF WELL CASING	TOP & BOTTOM SCREEN	GRAVEL PACK SIZES
	11.70	**11.42**	**3.7 / -6.3**	**Morie #02**



Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
Concrete			Utility clearance from 0-5 ft bls.
GRAVEL Fill; moist			
Brown fine to coarse SAND, some Gravel, little small Cobbles, trace Brick (Fill); moist			
Brown fine to medium SAND, trace Gravel, trace Brick (Fill); moist to wet			
Greenish brown sitly CLAY, trace brown fine Sand; wet			
Brown to dark brown fine to medium SAND, trace Silt; wet			
Brown fine to medium SAND, some Silt; wet			Bottom of boring at 19 ft bls.



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WELL LOCATION SKETCH MAP

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WELL CONSTRUCTION LOG

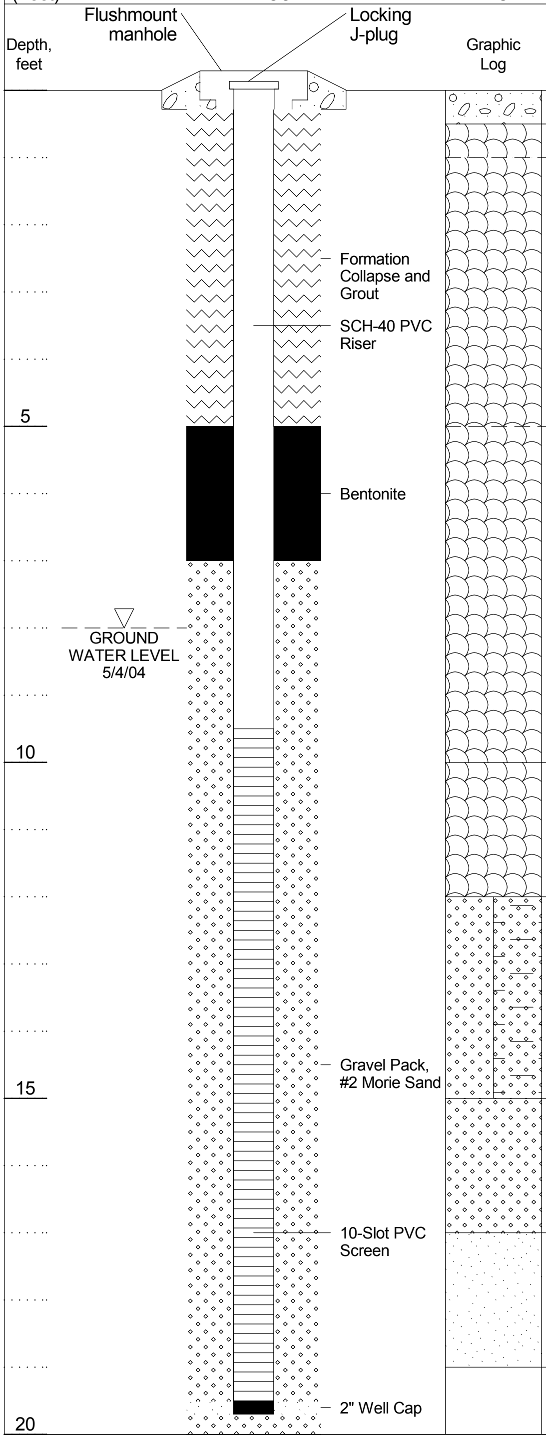
WELL NO. **MW-10**	NORTHING **5490.3**	EASTING **5788.1**
PROJECT NO./NAME **04744Y08 / Site B**		LOCATION **Gerry Street and Harrison Avenue** **Brooklyn, New York**
APPROVED BY **O. Ramotar**	LOGGED BY **B. Ben-Eliezer**	
DRILLING CONTRACTOR/DRILLER **ADT / Victor Champagne**		GEOGRAPHIC AREA **Site B**

DRILL BIT DIAMETER/TYPE **4.25-in. / Auger**	BOREHOLE DIAMETER **10-inches**	DRILLING EQUIPMENT/METHOD **CME LC-60 / HSA**	SAMPLING METHOD **2" Split Spoon**	START-FINISH DATE **5/4/04-5/4/04**

CASING MAT./DIA.
SCH 40 PVC / 2-inch

SCREEN:
TYPE **Slotted** MAT. **SCH 40 PVC** TOTAL LENGTH **10.0**ft DIA. **2-inch** SLOT SIZE **10-Slot**

ELEVATION OF: (Feet)	GROUND SURFACE **12.60**	TOP OF WELL CASING **12.37**	TOP & BOTTOM SCREEN **3.1 / -6.9**	GRAVEL PACK SIZES **Morie #02**



Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
CONCRETE			Utility clearance from 0 to 5 ft bls.
GRAVEL (Fill)			
Brown fine to coarse SAND, some Gravel, little small Cobbles, trace Brick; moist			
Brown fine to medium SAND, trace Gravel, trace Brick; moist to wet			Lithology for 0-10 ft bls obtained from MW-9.
Brown fine to coarse SAND, some Brick, some Gravel, trace Silt (Fill); moist	2 2 3 6		
Gray to brown fine to medium SAND, some Silt, some Gravel; wet		0.8	
Gray to brown medium to coarse SAND, little fine Sand, trace Gravel; wet	WOH WOH 5 5	20.7	
Grayish brown fine to medium SAND, trace coarse Sand, trace Silt; wet	3 5 6 6	1.3	
			Bottom of borehole at 20 ft bls.

BORING/FEET COPY OF COPY OF COPY OF COPY OF 04744Y08.GPJ ROUX.GDT 5/4/17

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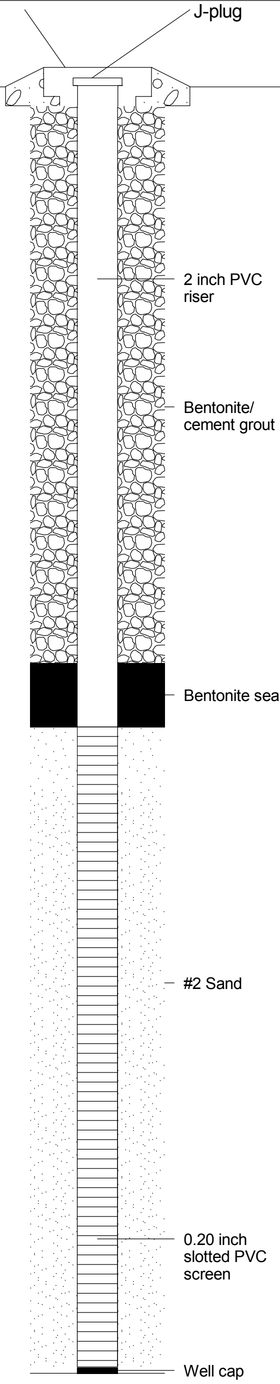
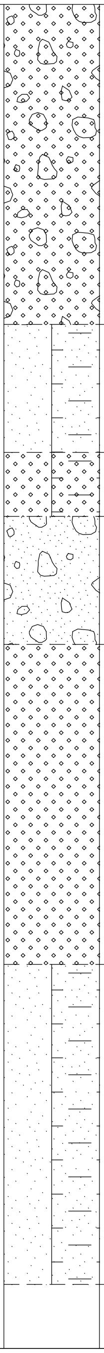
WELL CONSTRUCTION LOG

WELL NO. **MW-16R**	NORTHING **Not Measured**	EASTING **Not Measured**		
PROJECT NO./NAME **0047.0044Y042 / Pfizer Site B and Site D**		LOCATION **60-66 Gerry Street/ 191 Harrison Avenue** **Brooklyn, New York**		
APPROVED BY	LOGGED BY **A. Muscietta**			
DRILLING CONTRACTOR/DRILLER **Trinity / J. Sekelis**		GEOGRAPHIC AREA		
DRILL BIT DIAMETER/TYPE **/ Drive Sampler**	BOREHOLE DIAMETER **8-inches**	DRILLING EQUIPMENT/METHOD **/ Geoprobe**	SAMPLING METHOD **2" Macro-Core**	START-FINISH DATE **8/10/15-8/12/15**
CASING MAT./DIA. **PVC / 2-inch**	SCREEN: TYPE **Slotted**	MAT. **PVC** TOTAL LENGTH **10.0**ft	DIA. **2-inch**	SLOT SIZE **20-Slot**
ELEVATION OF: (Feet)	GROUND SURFACE	TOP OF WELL CASING	TOP & BOTTOM SCREEN /	GRAVEL PACK SIZES **#2**





Depth, feet	Visual Description	Blow Counts per 6"		PID Values (ppm)	REMARKS
	Medium brown, fine to medium SAND, some Gravel, little Cobble; moist.		G	0.2	Handcleared to 5' bls
5	Dark brown, fine SAND and SILT, some medium to coarse SAND, little Gravel, trace Brick; very moist.			6.5	
	Light to dark grey, fine to coarse SAND, some Silt, trace Clay; moist.			4.5	
	Light brown, coarse SAND with GRAVEL, some fine to medium SAND, trace Silt; wet.			10.7	
10	Dark brown, medium to coarse SAND, some fine Sand, trace Gravel; wet.			3.4 5.0	
15	Dark brown, fine SAND with SILT, little medium to coarse Sand and Clay; wet.			2.5 3.2	
20					

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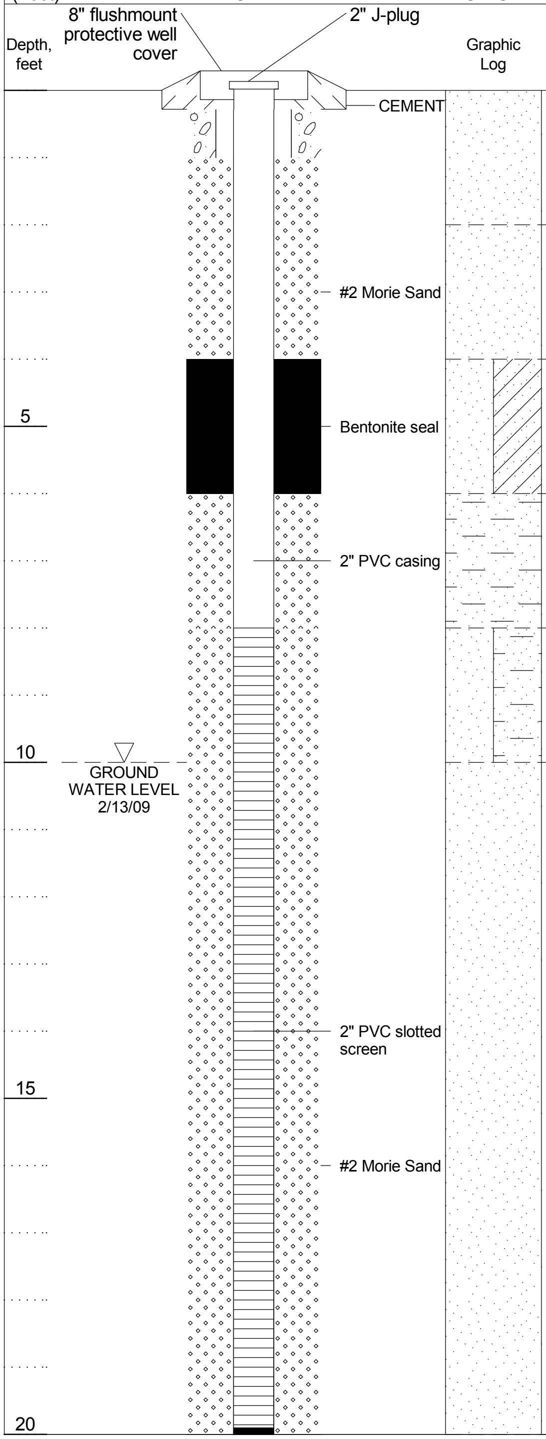
WELL CONSTRUCTION LOG

WELL NO. **MW-18**	NORTHING **5692.2**	EASTING **5586.1**		
PROJECT NO./NAME **0047.0044Y030 / Pfizer - Site B**		LOCATION **73-87 Gerry Street** **Brooklyn, New York**		
APPROVED BY **R. Kovacs**	LOGGED BY **C. Roth**			
DRILLING CONTRACTOR/DRILLER **Aquifer Drilling and Testing / Juri Kamenicek**		GEOGRAPHIC AREA **Wallabout Street**		
DRILL BIT DIAMETER/TYPE **4.25 / Auger**	BOREHOLE DIAMETER **8-inches**	DRILLING EQUIPMENT/METHOD **Geoprobe 6620DT / HSA**	SAMPLING METHOD **2" Macro-Core**	START-FINISH DATE **2/13/09-2/13/09**
CASING MAT./DIA. **SCH 40 PVC / 2-inch**	SCREEN: TYPE **Slotted**	MAT. **SCH 40 PVC** TOTAL LENGTH **12.0**ft	DIA. **2-inch**	SLOT SIZE **20-Slot**
ELEVATION OF: (Feet)	GROUND SURFACE **9.71**	TOP OF WELL CASING **9.43**	TOP & BOTTOM SCREEN **1.7 / -10.3**	GRAVEL PACK SIZES **Morie #2**



Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
Brown to red, medium to coarse SAND, little fine Sand, trace cobble; moist.		0.3	0 to 5 ft bls cleared for subsurface utilities using hand digging methods.
Brown, medium SAND; moist.		0.0	
Brown, fine SAND, some Clay; moist.		0.0	
Gray to dark gray, SILT and fine Sand; moist.		0.0	
Brown to red, fine SAND, little Silt and medium Sand; moist to wet.		0.1	
Brown, fine to medium SAND; wet.		0.0	
		0.0	
		0.0	
		0.0	
			Bottom of boring at 20 ft bls.

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WELL LOCATION SKETCH MAP

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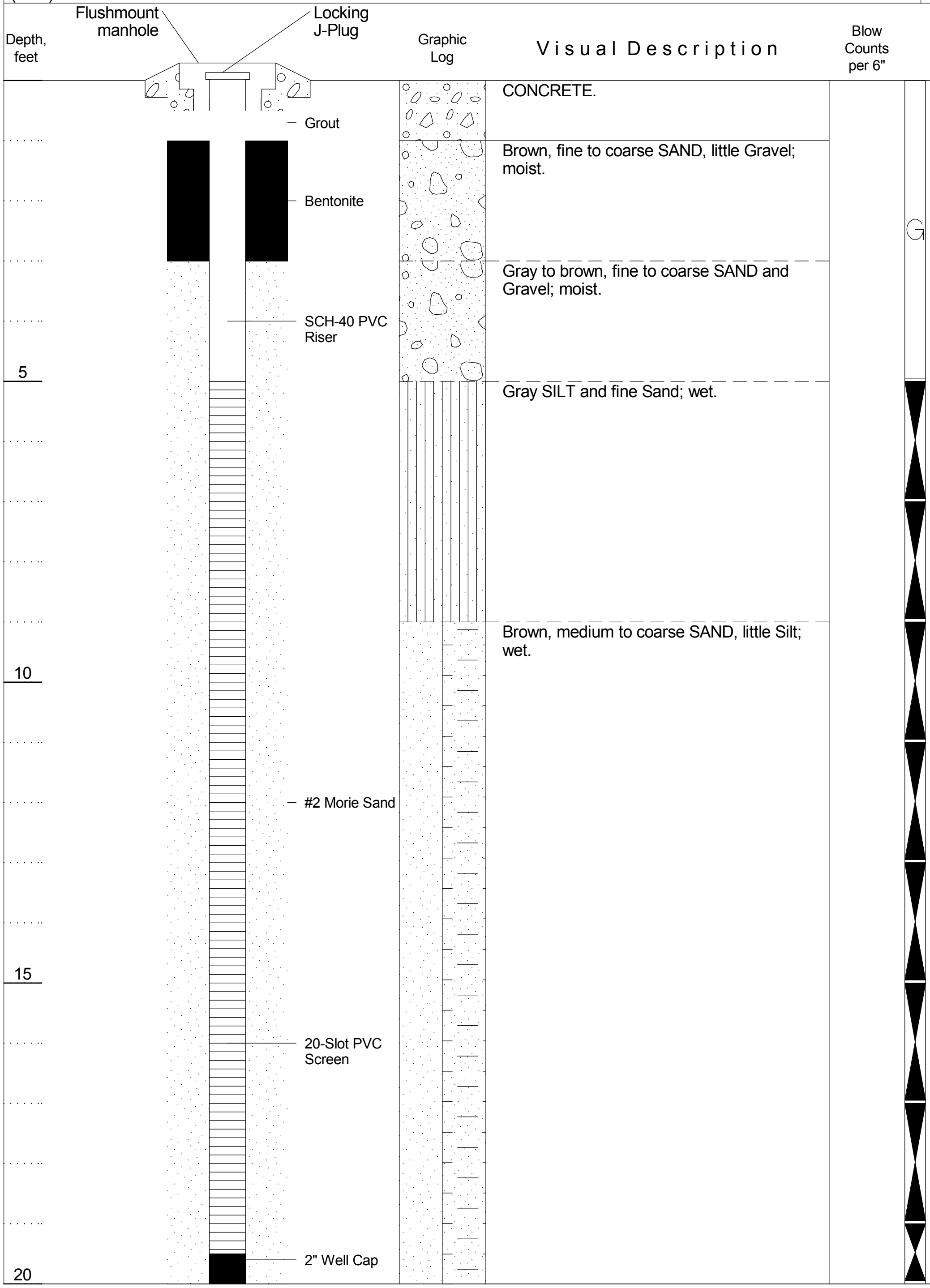
WELL CONSTRUCTION LOG

WELL NO. **MW-19**	NORTHING **5580.4**	EASTING **5822.1**
PROJECT NO./NAME **0047.0044Y035 / Pfizer Site B**		LOCATION **191 Harrison Avenue** **Brooklyn, New York**
APPROVED BY **J. Wills**	LOGGED BY **C. Roth**	
DRILLING CONTRACTOR/DRILLER **ADT / J. Kamenicek**		GEOGRAPHIC AREA **Arlington Press**

DRILL BIT DIAMETER/TYPE **4.25 inches / Auger**	BOREHOLE DIAMETER **8-inches**	DRILLING EQUIPMENT/METHOD **Geoprobe 6610 DT / Geoprobe**	SAMPLING METHOD **2" Macro-Core**	START-FINISH DATE **8/9/10-8/9/10**

CASING MAT./DIA. **SCH 40 PVC / 2-inch**
SCREEN: TYPE **Slotted** MAT. **SCH 40 PVC** TOTAL LENGTH **15.0**ft DIA. **2-inch** SLOT SIZE **20-Slot**

ELEVATION OF: (Feet)	GROUND SURFACE	TOP OF WELL CASING	TOP & BOTTOM SCREEN	GRAVEL PACK SIZES
	13.13	**12.62**	**8.1 / -6.9**	**Morie #2**



Visual Description	REMARKS
CONCRETE.	Hand cleared to 5 feet bls.
Brown, fine to coarse SAND, little Gravel; moist.	
Gray to brown, fine to coarse SAND and Gravel; moist.	
Gray SILT and fine Sand; wet.	
Brown, medium to coarse SAND, little Silt; wet.	

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WELL LOCATION SKETCH MAP

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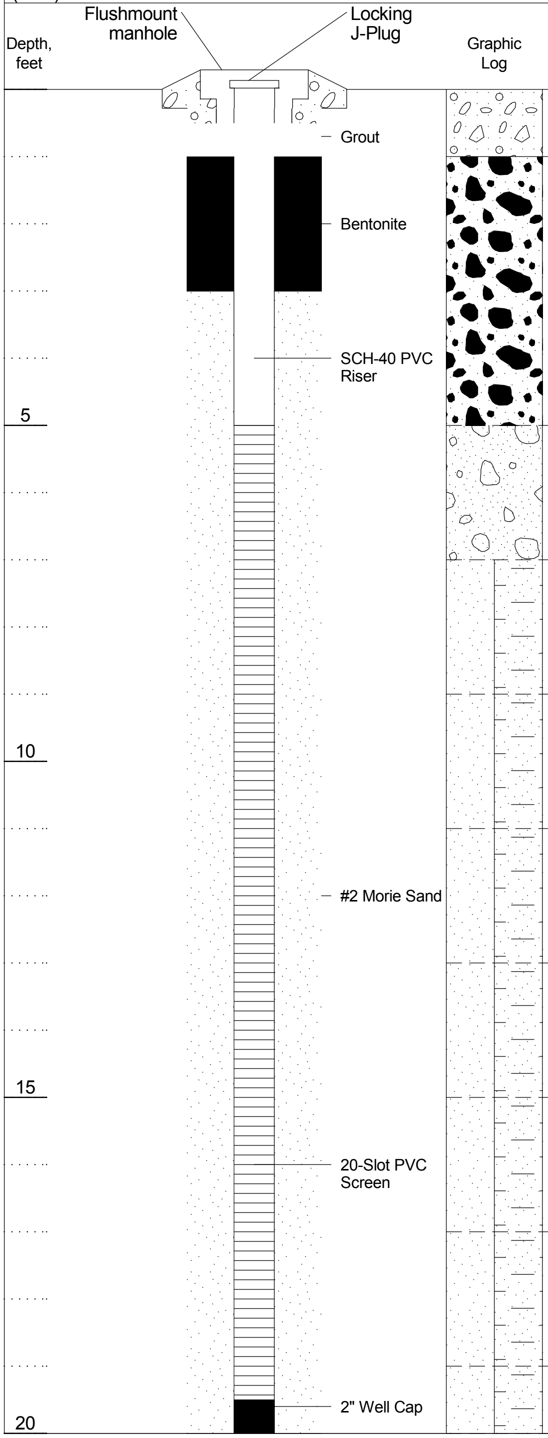
WELL CONSTRUCTION LOG

WELL NO. **MW-20**	NORTHING **5486.7**	EASTING **5774.7**		
PROJECT NO./NAME **0047.0044Y035 / Pfizer Site B**		LOCATION **191 Harrison Avenue** **Brooklyn, New York**		
APPROVED BY **J. Wills**	LOGGED BY **C. Roth**			
DRILLING CONTRACTOR/DRILLER **ADT / A. Babel**		GEOGRAPHIC AREA **Arlington Press**		
DRILL BIT DIAMETER/TYPE **4.25 inches / Auger**	BOREHOLE DIAMETER **8-inches**	DRILLING EQUIPMENT/METHOD **Geoprobe 6610 DT / Geoprobe**	SAMPLING METHOD **2" Macro-Core**	START-FINISH DATE **8/11/10-8/11/10**
CASING MAT./DIA. **SCH 40 PVC / 2-inch**	SCREEN: TYPE **Slotted**	MAT. **SCH 40 PVC** TOTAL LENGTH **15.0**ft	DIA. **2-inch**	SLOT SIZE **20-Slot**
ELEVATION OF: (Feet)	GROUND SURFACE **12.48**	TOP OF WELL CASING **12.30**	TOP & BOTTOM SCREEN **7.5 / -7.5**	GRAVEL PACK SIZES **Morie #2**



Visual Description	Blow Counts per 6"	PID/ FID Values (ppm)	REMARKS
CONCRETE.			Hand cleared to 5 feet bls.
GRAVEL and brown fine to coarse Sand; moist.	G	0.4/1.1 0.1/1.3	
Brown, fine to coarse SAND, little Gravel and Silt; moist to wet.		0.2/0.9	
Brown to tan, fine to medium SAND, some Silt; moist to wet.		0.3/0.1	
Gray to black, fine to medium SAND and Silt; wet.		0.0/0.2	
Black, fine to medium SAND, little Silt and Gravel; wet.		1.0/1.1	
Brown, fine to coarse SAND, little Silt; wet.		0.2/0.1	
Brown, medium SAND, little Silt; wet.		0.0/0.0	
Brown, medium to coarse SAND, little Silt; wet.		1.0/1.7	
Brown, medium to fine SAND, little Silt; wet.		1.0/1.1	

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WELL CONSTRUCTION LOG

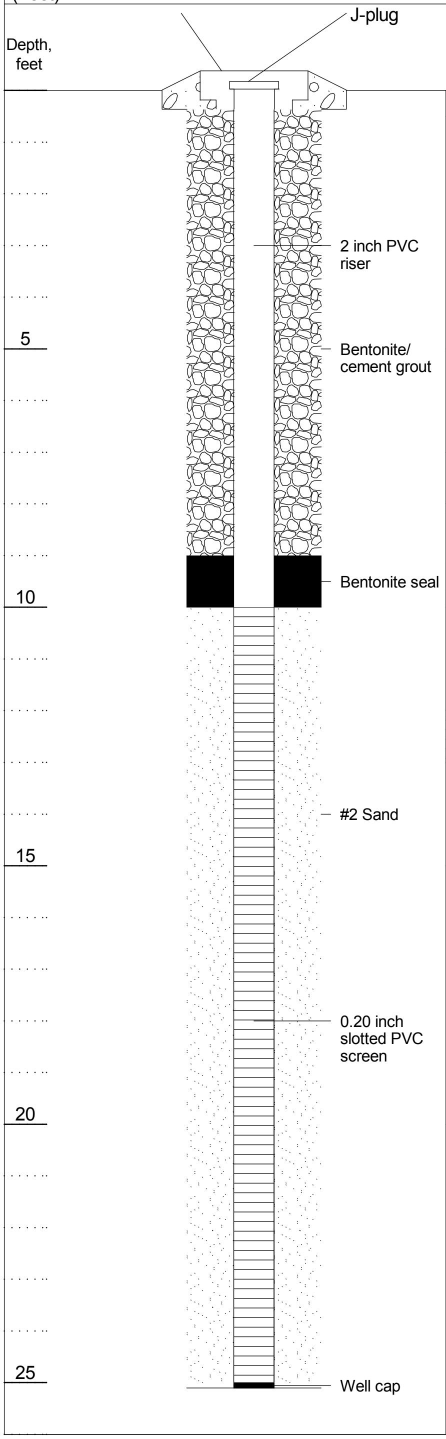
WELL NO. **MW-21**	NORTHING **Not Measured**	EASTING **Not Measured**
PROJECT NO./NAME **0047.0044Y042 / Pfizer Site B and Site D**		LOCATION **60-66 Gerry Street/ 191 Harrison Avenue** **Brooklyn, New York**
APPROVED BY	LOGGED BY **A. Muscietta**	
DRILLING CONTRACTOR/DRILLER **Trinity / J. Sekelis**		GEOGRAPHIC AREA

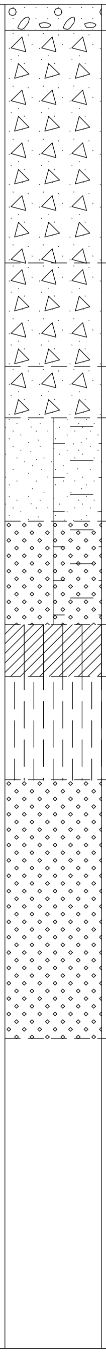
DRILL BIT DIAMETER/TYPE **/ Drive Sampler**	BOREHOLE DIAMETER **8-inches**	DRILLING EQUIPMENT/METHOD **/ Geoprobe**	SAMPLING METHOD **2" Macro-Core**	START-FINISH DATE **8/10/15-8/11/15**

CASING MAT./DIA. **PVC / 2-inch**

SCREEN: TYPE **Slotted** MAT. **PVC** TOTAL LENGTH **15.0**ft DIA. **2-inch** SLOT SIZE **20-Slot**

ELEVATION OF: (Feet)	GROUND SURFACE	TOP OF WELL CASING	TOP & BOTTOM SCREEN **/**	GRAVEL PACK SIZES **#2**





Visual Description	Blow Counts per 6"		PID Values (ppm)	REMARKS
Concrete				Handcleared to 5' bls
Brown, fine to medium SAND, some Gravel, some Cobbles, (fill); moist.		G	15.1	
Light brown, fine to medium SAND, some Silt, little Gravel, trace Brick, (fill); moist.				
Dark grey, coarse SAND and GRAVEL, little Silt, trace Ash, (fill); moist.				
Dark brown, fine SAND and SILT, little Clay, trace Gravel; moist.				
Light brown, fine to medium SAND, some Silt, little Gravel; moist.				
Dark grey, SILT and CLAY, little fine Sand; moist.				
Blue-green grey, Clay with Organics, little Silt; moist.				
Light brown, medium to coarse SAND, some fine Sand, little Silt; wet.				

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WELL CONSTRUCTION LOG

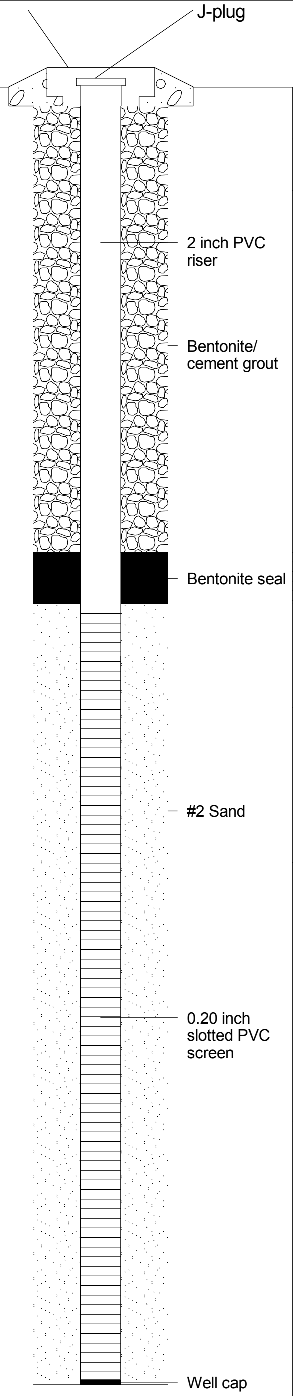
WELL NO. **MW-22**	NORTHING **Not Measured**	EASTING **Not Measured**
PROJECT NO./NAME **0047.0044Y042 / Pfizer Site B and Site D**		LOCATION **60-66 Gerry Street/ 191 Harrison Avenue** **Brooklyn, New York**
APPROVED BY	LOGGED BY **A. Muscietta**	
DRILLING CONTRACTOR/DRILLER **Trinity / J. Sekelis**		GEOGRAPHIC AREA

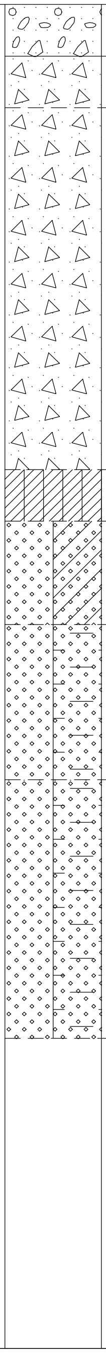
DRILL BIT DIAMETER/TYPE **/ Drive Sampler**	BOREHOLE DIAMETER **8-inches**	DRILLING EQUIPMENT/METHOD **/ Geoprobe**	SAMPLING METHOD **2" Macro-Core**	START-FINISH DATE **8/10/15-8/11/15**

CASING MAT./DIA. **PVC / 2-inch**

SCREEN: TYPE **Slotted** MAT. **PVC** TOTAL LENGTH **15.0**ft DIA. **2-inch** SLOT SIZE **20-Slot**

ELEVATION OF: (Feet)	GROUND SURFACE	TOP OF WELL CASING	TOP & BOTTOM SCREEN **/**	GRAVEL PACK SIZES **#2**





Depth, feet	Visual Description	Blow Counts per 6"		PID Values (ppm)	REMARKS
	Concrete				Handcleared to 5' bls
	Organic layer mixed with fill				
5	Medium brown, fine to medium SAND, some Gravel, some Cobble, (fill); moist.		G	11.9	
10	Dark grey, SILT and CLAY, little fine Sand; moist.				
	Dark grey, fine to medium SAND, some clay; moist.				
15	Dark grey, fine to medium SAND, some Silt; moist.				
20	Light brown, medium to coarse SAND, some fine Sand, some Silt; wet.				
25					

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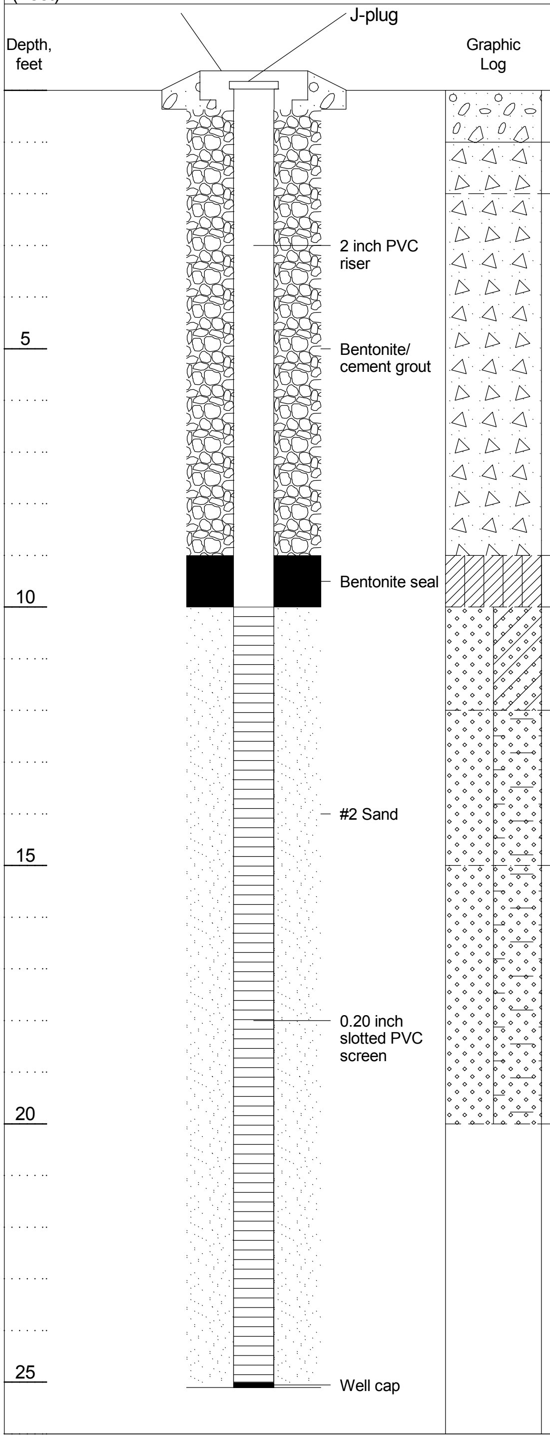
WELL CONSTRUCTION LOG

WELL NO. **MW-23**	NORTHING **Not Measured**	EASTING **Not Measured**		
PROJECT NO./NAME **0047.0044Y042 / Pfizer Site B and Site D**		LOCATION **60-66 Gerry Street/ 191 Harrison Avenue** **Brooklyn, New York**		
APPROVED BY	LOGGED BY **A. Muscietta**			
DRILLING CONTRACTOR/DRILLER **Trinity / J. Sekelis**		GEOGRAPHIC AREA		
DRILL BIT DIAMETER/TYPE **/ Drive Sampler**	BOREHOLE DIAMETER **8-inches**	DRILLING EQUIPMENT/METHOD **/ Geoprobe**	SAMPLING METHOD **2" Macro-Core**	START-FINISH DATE **8/10/15-8/12/15**
CASING MAT./DIA. **PVC / 2-inch**	SCREEN: TYPE **Slotted** MAT. **PVC** TOTAL LENGTH **15.0**ft DIA. **2-inch** SLOT SIZE **20-Slot**			
ELEVATION OF: (Feet)	GROUND SURFACE	TOP OF WELL CASING	TOP & BOTTOM SCREEN **/**	GRAVEL PACK SIZES **#2**



Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
Concrete			Handcleared to 5' bls
Organic layer mixed with fill			
Medium brown, fine to medium SAND, some Gravel, some Cobble, (fill); moist.		10.9	
Dark grey, SILT and CLAY, little fine Sand; moist.		7.1	
Dark grey, fine to medium SAND, some clay; moist.			
Dark grey, fine to medium SAND, some Silt; moist.		150	Petroleum odor
Light brown, medium to coarse SAND, some fine Sand, some Silt; wet.		17.4	

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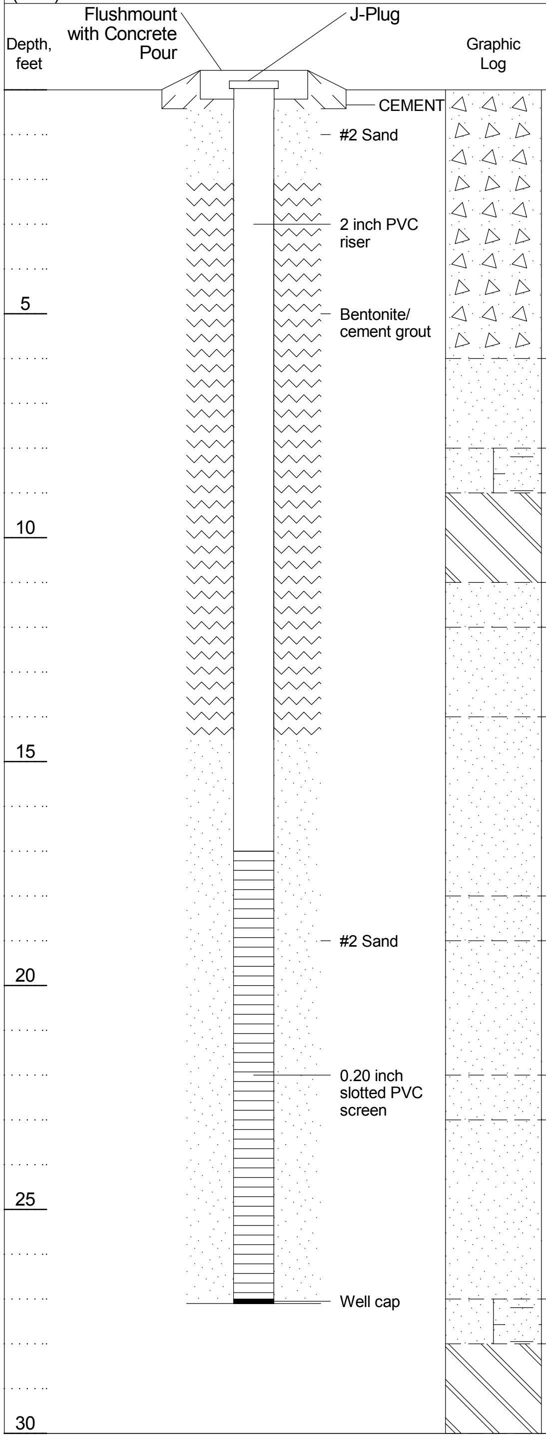
WELL CONSTRUCTION LOG

WELL NO. **MW-24I**	NORTHING **Not Measured**	EASTING **Not Measured**		
PROJECT NO./NAME **0047.0044Y042 / Pfizer Site B and Site D**		LOCATION **60-66 Gerry Street/ 191 Harrison Avenue** **Brooklyn, New York**		
APPROVED BY	LOGGED BY **J. Kendrot**			
DRILLING CONTRACTOR/DRILLER **Cascade / A**		GEOGRAPHIC AREA		
DRILL BIT DIAMETER/TYPE **/ Drive Sampler**	BOREHOLE DIAMETER **8-inches**	DRILLING EQUIPMENT/METHOD **Geoprobe 7720 DT / Geoprobe**	SAMPLING METHOD **2" Macro-Core**	START-FINISH DATE **4/5/17-4/7/17**
CASING MAT./DIA. **PVC / 2-inch**	SCREEN: TYPE **Slotted**	MAT. **PVC** TOTAL LENGTH **10.0**ft	DIA. **2-inch**	SLOT SIZE **20-Slot**
ELEVATION OF: (Feet)	GROUND SURFACE	TOP OF WELL CASING	TOP & BOTTOM SCREEN **/**	GRAVEL PACK SIZES **#2**



Depth, feet	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
	Brown, coarse to medium SAND, trace brick, cobble, and pebble (fill); moist.			
	Brown, coarse to medium SAND, trace brick, cobble, and pebble (fill); wet.			
5			0.0	Handcleared to 5 ft bls. 60% Recovery
	Light brown, coarse to medium SAND, trace pebble; wet.		81.4	
	Grey, coarse SAND and SILT; wet.		10.3	
	Black to grey, CLAY, trace silt; wet.		7.2	
10				75% Recovery
	Light grey to light brown, coarse SAND; wet.		20.6	
	Brown, coarse to medium SAND, trace pebble; wet.		10.0	
	Grey, coarse SAND, trace pebble; wet.		64.5	
15			8.0	40% Recovery
	Light brown to light grey, coarse SAND; wet.		20.8	
	Brown, coarse SAND; wet.		92.7	
20				80% Recovery
	Brown to light brown, medium to fine SAND, trace pebble; wet.		48.5	
	Grey to brown, coarse to medium SAND, red BRICK and STONE; wet.		62.6	
25				100% Recovery
	Grey, fine SAND and SILT; wet.		28.1	
	Grey, CLAY; wet.		0.3	
30				End of boring at 30 ft bls.

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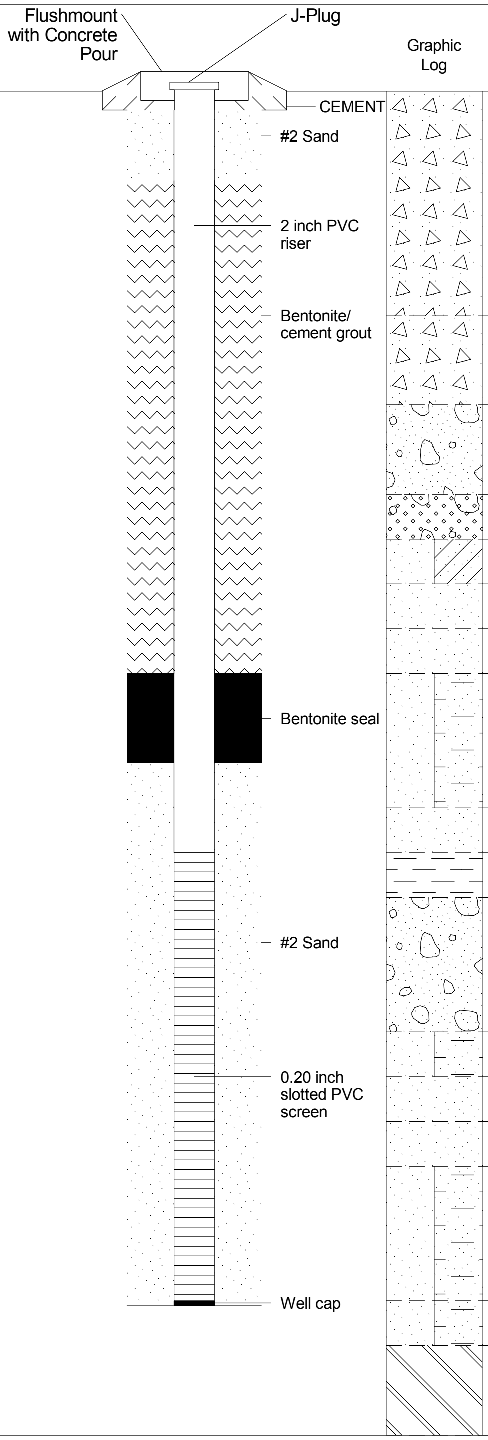
WELL CONSTRUCTION LOG

WELL NO. **MW-25I**	NORTHING **Not Measured**	EASTING **Not Measured**		
PROJECT NO./NAME **0047.0044Y042 / Pfizer Site B and Site D**		LOCATION **60-66 Gerry Street/ 191 Harrison Avenue** **Brooklyn, New York**		
APPROVED BY	LOGGED BY **J. Kendrot**			
DRILLING CONTRACTOR/DRILLER **Cascade /**		GEOGRAPHIC AREA		
DRILL BIT DIAMETER/TYPE **/ Drive Sampler**	BOREHOLE DIAMETER **8-inches**	DRILLING EQUIPMENT/METHOD **Geoprobe 7720 DT / Geoprobe**	SAMPLING METHOD **2" Macro-Core**	START-FINISH DATE **4/5/17-4/7/17**
CASING MAT./DIA. **PVC / 2-inch**	SCREEN: TYPE **Slotted**	MAT. **PVC** TOTAL LENGTH **10.0**ft	DIA. **2-inch**	SLOT SIZE **20-Slot**
ELEVATION OF: (Feet)	GROUND SURFACE	TOP OF WELL CASING	TOP & BOTTOM SCREEN **/**	GRAVEL PACK SIZES **#2**



Depth, feet	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
	Brown, coarse to medium SAND, trace brick, cobble, and pebble (fill).			
	Brown, coarse to medium SAND, trace brick, cobble, and pebble (fill); wet.			
5	Brown, medium to coarse SAND, Gravel, and Brick (fill); moist.		0.2	Handcleared to 5 ft bls. 50% Recovery
	Brown, fine to medium SAND, some Gravel, little coarse Sand; wet.		0.1	
	Dark grey, fine to coarse SAND, some Gravel; wet.		0.1	
10	Dark grey, fine SILT and CLAY, little Gravel; moist.		0.1	60% Recovery
	Brown, fine to medium SAND, little coarse Sand, trace gravel; wet.		0.2	
	Grey, fine to medium SAND, trace silt and gravel; wet.		0.2	
	Greenish grey, fine SAND and SILT, little Clay, trace gravel; wet.		0.3	
15			0.1	100% Recovery
	Dark brown, fine SAND, little medium Sand, trace gravel and silt; wet.		0.1	
	Dark brown, SILT, some Clay, trace gravel; wet.		28.1	
	Dark brown,fine to medium SAND, some coarse Sand, little Gravel, trace silt; wet.		153.8	
20				100% Recovery
	Dark brown, fine SAND and SILT, trace clay; wet.		165.2	
	Dark brown, fine SAND, trace silt and gravel; wet.		10.7	
	Dark brown, fine to medium SAND, little coarse Sand, trace gravel; wet.		32.9	
	Dark brown, fine SAND, little Silt, trace clay; wet.		0.2	
25				100% Recovery
	Dark brown, fine SAND and SILT; wet.		0.1	
	Dark grey to brown, CLAY; wet.		0.0	
30				End of boring at 30 ft bls.

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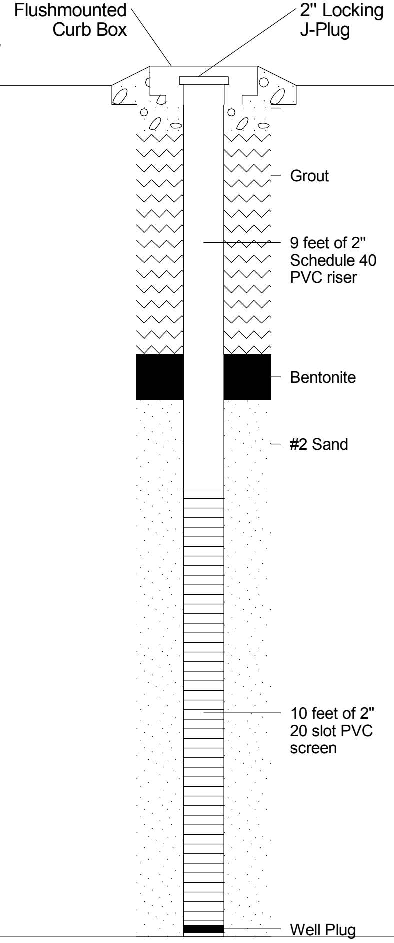
WELL CONSTRUCTION LOG

WELL NO. **MW-D2**	NORTHING **5452.6**	EASTING **5763.3**			
PROJECT NO./NAME **0047.0044Y039 / Pfizer Site B and Site D**		LOCATION **60-66 Gerry Street/191 Harrison Avenue** **Brooklyn, New York**			
APPROVED BY **W. Kwan**	LOGGED BY **A. Hoffmann**				
DRILLING CONTRACTOR/DRILLER **Roux / J. Freijomil**		GEOGRAPHIC AREA **Former Arlington Press**			
DRILL BIT DIAMETER/TYPE **4.25 inch / Auger**	BOREHOLE DIAMETER **8-inches**	DRILLING EQUIPMENT/METHOD **Geoprobe 6620 DT / Geoprobe**	SAMPLING METHOD	START-FINISH DATE **2/21/13-2/21/13**	
CASING MAT./DIA. **SCH 40 PVC / 2-inch**	SCREEN: TYPE **Slotted**	MAT. **SCH 40 PVC**	TOTAL LENGTH **10.0**ft	DIA. **2-inch**	SLOT SIZE **20-Slot**
ELEVATION OF: (Feet)	GROUND SURFACE **12.92**	TOP OF WELL CASING **12.73**	TOP & BOTTOM SCREEN **3.9 / -6.1**	GRAVEL PACK SIZES **Morie #2**	

Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
		Based on soil cuttings: Brown to grey, fine to coarse SAND, some Gravel, little Silt; moist to wet			
5					
10					
15					



BORING/FEET 0047.0044Y038.GPJ ROUX.GDT 5/4/17

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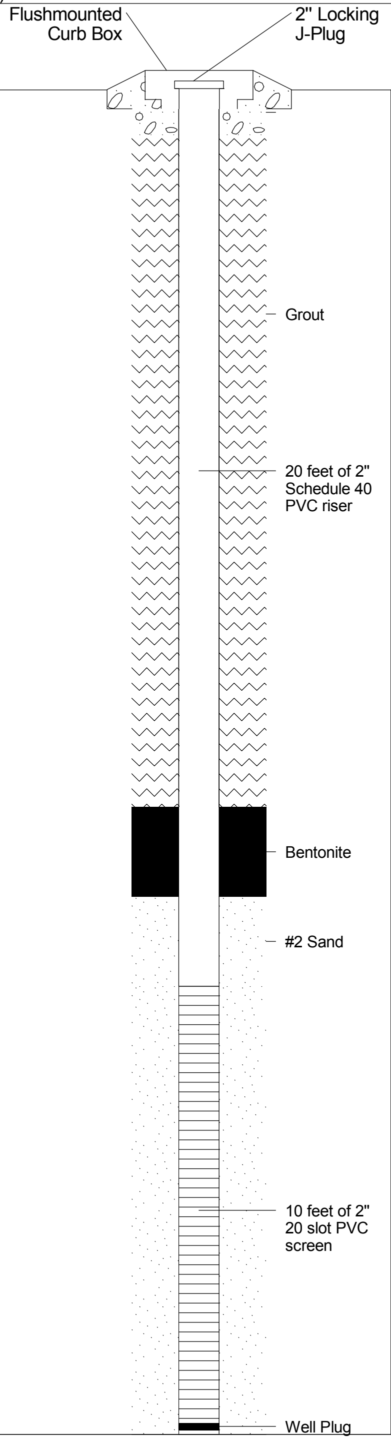
WELL CONSTRUCTION LOG

WELL NO. **MW-D2I**	NORTHING **5449.6**	EASTING **5764.8**		
PROJECT NO./NAME **0047.0044Y039 / Pfizer Site B and Site D**		LOCATION **60-66 Gerry Street/191 Harrison Avenue** **Brooklyn, New York**		
APPROVED BY **W. Kwan**	LOGGED BY **A. Hoffmann**			
DRILLING CONTRACTOR/DRILLER **Roux / J. Freijomil**		GEOGRAPHIC AREA **Former Arlington Press**		
DRILL BIT DIAMETER/TYPE **4.25 inch / Auger**	BOREHOLE DIAMETER **8-inches**	DRILLING EQUIPMENT/METHOD **Geoprobe 6620 DT / Geoprobe**	SAMPLING METHOD	START-FINISH DATE **2/22/13-2/22/13**
CASING MAT./DIA. **SCH 40 PVC / 2-inch**	SCREEN: TYPE **Slotted**	MAT. **SCH 40 PVC** TOTAL LENGTH **10.0**ft	DIA. **2-inch**	SLOT SIZE **20-Slot**
ELEVATION OF: (Feet)	GROUND SURFACE **12.90**	TOP OF WELL CASING **12.63**	TOP & BOTTOM SCREEN **-7.1 / -17.1**	GRAVEL PACK SIZES **Morie #2**



Depth, feet	Graphic Log	Visual Description	Blow Counts per 6"	PID Values (ppm)	REMARKS
		Based on soil cuttings: Brown to grey, fine to coarse SAND, some Gravel, little Silt; moist to wet			
5					5
10					10
15					15
20					20
25					25
30					30

APPENDIX F

Excavation Work Plan

APPENDIX F

EXCAVATION WORK PLAN (EWP)

F-1 Notification

At least 15 days prior to the start of any activity that is anticipated to encounter remaining contamination, the site owner or their representative will notify the NYSDEC. Table C-1 includes contact information for the above notification. The information on this table will be updated as necessary to provide accurate contact information. A full listing of site-related contact information is provided in Appendix B.

Table F-1: Notifications*

Central Office NYSDEC Representative: Jane O'Connell	Phone: 718-482-4995 Email: jane.oconnell@dec.ny.gov
Regional Office NYSDEC Representative: Man-tsz Yau	Phone: Email: man-tzu.yau@dec.ny.gov
NYSDEC Site Control: Kelly Lewandowski	Phone: 518-402-9553 Email: kelly.lewandowski@dec.ny.gov

* Note: Notifications are subject to change and will be updated as necessary.

This notification will include:

- A detailed description of the work to be performed, including the location and areal extent of excavation, plans/drawings for site re-grading, intrusive elements or utilities to be installed below the soil cover, estimated volumes of contaminated soil to be excavated and any work that may impact an engineering control;
- A summary of environmental conditions anticipated to be encountered in the work areas, including the nature and concentration levels of contaminants of concern, potential presence of grossly contaminated media, and plans for any pre-construction sampling;
- A schedule for the work, detailing the start and completion of all intrusive work;
- A summary of the applicable components of this EWP;
- A statement that the work will be performed in compliance with this EWP and 29 Code of Federal Regulation (CFR) 1910.120;
- A copy of the contractor's HASP, in electronic format, if it differs from the HASP provided in Appendix G of this SMP;

- Identification of disposal facilities for potential waste streams; and
- Identification of sources of any anticipated backfill, along with all required chemical testing results.

F-2 Soil Screening Methods

Visual, olfactory and instrument-based (i.e., photoionization detector) soil screening will be performed by a qualified environmental professional during all excavations into known or potentially contaminated material (remaining contamination). Field screening tests (hydrophobic dye test or similar) will be used to screen soil for NAPL. Soil screening will be performed when invasive work is done and will include all excavation and invasive work performed during development, such as excavations for foundations and utility work, after issuance of the COC.

Soils will be segregated based on previous environmental data and screening results into material that requires off-site disposal and material that requires testing to determine if the material can be reused on-site as soil beneath a cover or if the material can be used as cover soil. Further discussion of off-site disposal of materials and on-site reuse is provided in Sections C-6 and C-7 of this Appendix.

F-3 Soil Staging Methods

Soil stockpiles will be continuously encircled with a berm and/or silt fence. Hay bales will be used as needed near catch basins, surface waters, and other discharge points.

Stockpiles will be kept covered at all times with appropriately anchored tarps. Stockpiles will be routinely inspected and damaged tarp covers will be promptly replaced.

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

F-4 Materials Excavation and Load-Out

A qualified environmental professional or person under their supervision will oversee all invasive work as well as the excavation and load-out of all excavated material.

The owner of the property and remedial party (if applicable) and its contractors are responsible for safe execution of all invasive and other work performed under this Plan.

The presence of utilities and easements on the Site will be investigated by the qualified environmental professional. It will be determined whether a risk or impediment to the planned work under this SMP is posed by utilities or easements on the site.

Loaded vehicles leaving the Site 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).

A truck wash will be operated on-Site, as appropriate. The qualified environmental professional will be responsible for ensuring that all outbound trucks are washed at the truck wash before leaving the Site. Until the activities performed under this section are complete, truck wash waters will be collected and disposed of off-Site in an appropriate manner.

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

The qualified environmental professional will be responsible for ensuring that all egress points for truck and equipment transport from the Site are clean of dirt and other materials derived from the Site during intrusive excavation activities. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to site-derived materials.

F-5 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.

Material transported by trucks exiting the Site 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 loaded with Site materials will exit the vicinity of the Site using approved truck routes. 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 the Site will be kept clean of dirt and other materials during Site remediation and development.

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

F-6 Materials Disposal Off-Site

All material excavated and removed from the Site will be treated as contaminated and regulated material, and will be transported and disposed in accordance with all local, State (including 6NYCRR Part 360) and Federal regulations. If disposal of material from this Site is proposed for unregulated off-site disposal (i.e., clean soil removed for development purposes), a formal request with an associated plan will be made to the

NYSDEC. Unregulated off-site management of materials from this Site will not occur without formal NYSDEC approval.

Off-site disposal locations for excavated soils will be identified in the pre-excavation notification. This will include estimated quantities and a breakdown by class of disposal facility if appropriate, i.e., hazardous waste disposal facility, solid waste landfill, petroleum treatment facility, Construction and Demolition (C/D) recycling facility, etc. Actual disposal quantities and associated documentation will be reported to the NYSDEC in the PRR. This documentation will include: waste profiles, test results, facility acceptance letters, manifests, bills of lading, and facility receipts.

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

F-7 Materials Reuse On-Site

The qualified environmental professional will ensure that procedures defined for material reuse in this SMP are followed and that unacceptable material does not remain on-site. Contaminated on-site material, including historic fill and contaminated soil, that is acceptable for reuse on-site will be placed below the demarcation layer or impervious surface, and will not be reused within a cover soil layer, within landscaping berms, or as backfill for subsurface utility lines.

Any demolition material proposed for reuse on-site will be sampled for asbestos and the results will be reported to the NYSDEC for acceptance. Concrete crushing or processing on-site will not be performed without prior NYSDEC approval. Organic matter (wood, roots, stumps, etc.) or other solid waste derived from clearing and grubbing of the Site will not be reused on-site.

F-8 Fluids Management

All liquids to be removed from the Site, including but not limited to, excavation dewatering, decontamination waters and groundwater monitoring well purge and development waters, will be handled, transported and disposed in accordance with applicable local, State, and Federal regulations. Dewatering, purge and development fluids will not be recharged back to the land surface or subsurface of the Site, and will be managed off-site, unless prior approval is obtained from NYSDEC.

Discharge of water generated during large-scale construction activities to surface waters (i.e., a local pond, stream or river) will be performed under a State Pollutant Discharge Elimination System (SPDES) permit.

F-9 Cover System Restoration

After the completion of soil removal and any other invasive activities, the cover system will be restored in a manner that complies with the RAWP. The existing cover system will be a temporary cover system comprised of a minimum of 24 inches of RCA and buildings and their associated concrete slabs (which will be left in place). If excavation is required below the demarcation layer, consisting of orange snow fencing material, the demarcation layer will be replaced to provide a visual reference to the top of the remaining contamination zone. The demarcation zone that requires adherence to special conditions for disturbance of remaining contaminated soils defined in this SMP. If the type of cover system changes from that which exists prior to the excavation (i.e., a soil cover is replaced by asphalt), this will constitute a modification of the cover element of the remedy and the upper surface of the remaining contamination. A figure showing the modified surface will be included in the subsequent Periodic Review Report and in an updated SMP.

F-10 Backfill from Off-Site Sources

All materials proposed for import onto the Site will be approved by the qualified environmental professional and will be in compliance with provisions in this SMP prior to receipt at the Site. A Request to Import/Reuse Fill or Soil form, which can be found at http://www.dec.ny.gov/regulations/67386.html, will be prepared and submitted to the NYSDEC project manager allowing a minimum of 5 business days for review.

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

All imported soils will meet the backfill and cover soil quality standards established in 6NYCRR 375-6.7(d). Soils shall meet the lower of PoG or RRSCOs. Soils that meet 'exempt' fill requirements under 6 NYCRR Part 360, but do not meet backfill or cover soil objectives for this Site, will not be imported onto the Site without prior approval by NYSDEC. Solid waste will not be imported onto the Site.

Trucks entering the Site with imported soils will be securely covered with tight fitting covers. Imported soils will be stockpiled separately from excavated materials and covered to prevent dust releases.

F-11 Excavation Contingency Plan

If underground tanks or other previously unidentified contaminant sources are found during post-remedial subsurface excavations or development related construction, excavation activities will be suspended until sufficient equipment is mobilized to address the condition.

Sampling will be performed on product, sediment and surrounding soils, etc., as necessary to determine the nature of the material and proper disposal method. Chemical analysis will be performed for a full list of analytes (TAL metals; TCL volatiles and semi-volatiles, TCL pesticides and PCBs), unless the Site history and previous sampling results provide a sufficient justification to limit the list of analytes. In this case, a reduced list of analytes will be proposed to the NYSDEC for approval prior to sampling.

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. Reportable quantities of petroleum product will also be reported to the

NYSDEC spills hotline. These findings will be also included in the Periodic Review Report.

F-12 Community Air Monitoring Plan

The location of air sampling stations based on generally prevailing wind conditions at the Site. These locations will be adjusted on a daily or more frequent basis based on actual wind directions to provide an upwind and at least two downwind monitoring stations.

Exceedances of action levels listed in the CAMP will be reported to NYSDEC and NYSDOH Project Managers.

F-13 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 use of odor suppressants and controlled excavation procedures as discussed below. If nuisance odors are identified at the Site boundary, or if odor complaints are received, 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 any other complaints about the project. Implementation of all odor controls, including the halt of work, is the responsibility of the remedial party's Remediation Engineer, and any measures that are implemented will be discussed in the Periodic Review Report.

All necessary means will be employed to prevent on-site and off-site nuisances. At a minimum, these measures will include: (a) limiting the area of open excavations and size of soil stockpiles; (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.

If nuisance odors develop during intrusive work that cannot be corrected, or where the control of nuisance odors cannot otherwise be achieved due to on-site conditions or close proximity to sensitive receptors, odor control will be achieved by sheltering the excavation and handling areas in a temporary containment structure equipped with appropriate air venting/filtering systems.

F-14 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.

F-15 Other Nuisances

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

A plan will be developed and utilized by the contractor for all remedial work to ensure compliance with local noise control ordinances.

APPENDIX G

Health and Safety Plan &
Site-Specific Community Air Monitoring 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

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

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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-diethylm-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 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 burning[1] 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.

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[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 Levels[2]	
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.

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[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/O_2 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)	¾ : 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 Dräeger 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., Dräeger 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., Dräeger 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., Dräeger 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.

<u>Personnel</u>

- 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.

<u>Sampling/Monitoring</u>

- 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.

<u>Heavy Equipment</u>

- 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: ____

Name Printed	**Signature**	**Date**

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

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/m3 (water soluble) 0.01 mg/m3 (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:

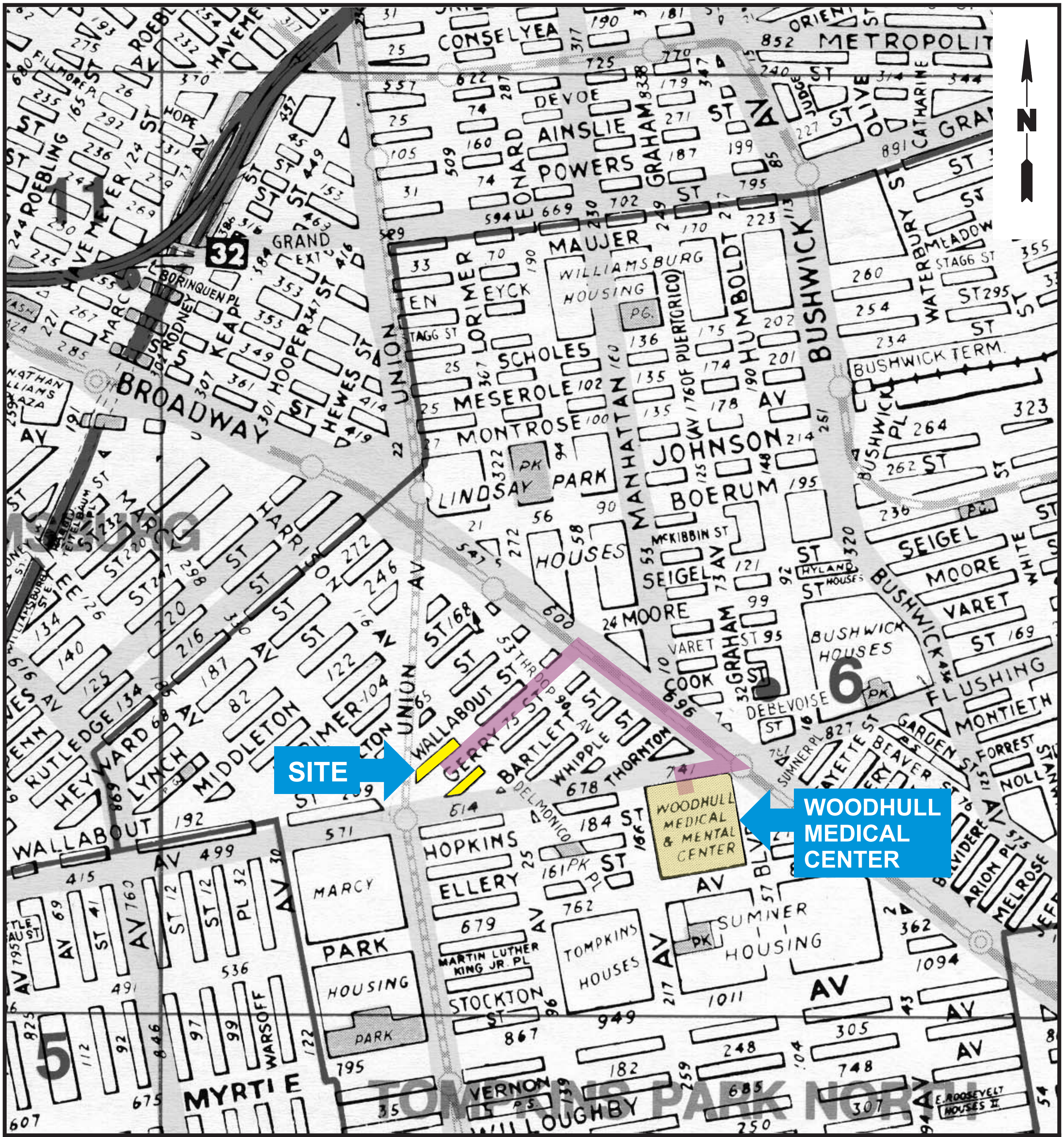
Ca – Carcinogen
TLV – Threshold Limit Value, as 8-hr. time-weighted averages (ACGIH)
IDLH – Immediately Dangerous to Life and Health (OSHA)
PEL – Permissive Exposure Level (OSHA)
PPM – Parts per million
mg/m^3 – milligrams per cubic meter
Fl. Pt. – Flash point
LEL – Lower Explosive Level
UEL – Upper 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.

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

ROUX
ROUX ASSOCIATES, INC.
Environmental Consulting & Management

Compiled by: W.K.	Date: 02NOV11	FIGURE
Prepared by: J.A.D.	Scale: AS SHOWN	1
Project Mgr.: W.K.	Project No.: 0047.0044Y036	
File: 0047.0044Y524R.07.CDR		

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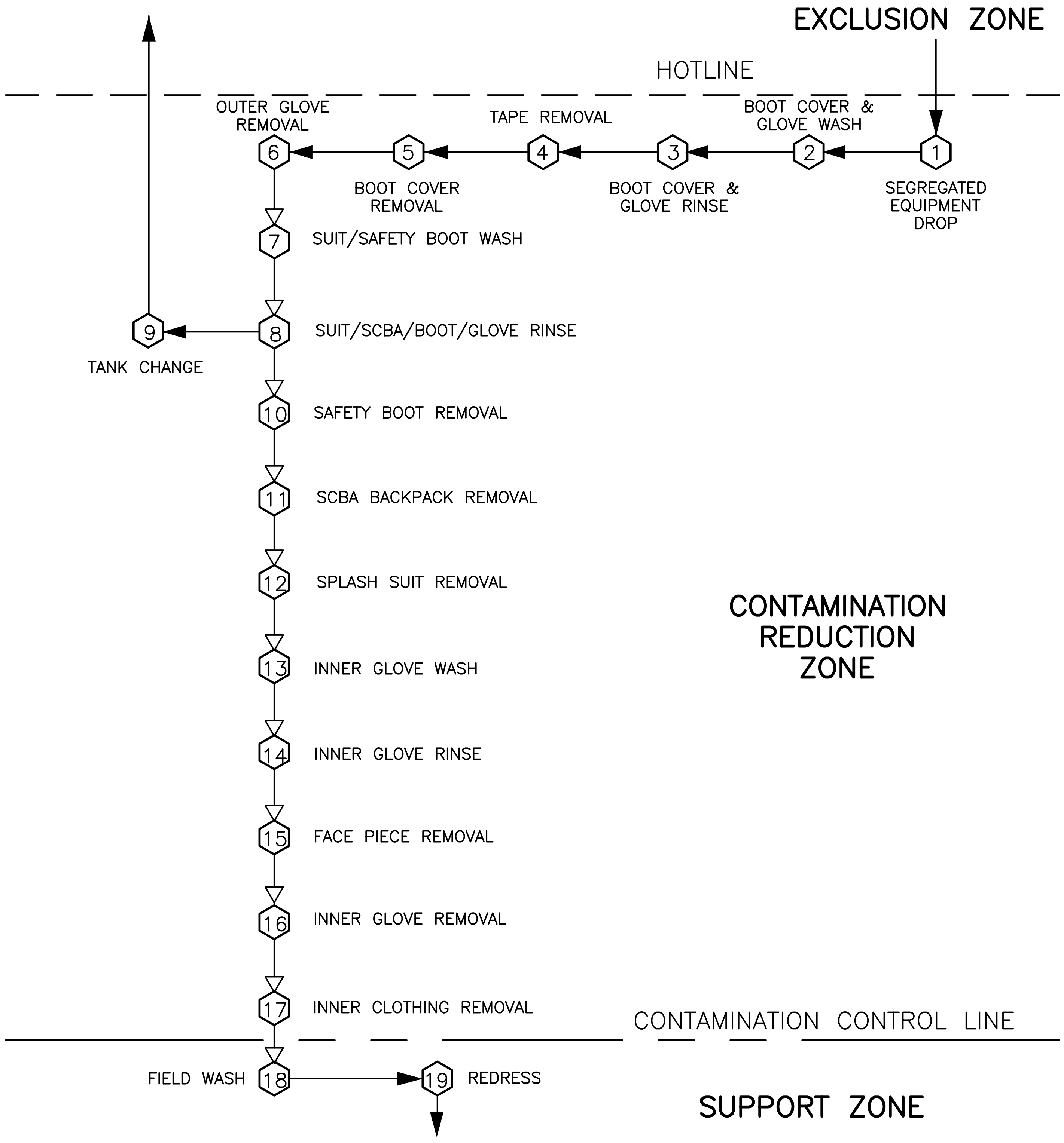

Title:

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
Prepared by: J.A.D.	Scale: NOT TO SCALE	2
Project Mgr: W.K.	Project: 0047.0044Y036	
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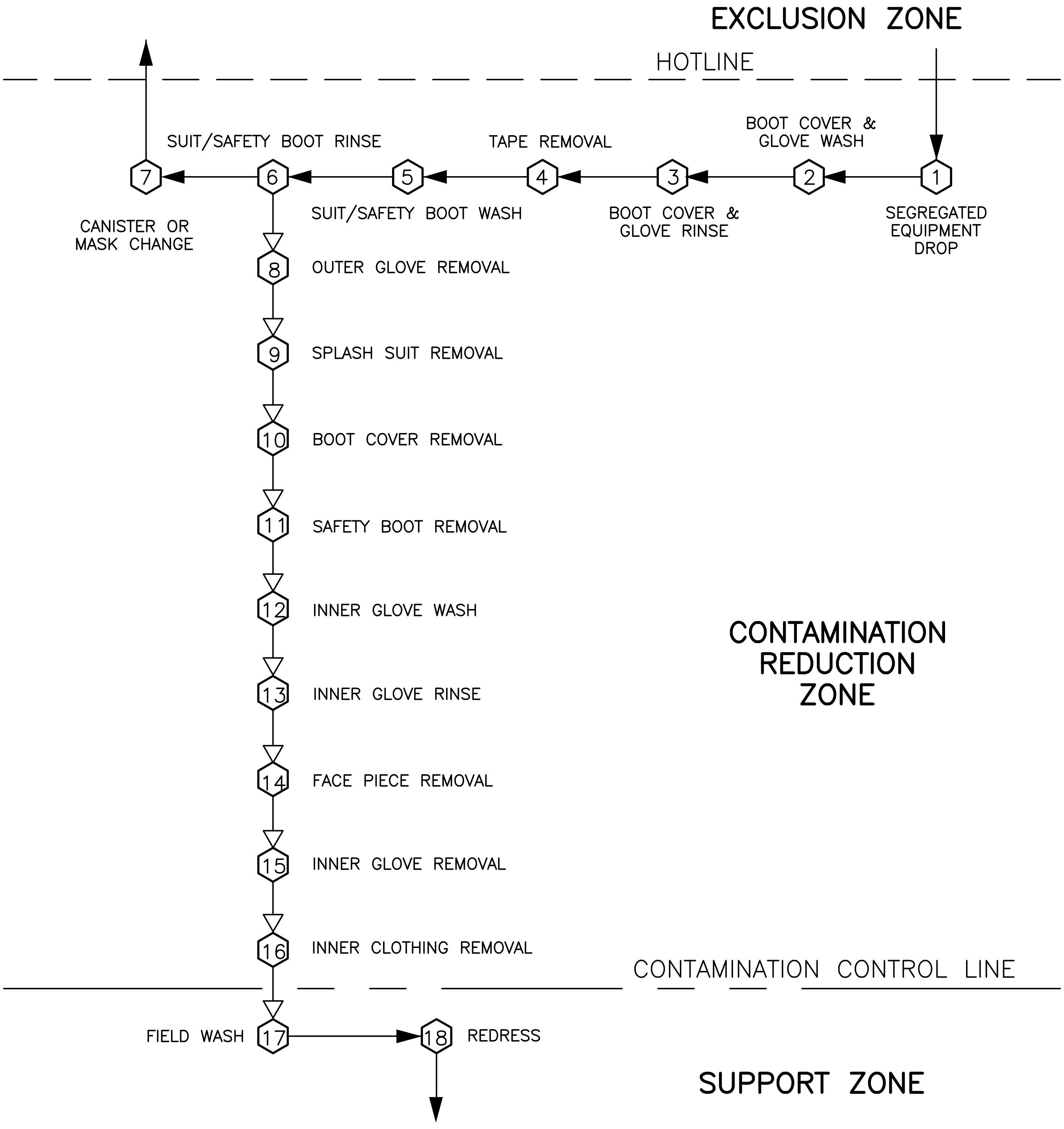

Title:

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
Prepared by: J.A.D.	Scale: NOT TO SCALE	3
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File: 0047.0044Y524R.08.DWG		

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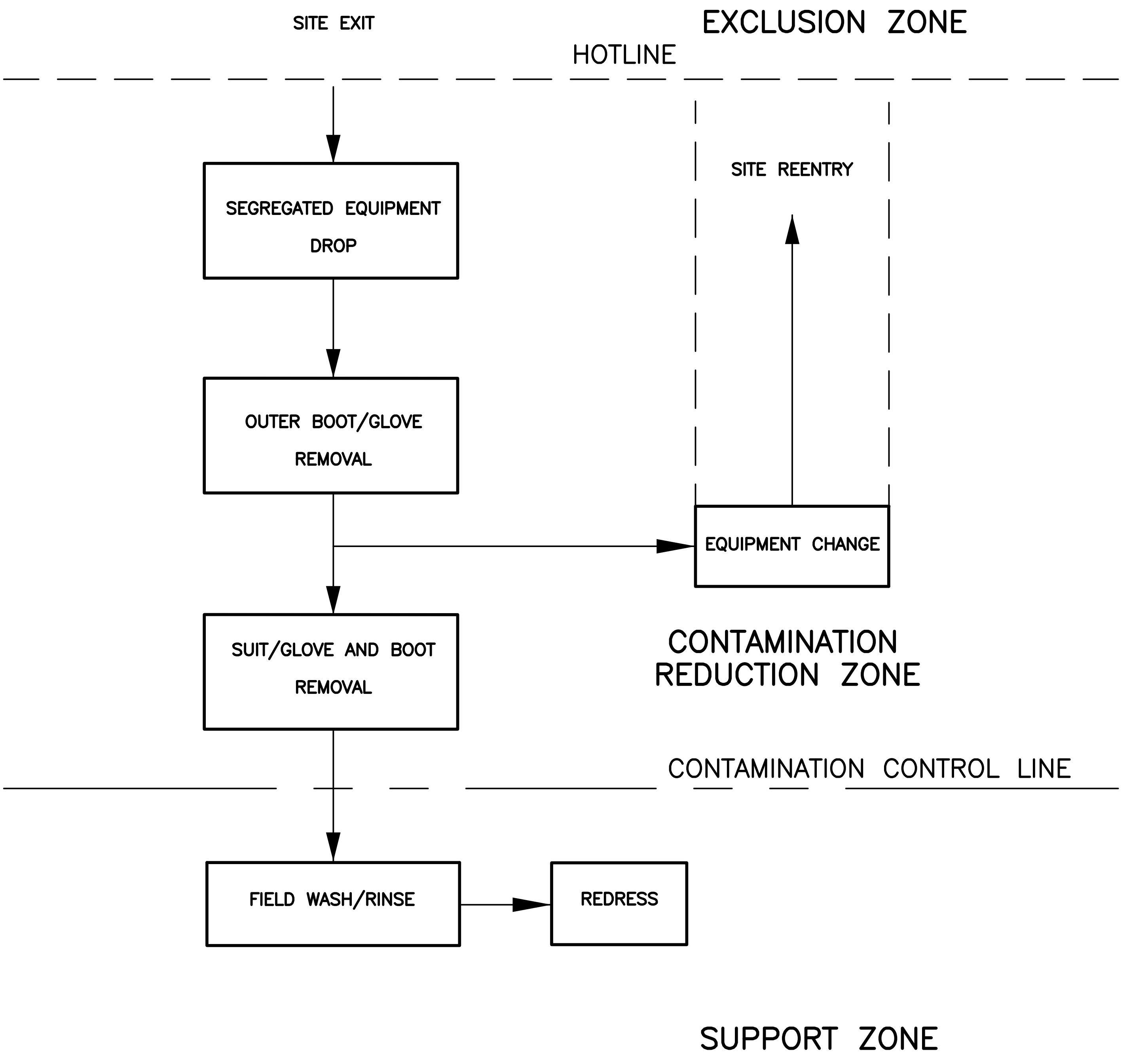

Title:

TYPICAL DECONTAMINATION LAYOUT
LEVEL D 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
Prepared by: J.A.D.	Scale: NOT TO SCALE	4
Project Mgr: W.K.	Project: 0047.0044Y036	
File: 0047.0044Y524R.08.DWG		

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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

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

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	☒ NEW ☐ 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)

☐ REFLECTIVE VEST	☐ GOGGLES	☐ AIR PURIFYING RESPIRATOR	☐ GLOVES ________
☐ HARD HAT	☐ FACE SHIELD	☐ SUPPLIED RESPIRATOR	☐ OTHER ________
☐ LIFELINE / HARNESS	☐ HEARING PROTECTION	☐ PPE CLOTHING	
☐ SAFETY GLASSES	☐ SAFETY SHOES ________	________	

[1]JOB STEPS	[2]POTENTIAL HAZARDS	[3]CRITICAL 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".

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?

____

____

____

____

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).

APPENDIX E

Acord Automobile Loss Notice Form

AUTOMOBILE LOSS NOTICE

DATE (MM/DD/YYYY)

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

INSURED

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

CONTACT

☐ CONTACT INSURED

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

LOSS

LOCATION OF LOSS **STREET:**	**POLICE OR FIRE DEPARTMENT CONTACTED**
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 ☐ (Check if same as insured)	**PRIMARY PHONE #** ☐ HOME ☐ BUS ☐ CELL
	SECONDARY PHONE # ☐ HOME ☐ BUS ☐ CELL
	PRIMARY E-MAIL ADDRESS:
	SECONDARY E-MAIL ADDRESS:
DRIVER'S NAME AND ADDRESS ☐ (Check if same as owner)	**PRIMARY PHONE #** ☐ HOME ☐ BUS ☐ CELL
	SECONDARY PHONE # ☐ HOME ☐ BUS ☐ 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)**
					☐

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?** ☐

VEH #	YEAR	MAKE: MODEL:	BODY TYPE: V.I.N.:	PLATE NUMBER	STATE

DESCRIBE PROPERTY (Other Than Vehicle)	OTHER VEH/PROP INS? (Y/N) ☐

CARRIER OR AGENCY NAME	NAIC CODE	POLICY NUMBER

OWNER'S NAME AND ADDRESS	PRIMARY PHONE # ☐ HOME ☐ BUS ☐ CELL	SECONDARY PHONE # ☐ HOME ☐ BUS ☐ CELL
	PRIMARY E-MAIL ADDRESS:	
	SECONDARY E-MAIL ADDRESS:	
DRIVER'S NAME AND ADDRESS ☐ (Check if same as owner)	PRIMARY PHONE # ☐ HOME ☐ BUS ☐ CELL	SECONDARY PHONE # ☐ HOME ☐ BUS ☐ 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
		☐	☐	☐		
		☐	☐	☐		
		☐	☐	☐		
		☐	☐	☐		

WITNESSES OR PASSENGERS

NAME & ADDRESS	PHONE (A/C, No)	INS VEH	OTH VEH	OTHER (Specify)
		☐	☐	
		☐	☐	
		☐	☐	

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.

APPENDIX F

Health and Safety Lessons Learned/ Accident Report Forms

☐ **Roux Associates, Inc.** ☐ **Remedial Engineering, P.C.**
(Check applicable company name)

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)**:**
____
____

Client Corporate Name / Contact / Address / Phone #:
____
____
____
____
____

Immediate Verbal Notifications Given To:

Corporate Health & Safety	☐Yes	☐No
Office Health & Safety	☐Yes	☐No
Office Manager	☐Yes	☐No
Project Principal	☐Yes	☐No
Project Manager	☐Yes	☐No
Client Contact	☐Yes	☐No

REPORT STATUS (time due):

☐ Initial (24 hr) ☐ Final (5-10 days)
Date: ____________ Date: ____________

Accident Report Delivered To:

Corporate Health & Safety	☐Yes	☐No
Office Health & Safety	☐Yes	☐No
Office Manager	☐Yes	☐No
Project Principal	☐Yes	☐No
Project Manager	☐Yes	☐No

REPORT TYPE: ☐ Loss ☐ Near Loss Estimated Costs: $ _______

OSHA CASE # Assigned by Corporate Health & Safety if Applicable: ____________________

Corporate Health & Safety Confirmed Final Accident Report
☐Yes ☐No

DATE OF INCIDENT: ____________________

TIME INCIDENT OCCURRED: ____________ ☐AM ☐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.

☐**INJURY** ☐**ILLNESS**

------------------------**Severity Level**---------------------------

☐Fatality
☐Restricted Work
☐First Aid
☐Lost Time
☐Medical Treatment

OTHER INCIDENT TYPES

☐Spill / Release
Material involved: ____________
Quantity (U.S. Gallons): ____________

☐Misdirected Waste
☐Property Damage
☐Motor Vehicle
☐Consent Order
☐Exceedance
☐Fine / Penalty
☐NOV

ACTIVITY TYPE (Check most appropriate one.)

☐Decommissioning
☐Demolition
☐Dewatering
☐Drilling
☐Excavation
☐Gauging
☐Geoprobe
☐Motor Vehicle
☐Operations/ Maintenance
☐Pump/Pilot Test
☐Rigging/Lifting
☐Sampling
☐System Start-up
☐Trenching
☐AST/UST Removal
☐Other__________

INJURY TYPE (Check all applicable.)

☐Abrasion
☐Amputation
☐Burn
☐Cold/Heat Stress
☐Inflammation
☐Laceration
☐Occupational Illness
☐Puncture
☐Rash
☐Repetitive Motion
☐Sprain/Strain
☐Other__________

BODY PART AFFECTED (Check all applicable.)

☐Respiratory
☐Neck
☐Chest
☐Abdomen
☐Groin
☐Back
☐Shoulder
☐Arm
☐Wrist
☐Hand/Fingers
☐Eye
☐Head
☐Face
☐Leg
☐Knee
☐Ankle
☐Foot/Toes
☐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:
☐Newspaper ☐Television ☐Community Group ☐Neighbors ☐Other ___________________				

Describe Response/Inquiry:

Roux/Remedial Response:

(Check all that apply.) (Attach photos, drawings, etc. to help illustrate the incident.)
ATTACHED INFORMATION: ☐Photo ☐Sketches ☐Vehicle Acord Form ☐Police Report ☐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

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: ______________________________

____

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 (PM_{10}) 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 (µg/m^3). This setting will allow proactive evaluation of worksite conditions prior to reaching the action level of 100 µg/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 µg/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 µg/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 µg/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 µg/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 µg/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 PM_{10} levels are not more than 150 µg/m^3 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/m^3, 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.

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

APPENDIX H

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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APPENDICES

A. Professional Profiles of Project Team
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_2SO_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_2SO_4 to pH 5-9; Cool to 4°C, No light	50 grams
TCLP	Acid Extractables Base Neutrals Metals Herbicides Pesticides Volatiles	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

		Field QC			Lab QC				
Sample Matrix	**Target Analytes**	**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
GTLC - Glass with Teflon lined cap
GTLS - Glass with Teflon lined septum
SDG - Sample Delivery Group
NA - Not Applicable
† To be provided to the lab by the field sampling personnel

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.

ROUX

Professional Profile

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 remove 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 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.

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- 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

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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 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.

- 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.

APPENDIX B

Roux Associates'
Standard Operating Procedures

FOR COLLECTION OF QUALITY CONTROL SAMPLES FOR WATER-QUALITY DATA

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

STANDARD OPERATING PROCEDURE 3.2
FOR FIELD RECORD KEEPING AND
QUALITY ASSURANCE/QUALITY CONTROL

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

STANDARD OPERATING PROCEDURE 4.2 FOR MEASURING WATER LEVELS USING AN ELECTRONIC SOUNDING DEVICE (M-SCOPE)

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 gal/ft3)(r2h), 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.

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 PROCUDURE

FOR FILTRATION OF GROUNDWATER AND SURFACE-WATER SAMPLES FOR DISSOLVED METALS ANALYSIS

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 prefiltering 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. Teflon™ 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

STANDARD OPERATING PROCEDURE 5.1
FOR COLLECTION OF SOIL SAMPLES
FOR LABORATORY ANALYSIS

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

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.

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.

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

STANDARD OPERATING PROCEDURE 6.2
FOR MEASURING THE CONDUCTIVITY
OF WATER SAMPLES

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 (µmhos/cm) while others have to be converted to this unit. Conductivity will be recorded in µmhos/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 µmhos/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 (° 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.

APPENDIX I

Site Management Forms

ROUX ASSOCIATES, INC. / REMEDIAL ENGINEERING, P.C.

SITE-WIDE MONITORING, INSPECTION AND MAINTENANCE FORM

Client: **Former Pfizer Inc Site D**
Location: **60-66 Gerry Street, Brooklyn, New York**
Inspector: ______________________
Date: ______________________

Site Observations: **Performed by (   ) on (   )**

Yes	No	
[ ]	[ ]	Have any Site improvements been made since last inspection?
[ ]	[ ]	Has there been any maintenance activity impacting engineering controls?
[ ]	[ ]	Are monitoring wells intact?
		-Include sketches or photos of observations

Inspection of Sand Cap (Building 25A): **Performed by (   ) on (   )**

Yes	No	
[ ]	[ ]	Underlying demarcation barrier exposed?
[ ]	[ ]	Are sand caps sloped to allow for drainage/prevention of pooling?

Inspection of Concrete Cap (Main Courtyard): **Performed by (   ) on (   )**

Yes	No	
[ ]	[ ]	Significant cracks observed?
[ ]	[ ]	Signs of settlement/ subsidence observed?
[ ]	[ ]	Other damage observed? If yes, refer to Page 2 for additional clarification.
		-Include sketches or photos of observations

Inspection of Building Covers: **Performed by (   ) on (   )**

Yes	No	
[ ]	[ ]	Were all buildings inspected?
[ ]	[ ]	Significant cracks observed?
[ ]	[ ]	Other damage observed? If yes, refer to Page 2 for additional clarification.
[ ]	[ ]	Any new slab penetrations observed? If yes, include description on page 2.
		-Include sketched or photos of observations

ROUX ASSOCIATES, INC. / REMEDIAL ENGINEERING, P.C.

SITE-WIDE MONITORING, INSPECTION AND MAINTENANCE FORM

Client: **Former Pfizer Inc Site D**
Location: **60-66 Gerry Street, Brooklyn, New York**
Inspector:
Date:

Site Observations

Additional Comments or Clarification Where Corrective Actions May Be Required:

Groundwater Gauging Form, Former Pfizer Inc Site D

60-66 Gerry Street

Brooklyn, New York, NYSDEC Site No. V00350

Date	Well	Depth to Water (ft)	Depth to Bottom (ft)	Well Diameter (inch)
	MW-8			
	MW-9			
	MW-10			
	MW-16R			
	MW-18			
	MW-19			
	MW-20			
	MW-21			
	MW-22			
	MW-23			
	MW-24I			
	MW-25I			
	MW-D2			
	MW-D2I			

Notes:

This form will be generated during the quarterly sampling events and/or in-situ chemical oxidation monitoring events.

ft - Feet

NG - Not gauged

Groundwater Sampling Form, Former Pfizer Inc Site D
60-66 Gerry Street
Brooklyn, New York, NYSDEC Site No. V00350

SITE NAME: **Former Pfizer Inc Site D**

Project Number: **0047.0044Y045**

Weather: ____________________

Date: ____________________

Well ID: ____________________

Intake depth: ____________________

DTW: ____________________

Vol Purged: ____________________

DTB: ____________________

Sampler: ____________________

Purge Start: ____________________

Purge End Time: ____________________

Purge WaterDescription: ____________________

Time	DTW (ft bls) (+/- 0.3 ft)	Flow Rate (ml/Min)	Temp (Degree C) (+/- 3%)	Conductivity (mS/cm) (+/- 3%)	DO (mg/L) (+/- 10%)	Ph (+/- 0.1 SU)	ORP (mV) (+/- 10)	Turbidity (NTU) (+/- 10%)

Summary of Green Remediation Metrics for Site Management

Site Name: ________________________________ Site Code: ______________________
Address: __________________________________ City: _________________________
State: _____________ Zip Code: _________ County: _______________________

Initial Report Period (Start Date of period covered by the Initial Report submittal)
Start Date: ____________________

Current Reporting Period
Reporting Period From: _____________________ To: ___________________________

Contact Information
Preparer's Name: ___________________________ Phone No.: ___________________
Preparer's Affiliation: ___________________________________

I. Energy Usage: Quantify the amount of energy used directly on-site and the portion of that derived from renewable energy sources.

	Current Reporting Period	**Total to Date**
Fuel Type 1 (e.g. natural gas (cf))		
Fuel Type 2 (e.g. fuel oil, propane (gals))		
Electricity (kWh)		
Of that Electric usage, provide quantity:		
Derived from renewable sources (e.g. solar, wind)		
Other energy sources (e.g. geothermal, solar thermal (Btu))		

Provide a description of all energy usage reduction programs for the site in the space provided on Page 3.

II. Solid Waste Generation: Quantify the management of solid waste generated on-site.

	Current Reporting Period (tons)	**Total to Date (tons)**
Total waste generated on-site		
OM&M generated waste		
Of that total amount, provide quantity:		
Transported off-site to landfills		
Transported off-site to other disposal facilities		
Transported off-site for recycling/reuse		
Reused on-site		

Provide a description of any implemented waste reduction programs for the site in the space provided on Page 3.

III. Transportation/Shipping: Quantify the distances travelled for delivery of supplies, shipping of laboratory samples, and the removal of waste.

	Current Reporting Period (miles)	**Total to Date (miles)**
Standby Engineer/Contractor		
Laboratory Courier/Delivery Service		
Waste Removal/Hauling		

Provide a description of all mileage reduction programs for the site in the space provided on Page 3. Include specifically any local vendor/services utilized that are within 50 miles of the site.

IV. Water Usage: Quantify the volume of water used on-site from various sources.

	Current Reporting Period (gallons)	**Total to Date (gallons)**
Total quantity of water used on-site		
Of that total amount, provide quantity:		
Public potable water supply usage		
Surface water usage		
On-site groundwater usage		
Collected or diverted storm water usage		

Provide a description of any implemented water consumption reduction programs for the site in the space provided on Page 3.

V. Land Use and Ecosystems: Quantify the amount of land and/or ecosystems disturbed and the area of land and/or ecosystems restored to a pre-development condition (i.e. Green Infrastructure).

	Current Reporting Period (acres)	**Total to Date (acres)**
Land disturbed		
Land restored		

Provide a description of any implemented land restoration/green infrastructure programs for the site in the space provided on Page 3.

Description of green remediation programs reported above (Attach additional sheets if needed)
Energy Usage:
Waste Generation:
Transportation/Shipping:
Water usage:
Land Use and Ecosystems:
Other:

CERTIFICATION BY CONTRACTOR

I, ___________________________ (**Name**) do hereby certify that I am ______________________ (**Title**) of the Company/Corporation herein referenced and contractor for the work described in the foregoing application for payment. According to my knowledge and belief, all items and amounts shown on the face of this application for payment are correct, all work has been performed and/or materials supplied, the foregoing is a true and correct statement of the contract account up to and including that last day of the period covered by this application.

________________________ ____

Date **Contractor**

APPENDIX J

Field Sampling Plan

May 4, 2017

FIELD SAMPLING PLAN

Former Pfizer Inc Site D
VCP Site Number V00350
60-66 Gerry Street
Brooklyn, New York

Prepared for

PFIZER INC
100 Route 206 North
Peapack, New Jersey 07977

ROUX ASSOCIATES, INC.

Environmental Consulting & Management

ROUX

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

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1. Preservation, Holding Times and Sample Containers

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1. Roux Associates' Standard Operating Procedure for Tasks Described in this Field Sampling Plan
2. Chain of Custody Form
3. Low Stress (Low Flow) Purging and Sampling Procedures for the Collection of Groundwater Samples From Monitoring Wells

1.0 INTRODUCTION

Roux Associates, Inc. (Roux Associates) has developed a Site Management Plan (SMP) to further monitor the nature and extent of potential environmental impacts to the facility identified as the former Pfizer Inc Site D located at 60-66 Gerry Street, Brooklyn, New York (Site). This Field Sampling Plan (FSP) was developed to describe in detail the methods and procedures to be followed by field personnel during the implementation of the fieldwork associated with the SMP.

The FSP was prepared in accordance with directives provided in the DER-10 Technical Guidance for Site Investigation and Remediation (May 2010) issued by the New York State Department of Environmental Conservation (NYSDEC), as well as relevant NYSDEC Technical and Administrative Guidance Memoranda (TAGMs), and provides guidelines and procedures to be followed by field personnel during performance of the SMP. Information contained in this FSP relates to sampling objectives, sampling locations, sampling frequencies, sample designations, sampling equipment, sample handling, sample analysis, and decontamination.

2.0 SAMPLING OBJECTIVES

This FSP was developed based upon a detailed review of available information obtained during previous investigations and is designed to obtain the additional data necessary to achieve the objectives of the SMP. This FSP describes in detail the sampling and data gathering methods to be used during implementation of the SMP.

The objective of the proposed sampling is to monitor the nature and extent of the known contamination on Site, and to evaluate the remediation activities that will be implemented during the redevelopment of the Site.

The scope of work discussed in the FSP includes the tasks described in the SMP, these tasks include:

- Groundwater investigation; and
- Indoor air evaluation.

The sampling procedures associated with characterization of groundwater and indoor air vapor are discussed in detail in Section 4 of this FSP. A discussion of the data quality objectives (DQOs) is provided in the Quality Assurance Project Plan (QAPP) located in Appendix H of the SMP.

3.0 SAMPLE MEDIA, LOCATIONS, ANALYTICAL SUITES, AND FREQUENCY

The media to be sampled during the SMP include groundwater and potentially indoor air vapor. Sampling locations, analytical suites, and frequency vary by medium. A discussion of the sampling schedule for each medium is provided below, while the assumed number of field samples to be collected for each medium, including quality control (QC) samples, will be discussed dependent on the monitoring to be completed. Specifics regarding the collection of samples at each location and for each task are provided in Section 4 of this FSP.

3.1 Groundwater Sampling

There are 14 existing monitoring wells at the Site; all 14 monitoring wells will be gauged using an electronic water probe prior to the start of purging and sampling. Samples will be analyzed, at a minimum, for VOCs plus any additional parameters that are required during completion of the in-site chemical oxidation (ISCO) monitoring phase of work. Field parameters, including temperature, pH, conductivity, redox potential, dissolved oxygen, and turbidity will also be measured.

All Groundwater samples will be analyzed at a laboratory with a current NYSDOH ELAP CLP certification for each of the parameters noted above. Samples will be analyzed on a standard turnaround time and will be reported as Category B data deliverables.

3.2 Indoor Air Monitoring

New buildings with occupancy are planned to have foundations extending below the water table and will have foundation waterproofing acting as a vapor barrier. A sub-slab depressurization system will not be feasible below the proposed building slab. The potential for soil vapor intrusion in new development structures will be evaluated with the collection and analysis of indoor air samples prior to occupation.

4.0 FIELD INVESTIGATION PROCEDURES

This section provides a detailed discussion of the field procedures to be followed during the performance of each field task described in Section 2.0 of the FSP. Proposed sampling locations were determined based upon the information collected during previous investigations and upon completion of the redevelopment.

Roux Associates' Standard Operating Procedures (SOPs) that are relevant to this scope of work are included in Attachment 1 and will be referenced where applicable. Additional information regarding QA/QC protocols and methods may be found in the QAPP (Appendix C of the RI Work Plan).

4.1 Groundwater Investigation

To characterize groundwater flow and quality conditions, the entire network of monitoring wells will be gauged and sampled. Groundwater samples will be collected no sooner than two weeks following development of the wells. As part of the gauging round, water-level measurements will be recorded for all monitoring wells to further define groundwater flow patterns beneath the Site. The wells will be gauged using an electronic water interface probe.

Following the groundwater gauging event, a comprehensive groundwater sampling event will be completed. To ensure groundwater samples collected are representative of the conditions in the surrounding aquifer, monitoring wells will be purged prior to sample collection using low flow sampling procedures as outlined in USEPA document titled "Low Stress (Low Flow) Purging and Sampling Procedures for the Collection of Groundwater Samples From Monitoring Wells" (USEPA, 2010) (Attachment 3). Additional details for the collection of groundwater samples are included in Roux Associates SOPs (Attachment 1).

4.2 Indoor Air Investigation

Indoor air quality samples will be collected within the basement and first floor levels at the breathing zone to determine the potential of vapor intrusion into the Site building. Samples will be collected using batch-certified, vacuum canisters equipped with laboratory-supplied regulators calibrated to collect a sample over a 24-hour interval. Indoor air quality samples will be submitted for VOCs via USEPA Method TO 15.

In conjunction with the indoor air sampling, a minimum of one (1) ambient air quality sample will be collected at the breathing zone to characterize Site-specific background outdoor air conditions. Ambient air samples will accompany each of the indoor air samples in tandem to utilize the NYSDOH matrix to determine the course of action, if warranted.

Samples will be collected using batch-certified, vacuum canisters equipped with laboratory-supplied regulators calibrated to collect a sample over an 8-hour interval. Indoor air quality samples will be submitted for VOCs via USEPA Method TO 15.

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 and shipping procedures.

5.1 Field Sample Handling

A detailed discussion of the number and types of samples to be collected during each task, as well as the analyses to be performed can be found in Section 3.0 of this FSP. The types of containers, volumes needed, and preservation techniques for the aforementioned testing parameters are presented in Table 1.

5.2 Sample Custody Documentation

The purpose of documenting sample custody is to confirm 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. Specific procedures regarding sample tracking from the field to the laboratory are described in Roux Associates' SOP for Sample Handling (Attachment 1).

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 fieldwork and to decide if additional samples are required.

All samples being shipped off-site for analysis must be accompanied by a properly completed chain of custody form (Attachment 2). 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 laboratory pick up and/or shipment 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

Laboratory courier services will be used for the majority of sample transport on this project. However, in the event that samples are shipped to the laboratory the following procedures will apply. 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. Sample packaging and shipment must be performed using the general outline described below. Additional information regarding sample handling is provided in Roux Associates' SOP for Sample Handling (Attachment 1).

All samples will be shipped within 12 hours of collection (when possible) 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;
   - Affix "This Side Up" arrow labels and "Fragile" labels on each cooler; and
   - Place mailing label with laboratory address on top of cooler(s).
2. Arrange sample containers in groups by sample number or analyte.
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 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 with packaging material.
9. If ice is required to preserve the samples, ice cubes should be repackaged in double 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 Federal Express or other carrier, as appropriate.

11. Separate chain of custody forms. Seal proper copies within a large Zip-Lock™ bag and tape to 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 Federal Express or other courier service as appropriate. Retain airbill receipt for project records. (Note: All samples will be shipped for "NEXT A.M." delivery).
16. Telephone laboratory contact and provide him/her with the following shipment information:
    - sampler's name;
    - project name;
    - number of samples sent according to matrix and concentration; and
    - airbill number.

6.0 SITE CONTROL PROCEDURES

Site control procedures, including decontamination and waste handling and disposal, are discussed below.

6.1 Decontamination

In an attempt to avoid the spread of contamination, all drilling and sampling equipment must be decontaminated at a reasonable frequency in a properly designed and located decontamination area. Detailed procedures for the decontamination of field and sampling equipment are included in Roux Associates' SOPs for the Decontamination of Field Equipment, which is provided in Attachment 1. The location of the decontamination area will be determined prior to the start of field operations. The decontamination area will be constructed to ensure that all wash water generated during decontamination can be collected and containerized for proper disposal.

6.2 Waste Handling and Disposal

All waste materials (drill cuttings, decontamination water, etc.) generated during the SMP-phase of work will be consolidated and stored in appropriate bulk containers (drums, etc.), and temporarily staged at an investigation-derived-waste storage area onsite. Roux Associates will then coordinate waste characterization and disposal by appropriate means.

Table 1. Preservation, Holding Times and Sample Containers, Field Sampling Plan, Site Management Plan
Former Pfizer Inc Site D, Brooklyn, NY

Analysis	Sample Medium	Bottle Type	Preservation[a]	Holding Time[b]
TCL Volatile Organic Compounds (VOCs) SW-846 8260B (groundwater) TO-15 (air)	Soil	2 oz wide mouth glass, Teflon lined cap	Cool to 4°C	14 days from sample collection
	Air	6 Liter SUMMA canister with regulator	N/A	30 days from sample collection

Notes:

[a] All groundwater samples to be preserved in ice immediately after collection and during transport

[b] Days from date of sample collection.

oz - Ounces
ml - Milliliters
HCL - Hydrochloric acid

Attachment 1

Roux Associates'
Standard Operating Procedure for
Tasks Described in this Field Sampling Plan

STANDARD OPERATING PROCEDURE 3.1
FOR COLLECTION OF QUALITY CONTROL SAMPLES FOR WATER-QUALITY DATA

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

STANDARD OPERATING PROCEDURE 4.2
FOR MEASURING WATER LEVELS USING AN ELECTRONIC SOUNDING DEVICE (M-SCOPE)

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 gal/ft3)(r2h), 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.

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 PROCUDURE

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.

STANDARD OPERATING PROCEDURE 10.3
FOR SOIL BORING AND/OR MONITORING OR OBSERVATION WELL DRILLING, FORMATION SAMPLING AND BOREHOLE ABANDONMENT IN UNCONSOLIDATED FORMATIONS

Date: May 5, 2000

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to describe the considerations and procedures, and to establish the guidelines for drilling (soil borings, wells, or piezometers) and formation sampling activities in unconsolidated formations. There are several drilling techniques available which include hollow-stem auger, cable tool, hydraulic rotary, cased-hole rotary, and air rotary. Formation (sediment/soil) sample collection include disturbed (drill cuttings), intact (split-spoon), and undisturbed (Shelby-tube or Denison-core). Borehole abandonment (closure) procedures will also be addressed in this SOP.

The objective of drilling is to collect accurate subsurface information and to prepare a borehole for potential completion as a well or piezometer. Consequently, the lithologic data is the all important, most essential information that can be collected. The lithologic data characterizes subsurface conditions, describes hydrogeologic coefficients qualitatively and/or quantitatively, and identifies optimum locations for screen zones if wells are constructed.

Data can be obtained through the physical examination and testing of formation samples, as well as knowledge regarding ground-water levels. Thus, drill fluid mix, fluid loss, rate of drilling, lengths of split-spoon and Shelby-tube/Denison-core recovery, etc. must be monitored by the on-site hydrogeologist or geologist.

2.0 DRILLING TECHNIQUE-SELECTION

Verify that the drilling technique is the one specified in the investigation work plan, and that the drilling equipment mobilized by the driller is in good condition and proper working order. Do not permit the driller to use a drilling rig that appears to be substandard, in disrepair, etc., and/or is questionable as to whether or not the rig has the capabilities to accomplish the goals of the drilling program. The drilling rig must be capable of:

a. Penetration of all anticipated subsurface materials and formations at a desired rate, and construction of a borehole of desired diameter (for the anticipated well, if applicable, including the placement of a gravel or sand pack through a tremie pipe and necessary formation sealing material such as bentonite or cement).

b. Identification of lithology for development of a geologic log of all unconsolidated formations and materials penetrated, including physical characteristics and visual description of color, grain sizes, sorting and mineralogy.

c. Collection of samples of aquifer fluids during the drilling process and prior to well construction, while at the same time minimizing potential for cross-contamination. The method used should prevent cross-contamination between surface soils and ground water or between different hydrogeologic units.

d. Collection of intact and/or undisturbed soil samples from the center line or sidewall of the borehole. This objective requires the drilling to be halted while soil samples are taken from the bottom or side of the incomplete borehole.

e. Completion of the borehole into a well (monitoring or observation) or piezometer during the initial construction process (i.e., constructing a well or piezometer as the borehole is drilled, or constructing a well or piezometer in the borehole immediately after the drilling tools are removed).

f. Implementation of borehole geophysical logging (when applicable and possible) to enable more accurate vertical and horizontal extrapolation of borehole data to the lithology of the hydrogeologic system.

g. Completion of a well or piezometer, if applicable, in the borehole following a time lapse for interpretation of geologic or geophysical data from the borehole.

3.0 DRILLING TECHNIQUE - DESCRIPTION

3.1 Hollow-Stem Auger - This drilling method is rapid and extremely effective in most cohesive sediments but less so in loose sandy material. Penetration may be up to 150 feet below land surface (bls) depending on the size of the rig, drilling conditions, and the diameter of the auger flight; however, depths up to 250 feet bls have been achieved under compatible conditions. A major advantage of this technique is that normally no fluids are introduced into the formation. If the auger flights can be removed and the integrity of the borehole maintained, then electrical and radiation (e.g., gamma, neutron, etc.) geophysical logs can be run. If the auger flights must remain in the borehole, then only radiation geophysical logs can be run. Casing, screen, and sampling devices can then be lowered through the hollow stem by removing the removable plug at the bottom of the auger flights, and gravel packing and cementing can be accomplished within the hollow stem. However, this can be difficult especially below the water table. Auger flight outside diameters (OD) range from 5 inches (in.) to 12 in. The diameter of a well that can be constructed inside the hollow stem is limited, however, to about 4 in.

3.2 Cable Tool (Percussion) - This drilling method is slow because the borehole is advanced by lifting and dropping a heavy string of drilling tools. Cuttings accumulate in the drill casing and are removed by a sand bailer. A steel casing is driven in as the hole is deepened. Cable-tool rigs can be used in unconsolidated sediment and bedrock to depths of hundreds or thousands of feet and often employ telescoping techniques for drilling deep boreholes. Electrical geophysical logs cannot be run through the steel cased borehole, but radiation logs (e.g., gamma, neutron, etc.) can be run. Well casing and screen can be installed within the cased hole after which the outer casing is pulled back (removed). Because the boring is cased as it is being drilled, cross-contamination between various depths is practically eliminated. The method provides an excellent means to collect good, representative formation samples.

3.3 Hydraulic Rotary - This drilling method uses a rotating bit to drill (advance) the borehole. Drill cuttings are removed using a recirculating drilling fluid (mud or water). Although setting up the drilling equipment is slow, the drilling process is reasonably fast. In the mud-rotary method, drilling mud forms a cake on the borehole wall which prevents excessive loss of fluid to the formation being drilled. The hydrostatic pressure combined with the weight and density of the mud slurry keeps the hole open. This allows the drill rods to be removed from the borehole and geophysical logs (electric and radiation) to be run in the open borehole.

In reverse hydraulic rotary drilling, the drilling fluid moves downward through annular space and then upward inside the drill pipe. If the drilling fluid does not contain mud, then sufficient water flow is required as make-up water because the borehole wall is not sealed; therefore, significant water loss can occur to the formation being drilled. The borehole is held open by hydrostatic pressure only. A serious obstacle to this drilling method occurs when the static water level is less than 15 feet below land surface because of insufficient hydrostatic head difference between the borehole and the water table. However, the problems of excessive water loss and shallow depths to water may be overcome by using mud as the drilling fluid.

In mud-rotary drilling, the drilling fluid (mud) moves downward through the drill pipe and then upward through the annular space. Therefore, the borehole is held open by hydrostatic pressure and the mud cake lining the wall of the borehole. The mud-rotary method can be used to construct moderate to deep wells in unconsolidated (and consolidated material), while the reverse rotary technique can be used to construct moderate to deep wells in unconsolidated materials. The principal disadvantage may be the difficulty in removing mud cake from the formation at the screened zone. Extensive well development may be required to remove the mud cake.

3.4 Cased-Hole Rotary - Several new rotary drilling techniques have been developed in which a steel casing is advanced with an air-rotary or mud-rotary drill. This technique is highly desirable for use in exploratory drilling at monitoring sites because water and soil samples may be collected under conditions which preclude contamination from shallower depths. Furthermore, this technique is extremely effective in boulder or cavernous zones which would inhibit or preclude drilling using other techniques. Drilling results are comparable to cable-tool drilling but with greatly enhanced speeds. In all the cased-hole techniques, the main benefit is that the only portion of the borehole which is open, is at the bottom of the drill casing; thus, no soil or water from shallower depths can move down and impact the depth drilled and/or sampled. Electrical geophysical logs cannot be run through the steel-cased borehole, however, radiation logs (e.g., gamma, neutron, etc.) can be run.

Presently, there are three cased-hole rotary techniques which include:

a. The drill-thru casing hammer technique in which the casing is advanced by percussion with a casing hammer or vibratory driver similar to the method used in a borehole drilled by the air-rotary method. The casing hammer can also pull out the casing (air drilling only).

b. The Odex™ Drilling System (European system) which “pulls” the casing using a fixture attached to an air-hammer type drill bit (air drilling only).

c. The Barber™ Drilling System in which drilling is done with a top-head drive and a rotary table that spins casing into the ground. Casing can be fitted with a carbide “shoe” to cut boulders and an air hammer can be used above the bit. Air or mud rotary can be used to lift cuttings.

Two potential problems may be encountered using the cased-hole rotary technique which include: 1) “sand heave” when drilling stops (which can be quickly drilled or bailed out) and 2) possible aeration of water in the cased borehole if volatiles are being tested (which can be overcome by pumping or bailing the standing water out before sampling). The minimum drill casing diameter is 6 inches and depth is limited to approximately 450 feet.

3.5 Air Rotary - This drilling method uses a rotating bit to drill, and high-velocity compressed air to remove cuttings from the borehole. A pneumatic down-hole hammer is often used to add percussion to the rotary drilling action. This drilling method is very fast and, although it is most suitable for penetrating hard bedrock, it can be used in unconsolidated formations. The borehole may be cased or uncased depending on geologic conditions. If an open borehole is drilled, then electrical and radiation (e.g., gamma, neutron, etc.) geophysical logs can be run. If a cased borehole is drilled, then only radiation geophysical logs can be run.

Four potential problems may be encountered when using the air-rotary technique:

a. When a prolific aquifer is tapped, the compressed air may not be able to lift the water to the surface.

b. Aeration of water in the borehole (and finished well) immediately prior to sampling can interfere with a number of inorganic and organic water-quality parameters.

c. Low yield water entry zones may not be identified because the air pressure prevents water from entering the borehole. Care should be taken to prevent overdrilling of the borehole.

d. Air rotary drilling can induce the migration of volatile organics to the surface or adjacent structures causing potential aesthetic or health and safety concerns.

If the air-rotary technique is used then the following special procedures will be implemented:

a. The type of air compressor and lubricating oil will be documented on an appropriate field form and in the field notebook and a 1-pint sample of the oil will be retained for characterization in the event organic compounds are detected in a well sample.

b. An air line oil filter will be required and changed per manufacturer's recommendations during operation with documentation of this maintenance on an appropriate field form and in the field notebook. More frequent oil filter changes will be made if oil is visibly detected in the filtered air.

c. The use of any additive will be prohibited, except approved water (e.g., potable water) for dust control and cuttings removal.

4.0 DECONTAMINATION

Drilling equipment decontamination procedures are outlined in the field equipment decontamination SOP. Proper decontamination in accordance with regulatory guidelines must be clearly documented in the field notebook.

5.0 PROCEDURE FOR DRILLING

5.1 Document all drilling-related activities (e.g., starting, stopping, footage, problems, decontamination, etc.) on the daily log form and in the field notebook. Record dates and times of activities, and names of Roux Associates personnel providing oversight.

5.2 Monitor and record drill fluid mix, speed of rotation, pressure on the drill fluid, rate of drilling, and length of drill rods or casing in the borehole.

5.3 Confirm that the drill rods and core barrel are straight, or discontinue drilling.

5.4 Pay particular attention to the advancement of the boring because differences in the rate of drilling may be indicative of differences in subsurface geologic conditions (e.g., sand and gravel versus clay).

5.5 Maintain a continuous dialogue with the driller to track and keep informed of all drilling activities (e.g., the speed of the drill and drilling pressure, difficult and easy drilling conditions, etc.).

5.6 Collect formation samples as described below in Section 6.0. Sample jars must be labeled appropriately (e.g., project number and name, site location, boring number, date, sample interval, blow counts, and initials of Roux Associates personnel collecting sample).

5.7 Record geologic information in the geologic log form and in the field notebook.

5.8 Handle and ship split-spoon sample jars carefully to avoid breakage and handle and ship tubes or cores carefully to prevent disturbance.

6.0 PROCEDURE FOR FORMATION SAMPLING

6.1 Intact formation sampling will be implemented using split-spoon samplers (which are driven), Shelby-tube samplers (which are pushed), or Denison-core samplers (which are rotated) depending on the drilling technique employed. Formation samples will be retained in suitable size (e.g., 1-pint or 0.5-pint) jars for physical descriptions and potential physical and chemical analysis. The appropriately labeled jars and tubes will be stored in a safe place to avoid breakage, agitation, and freezing. Intact formation samples will be collected as described in the work plan at specified intervals (e.g., at 5-foot increments below land surface) and at each major change in subsurface materials. Hydrogeologic information will be recorded on a geologic log form and in the field notebook. Detailed descriptions of the type(s) of intact sample(s) collected, sampling intervals and conditions, and objective(s) of the sample collection will be provided in the work plan.

6.2 Disturbed formation samples (drill cuttings) will be examined continuously throughout the entire depth of the borehole. If applicable to the study and/or stated in the work plan, borehole cuttings will be collected from the circulating auger flights which lift cuttings to land surface (hollow-stem auger technique), from the sand bailer (cable-tool technique), from the recirculating drilling fluid (mudflume) which transports cuttings to land surface (mud-rotary and related techniques), or from the compressed air used to carry cuttings to land surface (air-rotary and related techniques). Formation samples will be retained in appropriate size (e.g., 1-pint or 0.5-pint), properly labeled jars and stored in a safe place to avoid breakage, agitation, and freezing. Hydrogeologic data will be recorded on a geologic log form and in the field notebook.

6.3 The soil cores from the wells drilled at the site are used for lithologic identification. The first 18 inches of soil for each borehole will be collected intact using a split-spoon sample, Shelby-tube sampler, or Denison-core sampler. Split-spoon samples may be collected continuously from boreholes for cluster wells; single well and/or piezometer boreholes may be split-spooned throughout drilling or at specified intervals or changes in lithology. The conditions for sampling will be specified in the work plan.

6.4 Before collecting and retaining soil and/or sediments collected with the split-spoon sampler, the top several inches will be removed from the sampler and discarded to eliminate any sediment that may have caved into the bottom of the borehole.

6.5 Sediment sampling equipment such as split-spoon samplers, spatulas, etc. (but not including Shelby-tube or Denison-core samplers, which area not re-usable) will be decontaminated by steam cleaning and/or a non-phosphate, laboratory-grade and distilled/deionized wash followed by a distilled/deionized water rinse. (Refer to the SOP for Decontamination of Field Equipment for a detailed description of minimum and special decontamination procedures.) Decontamination of sediment sampling equipment will take place prior to the collection of the first sample and following the collection of each subsequent sample.

7.0 BOREHOLE ABANDONMENT OR CLOSURE

7.1 Upon the completion of the investigation, a determination will be made as whether to maintain the borehole (for a well or piezometer) or to close it (i.e., abandon and seal it). If the client and Roux Associates agree to abandon the borehole, then the state will be notified and a request will be presented for borehole abandonment. Upon state approval to seal the borehole, appropriate state borehole abandonment forms will be completed, if required. Following state approval, the abandonment of any borehole (or boring) will be in accordance with local, state and/or Federal regulations.

7.2 For each abandoned borehole, the procedure will be documented on an appropriate field form or in the study notebook. Documentation may include, where appropriate, the following:

a. Borehole designation.

b. Location with respect to the replacement borehole, if replaced (e.g., 30 ft north and 40 ft west of Borehole B-1). A location sketch should be prepared.

c. Open depth prior to grouting and any other relevant circumstances (e.g., formation collapse).

d. Drill casing left in the borehole by depth, size, and composition.

e. A copy of the geologic log.

f. A revised diagram of the abandoned borehole using a supplemental geologic log form.

g. Additional items left in hole by depth, description, and composition (e.g., lost tools, bailers, etc.).

h. A description and daily quantities of grout used to compensate for settlement.

i. The date of grouting.

j. The level of water or mud prior to grouting and the date and time measured.

k. Any other state or local well abandonment reporting requirements.

END OF PROCEDURE

Attachment 2

Chain of Custody Form

NEW YORK CHAIN OF CUSTODY

Westborough, MA 01581
8 Walkup Dr.
TEL: 508-898-9220
FAX: 508-898-9193

Mansfield, MA 02048
320 Forbes Blvd
TEL: 508-822-9300
FAX: 508-822-3288

Service Centers
Mahwah, NJ 07430: 35 Whitney Rd, Suite 5
Albany, NY 12205: 14 Walker Way
Tonawanda, NY 14150: 275 Cooper Ave, Suite 105

Page
of

Date Rec'd in Lab

ALPHA Job #

Client Information

Client:
Address:
Phone:
Fax:
Email:

Project Information

Project Name:
Project Location:
Project #
(Use Project name as Project #) ☐
Project Manager:
ALPHAQuote #:

Turn-Around Time

Standard ☐ Due Date:
Rush (only if pre approved) ☐ # of Days:

Deliverables

☐ ASP-A
☐ ASP-B
☐ EQuIS (1 File)
☐ EQuIS (4 File)
☐ Other

Regulatory Requirement

☐ NY TOGS
☐ NY Part 375
☐ AWQ Standards
☐ NY CP-51
☐ NY Restricted Use
☐ Other
☐ NY Unrestricted Use
☐ NYC Sewer Discharge

Billing Information

☐ Same as Client Info
PO #

Disposal Site Information

Please identify below location of applicable disposal facilities.

Disposal Facility:
☐ NJ ☐ NY
☐ Other:

These samples have been previously analyzed by Alpha ☐

Other project specific requirements/comments:

Please specify Metals or TAL.

ANALYSIS

Sample Filtration
☐ **Done**
☐ **Lab to do**
Preservation
☐ **Lab to do**

(Please Specify below)

ALPHA Lab ID (Lab Use Only)	Sample ID	Collection Date	Collection Time	Sample Matrix	Sampler's Initials									**Sample Specific Comments**	Total Bottle

Preservative Code:
A = None
B = HCl
C = HNO_3
D = H_2SO_4
E = NaOH
F = MeOH
G = $NaHSO_4$
H = $Na_2S_2O_3$
K/E = Zn Ac/NaOH
O = Other

Container Code
P = Plastic
A = Amber Glass
V = Vial
G = Glass
B = Bacteria Cup
C = Cube
O = Other
E = Encore
D = BOD Bottle

Westboro: Certification No: MA935
Mansfield: Certification No: MA015

Container Type								
Preservative								

Relinquished By:	Date/Time	Received By:	Date/Time

Please print clearly, legibly and completely. Samples can not be logged in and turnaround time clock will not start until any ambiguities are resolved. BY EXECUTING THIS COC, THE CLIENT HAS READ AND AGREES TO BE BOUND BY ALPHA'S TERMS & CONDITIONS. (See reverse side.)

Form No: 01-25 HC (rev. 30-Sept-2013)

Attachment 3

Low Stress (Low Flow) Purging and Sampling Procedures for the Collection of Groundwater Samples From Monitoring Wells

U.S. ENVIRONMENTAL PROTECTION AGENCY REGION I

LOW STRESS (low flow) PURGING AND SAMPLING PROCEDURE FOR THE COLLECTION OF GROUNDWATER SAMPLES FROM MONITORING WELLS

Quality Assurance Unit
U.S. Environmental Protection Agency – Region 1
11 Technology Drive
North Chelmsford, MA 01863

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Prepared by: Charles Porfert 1/19/10
(Charles Porfert, Quality Assurance Unit) Date

Approved by: Gerard Sotolongo 1-19-10
(Gerard Sotolongo, Quality Assurance Unit) Date

Revision Page

Date	**Rev #**	**Summary of changes**	**Sections**
7/30/96	2	Finalized	
01/19/10	3	Updated	All sections

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USE OF TERMS

Equipment blank: The equipment blank shall include the pump and the pump's tubing. If tubing is dedicated to the well, the equipment blank needs only to include the pump in subsequent sampling rounds. If the pump and tubing are dedicated to the well, the equipment blank is collected prior to its placement in the well. If the pump and tubing will be used to sample multiple wells, the equipment blank is normally collected after sampling from contaminated wells and not after background wells.

Field duplicates: Field duplicates are collected to determine precision of the sampling procedure. For this procedure, collect duplicate for each analyte group in consecutive order (VOC original, VOC duplicate, SVOC original, SVOC duplicate, etc.).

Indicator field parameters: This SOP uses field measurements of turbidity, dissolved oxygen, specific conductance, temperature, pH, and oxidation/reduction potential (ORP) as indicators of when purging operations are sufficient and sample collection may begin.

Matrix Spike/Matrix Spike Duplicates: Used by the laboratory in its quality assurance program. Consult the laboratory for the sample volume to be collected.

Poteniometric Surface: The level to which water rises in a tightly cased well constructed in a confined aquifer. In an unconfined aquifer, the potentiometric surface is the water table.

QAPP: Quality Assurance Project Plan

SAP: Sampling and Analysis Plan

SOP: Standard operating procedure

Stabilization: A condition that is achieved when all indicator field parameter measurements are sufficiently stable (as described in the "Monitoring Indicator Field Parameters" section) to allow sample collection to begin.

Temperature blank: A temperature blank is added to each sample cooler. The blank is measured upon receipt at the laboratory to assess whether the samples were properly cooled during transit.

Trip blank (VOCs): Trip blank is a sample of analyte-free water taken to the sampling site and returned to the laboratory. The trip blanks (one pair) are added to each sample cooler that contains VOC samples.

SCOPE & APPLICATION

The goal of this groundwater sampling procedure is to collect water samples that reflect the total mobile organic and inorganic loads (dissolved and colloidal sized fractions) transported through the subsurface under ambient flow conditions, with minimal physical and chemical alterations from sampling operations. This standard operating procedure (SOP) for collecting groundwater samples will help ensure that the project's data quality objectives (DQOs) are met under certain low-flow conditions.

The SOP emphasizes the need to minimize hydraulic stress at the well-aquifer interface by maintaining low water-level drawdowns, and by using low pumping rates during purging and sampling operations. Indicator field parameters (e.g., dissolved oxygen, pH, etc.) are monitored during purging in order to determine when sample collection may begin. Samples properly collected using this SOP are suitable for analysis of groundwater contaminants (volatile and semi-volatile organic analytes, dissolved gases, pesticides, PCBs, metals and other inorganics), or naturally occurring analytes. This SOP is based on Puls, and Barcelona (1996).

This procedure is designed for monitoring wells with an inside diameter (1.5-inches or greater) that can accommodate a positive lift pump with a screen length or open interval ten feet or less and with a water level above the top of the screen or open interval (Hereafter, the "screen or open interval" will be referred to only as "screen interval"). This SOP is not applicable to other well-sampling conditions.

While the use of dedicated sampling equipment is not mandatory, dedicated pumps and tubing can reduce sampling costs significantly by streamlining sampling activities and thereby reducing the overall field costs.

The goal of this procedure is to emphasize the need for consistency in deploying and operating equipment while purging and sampling monitoring wells during each sampling event. This will help to minimize sampling variability.

This procedure describes a general framework for groundwater sampling. Other site specific information (hydrogeological context, conceptual site model (CSM), DQOs, etc.) coupled with systematic planning must be added to the procedure in order to develop an appropriate site specific SAP/QAPP. In addition, the site specific SAP/QAPP must identify the specific equipment that will be used to collect the groundwater samples.

This procedure does not address the collection of water or free product samples from wells containing free phase LNAPLs and/or DNAPLs (light or dense non-aqueous phase liquids). For this type of situation, the reader may wish to check: Cohen, and Mercer (1993) or other pertinent documents.

This SOP is to be used when collecting groundwater samples from monitoring wells at all Superfund, Federal Facility and RCRA sites in Region 1 under the conditions described herein. Request for modification of this SOP, in order to better address specific situations at individual wells, must include adequate technical justification for proposed changes. <u>All changes and modifications must be approved and included in a revised SAP/QAPP before implementation in field.</u>

BACKGROUND FOR IMPLEMENTATION

It is expected that the monitoring well screen has been properly located (both laterally and vertically) to intercept existing contaminant plume(s) or along flow paths of potential contaminant migration. Problems with inappropriate monitoring well placement or faulty/improper well installation cannot be overcome by even the best water sampling procedures. This SOP presumes that the analytes of interest are moving (or will potentially move) primarily through the more permeable zones intercepted by the screen interval.

Proper well construction, development, and operation and maintenance cannot be overemphasized. The use of installation techniques that are appropriate to the hydrogeologic setting of the site often prevent "problem well" situations from occurring. During well development, or redevelopment, tests should be conducted to determine the hydraulic characteristics of the monitoring well. The data can then be used to set the purging/sampling rate, and provide a baseline for evaluating changes in well performance and the potential need for well rehabilitation. Note: if this installation data or well history (construction and sampling) is not available or discoverable, for all wells to be sampled, efforts to build a sampling history should commence with the next sampling event.

The pump intake should be located within the screen interval and at a depth that will remain under water at all times. It is recommended that the intake depth and pumping rate remain the same for all sampling events. The mid-point or the lowest historical midpoint of the saturated screen length is often used as the location of the pump intake. For new wells, or for wells without pump intake depth information, the site's SAP/QAPP must provide clear reasons and instructions on how the pump intake depth(s) will be selected, and reason(s) for the depth(s) selected. If the depths to top and bottom of the well screen are not known, the SAP/QAPP will need to describe how the sampling depth will be determined and how the data can be used.

Stabilization of indicator field parameters is used to indicate that conditions are suitable for sampling to begin. Achievement of turbidity levels of less than 5 NTU, and stable drawdowns of less than 0.3 feet, while desirable, are not mandatory. Sample collection may still take place provided the indicator field parameter criteria in this procedure are met. If after 2 hours of purging indicator field parameters have not stabilized, one of three optional courses of action may be taken: a) continue purging until stabilization is achieved, b) discontinue purging, do not collect any samples, and record in log book that stabilization could not be achieved (documentation must describe attempts to achieve stabilization), c) discontinue purging, collect samples and provide full explanation of attempts to achieve stabilization (note: there is a risk that the analytical data obtained, especially metals and strongly hydrophobic organic analytes, may reflect a sampling bias and therefore, the data may not meet the data quality objectives of the sampling event).

It is recommended that low-flow sampling be conducted when the air temperature is above 32°F (0°C). If the procedure is used below 32°F, special precautions will need to be taken to prevent the groundwater from freezing in the equipment. Because sampling during freezing temperatures may adversely impact the data quality objectives, the need for water sample collection during months when these conditions are likely to occur should be evaluated during site planning and special sampling measures may need to be developed. Ice formation in the flow-through-cell will cause the monitoring probes to act erratically. A transparent flow-through-cell needs to be used to observe if ice is forming in the cell. If ice starts to form on the other pieces of the sampling equipment, additional problems may occur.

HEALTH & SAFETY

When working on-site, comply with all applicable OSHA requirements and the site's health/safety procedures. All proper personal protection clothing and equipment are to be worn. Some samples may contain biological and chemical hazards. These samples should be handled with suitable protection to skin, eyes, etc.

CAUTIONS

The following cautions need to be considered when planning to collect groundwater samples when the below conditions occur.

If the groundwater degasses during purging of the monitoring well, dissolved gases and VOCs will be lost. When this happens, the groundwater data for dissolved gases (e.g., methane, ethene, ethane, dissolved oxygen, etc.) and VOCs will need to be qualified. Some conditions that can promote degassing are the use of a vacuum pump (e.g., peristaltic pumps), changes in aperture along the sampling tubing, and squeezing/pinching the pump's tubing which results in a pressure change.

When collecting the samples for dissolved gases and VOCs analyses, avoid aerating the groundwater in the pump's tubing. This can cause loss of the dissolved gases and VOCs in the groundwater. Having the pump's tubing completely filled prior to sampling will avoid this problem when using a centrifugal pump or peristaltic pump.

Direct sun light and hot ambient air temperatures may cause the groundwater in the tubing and flow-through-cell to heat up. This may cause the groundwater to degas which will result in loss of VOCs and dissolved gases. When sampling under these conditions, the sampler will need to shade the equipment from the sunlight (e.g., umbrella, tent, etc.). If possible, sampling on hot days, or during the hottest time of the day, should be avoided. The tubing exiting the monitoring well should be kept as short as possible to avoid the sun light or ambient air from heating up the groundwater.

Thermal currents in the monitoring well may cause vertical mixing of water in the well bore. When the air temperature is colder than the groundwater temperature, it can cool the top of the water column. Colder water which is denser than warm water sinks to the bottom of the well and the warmer water at the bottom of the well rises, setting up a convention cell. "During low-flow sampling, the pumped water may be a mixture of convecting water from within the well casing and aquifer water moving inward through the screen. This mixing of water during low-flow sampling can substantially increase equilibration times, can cause false stabilization of indicator parameters, can give false indication of redox state, and can provide biological data that are not representative of the aquifer conditions" (Vroblesky 2007).

Failure to calibrate or perform proper maintenance on the sampling equipment and measurement instruments (e.g., dissolved oxygen meter, etc.) can result in faulty data being collected.

Interferences may result from using contaminated equipment, cleaning materials, sample containers, or uncontrolled ambient/surrounding air conditions (e.g., truck/vehicle exhaust nearby).

Cross contamination problems can be eliminated or minimized through the use of dedicated sampling equipment and/or proper planning to avoid ambient air interferences. Note that the use of dedicated sampling equipment can also significantly reduce the time needed to complete each sampling event, will promote consistency in the sampling, and may reduce sampling bias by having the pump's intake at a constant depth.

Clean and decontaminate all sampling equipment prior to use. All sampling equipment needs to be routinely checked to be free from contaminants and equipment blanks collected to ensure that the equipment is free of contaminants. Check the previous equipment blank data for the site (if they exist) to determine if the previous cleaning procedure removed the contaminants. If contaminants were detected and they are a concern, then a more vigorous cleaning procedure will be needed.

PERSONNEL QUALIFICATIONS

All field samplers working at sites containing hazardous waste must meet the requirements of the OSHA regulations. OSHA regulations may require the sampler to take the 40 hour OSHA health and safety training course and a refresher course prior to engaging in any field activities, depending upon the site and field conditions.

The field samplers must be trained prior to the use of the sampling equipment, field instruments, and procedures. Training is to be conducted by an experienced sampler before initiating any sampling procedure.

The entire sampling team needs to read, and be familiar with, the site Health and Safety Plan, all relevant SOPs, and SAP/QAPP (and the most recent amendments) before going onsite for the sampling event. It is recommended that the field sampling leader attest to the understanding of these site documents and that it is recorded.

EQUIPMENT AND SUPPLIES

A. Informational materials for sampling event

A copy of the current Health and Safety Plan, SAP/QAPP, monitoring well construction data, location map(s), field data from last sampling event, manuals for sampling, and the monitoring instruments' operation, maintenance, and calibration manuals should be brought to the site.

B. Well keys.

C. Extraction device

Adjustable rate, submersible pumps (e.g., centrifugal, bladder, etc.) which are constructed of stainless steel or Teflon are preferred. Note: if extraction devices constructed of other materials are to be used, adequate information must be provided to show that the substituted materials do not leach contaminants nor cause interferences to the analytical procedures to be used. Acceptance of these materials must be obtained before the sampling event.

If bladder pumps are selected for the collection of VOCs and dissolved gases, the pump setting should be set so that one pulse will deliver a water volume that is sufficient to fill a 40 mL VOC vial. This is not mandatory, but is considered a "best practice". For the proper operation, the bladder pump will need a minimum amount of water above the pump; consult the manufacturer for the recommended submergence. The pump's recommended submergence value should be determined during the planning stage, since it may influence well construction and placement of dedicated pumps where water-level fluctuations are significant.

Adjustable rate, peristaltic pumps (suction) are to be used with caution when collecting samples for VOCs and dissolved gases (e.g., methane, carbon dioxide, etc.) analyses. Additional information on the use of peristaltic pumps can be found in Appendix A. If peristaltic pumps are used, the inside diameter of the rotor head tubing needs to match the inside diameter of the tubing installed in the monitoring well.

Inertial pumping devices (motor driven or manual) are not recommended. These devices frequently cause greater disturbance during purging and sampling, and are less easily controlled than submersible pumps (potentially increasing turbidity and sampling variability, etc.). This can lead to sampling results that are adversely affected by purging and sampling operations, and a higher degree of data variability.

D. Tubing

Teflon or Teflon-lined polyethylene tubing are preferred when sampling is to include VOCs, SVOCs, pesticides, PCBs and inorganics. Note: if tubing constructed of other materials is to be used, adequate information must be provided to show that the substituted materials do not leach contaminants nor cause interferences to the analytical procedures to be used. Acceptance of these materials must be obtained before the sampling event.

PVC, polypropylene or polyethylene tubing may be used when collecting samples for metal and other inorganics analyses.

The use of 1/4 inch or 3/8 inch (inside diameter) tubing is recommended. This will help ensure that the tubing remains liquid filled when operating at very low pumping rates when using centrifugal and peristaltic pumps.

Silastic tubing should be used for the section around the rotor head of a peristaltic pump. It should be less than a foot in length. The inside diameter of the tubing used at the pump rotor head must be the same as the inside diameter of tubing placed in the well. A tubing connector is used to connect the pump rotor head tubing to the well tubing. Alternatively, the two pieces of tubing can be connected to each other by placing the one end of the tubing inside the end of the other tubing. The tubing must not be reused.

E. The water level measuring device

Electronic "tape", pressure transducer, water level sounder/level indicator, etc. should be capable of measuring to 0.01 foot accuracy. Recording pressure transducers, mounted above the pump, are especially helpful in tracking water levels during pumping operations, but their use must include check measurements with a water level "tape" at the start and end of each sampling event.

F. Flow measurement supplies

Graduated cylinder (size according to flow rate) and stopwatch usually will suffice.

Large graduated bucket used to record total water purged from the well.

G. Interface probe

To be used to check on the presence of free phase liquids (LNAPL, or DNAPL) before purging begins (as needed).

H. Power source (generator, nitrogen tank, battery, etc.)

When a gasoline generator is used, locate it downwind and at least 30 feet from the well so that the exhaust fumes do not contaminate samples.

I. Indicator field parameter monitoring instruments

Use of a multi-parameter instrument capable of measuring pH, oxidation/reduction potential (ORP), dissolved oxygen (DO), specific conductance, temperature, and coupled with a flow-through-cell is required when measuring all indicator field parameters, except turbidity. Turbidity is collected using a separate instrument. Record equipment/instrument identification (manufacturer, and model number).

Transparent, small volume flow-through-cells (e.g., 250 mLs or less) are preferred. This allows observation of air bubbles and sediment buildup in the cell, which can interfere with the operation of the monitoring instrument probes, to be easily detected. A small volume cell facilitates rapid turnover of water in the cell between measurements of the indicator field parameters.

It is recommended to use a flow-through-cell and monitoring probes from the same manufacturer and model to avoid incompatibility between the probes and flow-through-cell.

Turbidity samples are collected before the flow-through-cell. A "T" connector coupled with a valve is connected between the pump's tubing and flow-through-cell. When a turbidity measurement is required, the valve is opened to allow the groundwater to flow into a container. The valve is closed and the container sample is then placed in the turbidimeter.

Standards are necessary to perform field calibration of instruments. A minimum of two standards are needed to bracket the instrument measurement range for all parameters except ORP which use a Zobell solution as a standard. For dissolved oxygen, a wet sponge used for the 100% saturation and a zero dissolved oxygen solution are used for the calibration.

Barometer (used in the calibration of the Dissolved Oxygen probe) and the conversion formula to convert the barometric pressure into the units of measure used by the Dissolved Oxygen meter are needed.

J. Decontamination supplies

Includes (for example) non-phosphate detergent, distilled/deionized water, isopropyl alcohol, etc.

K. Record keeping supplies

Logbook(s), well purging forms, chain-of-custody forms, field instrument calibration forms, etc.

L. Sample bottles

M. Sample preservation supplies (as required by the analytical methods)

N. Sample tags or labels

O. PID or FID instrument

If appropriate, to detect VOCs for health and safety purposes, and provide qualitative field evaluations.

P. Miscellaneous Equipment

Equipment to keep the sampling apparatus shaded in the summer (e.g., umbrella) and from freezing in the winter. If the pump's tubing is allowed to heat up in the warm weather, the cold groundwater may degas as it is warmed in the tubing.

EQUIPMENT/INSTRUMENT CALIBRATION

Prior to the sampling event, perform maintenance checks on the equipment and instruments according to the manufacturer's manual and/or applicable SOP. This will ensure that the equipment/instruments are working properly before they are used in the field.

Prior to sampling, the monitoring instruments must be calibrated and the calibration documented. The instruments are calibrated using U.S Environmental Protection Agency Region 1 *Calibration of Field Instruments (temperature, pH, dissolved oxygen, conductivity/specific conductance, oxidation/reduction [ORP], and turbidity)*, January 19, 2010, or latest version or from one of the methods listed in 40CFR136, 40CFR141 and SW-846.

The instruments shall be calibrated at the beginning of each day. If the field measurement falls outside the calibration range, the instrument must be re-calibrated so that all measurements fall within the calibration range. At the end of each day, a calibration check is performed to verify that instruments remained in calibration throughout the day. This check is performed while the instrument is in measurement mode, not calibration mode. If the field instruments are being used to monitor the natural attenuation parameters, then a calibration check at mid-day is highly recommended to ensure that the instruments did not drift out of calibration. Note: during the day if the instrument reads zero or a negative number for dissolved oxygen, pH, specific conductance, or turbidity (negative value only), this indicates that the instrument drifted out of calibration or the instrument is malfunctioning. If this situation occurs the data from this instrument will need to be qualified or rejected.

PRELIMINARY SITE ACTIVITIES (as applicable)

Check the well for security (damage, evidence of tampering, missing lock, etc.) and record pertinent observations (include photograph as warranted).

If needed lay out sheet of clean polyethylene for monitoring and sampling equipment, unless equipment is elevated above the ground (e.g., on a table, etc.).

Remove well cap and if appropriate measure VOCs at the rim of the well with a PID or FID instrument and record reading in field logbook or on the well purge form.

If the well casing does not have an established reference point (usually a V-cut or indelible mark in the well casing), make one. Describe its location and record the date of the mark in the logbook (consider a photographic record as well). All water level measurements must be recorded relative to this reference point (and the altitude of this point should be determined using techniques that are appropriate to site's DQOs.

If water-table or potentiometric surface map(s) are to be constructed for the sampling event, perform synoptic water level measurement round (in the shortest possible time) before any purging and sampling activities begin. If possible, measure water level depth (to 0.01 ft.) and total well depth (to 0.1 ft.) the day before sampling begins, in order to allow for re-settlement of any particulates in the water column. This is especially important for those wells that have not been recently sampled because sediment buildup in the well may require the well to be redeveloped. If measurement of total well depth is not made the day before, it should be measured after sampling of the well is complete. All measurements must be taken from the established referenced point. Care should be taken to minimize water column disturbance.

Check newly constructed wells for the presence of LNAPLs or DNAPLs before the initial sampling round. If none are encountered, subsequent check measurements with an interface probe may not be necessary unless analytical data or field analysis signal a worsening situation. This SOP cannot be used in the presence of LNAPLs or DNAPLs. If NAPLs are present, the project team must decide upon an alternate sampling method. All project modifications must be approved and documented prior to implementation.

If available check intake depth and drawdown information from previous sampling event(s) for each well. Duplicate, to the extent practicable, the intake depth and extraction rate (use final pump dial setting information) from previous event(s). If changes are made in the intake depth or extraction rate(s) used during previous sampling event(s), for either portable or dedicated extraction devices, record new values, and explain reasons for the changes in the field logbook.

PURGING AND SAMPLING PROCEDURE

Purging and sampling wells in order of increasing chemical concentrations (known or anticipated) are preferred.

The use of dedicated pumps is recommended to minimize artificial mobilization and entrainment of particulates each time the well is sampled. Note that the use of dedicated sampling equipment can also significantly reduce the time needed to complete each sampling event, will promote consistency in the sampling, and may reduce sampling bias by having the pump's intake at a constant depth.

A. Initial Water Level

Measure the water level in the well before installing the pump if a non-dedicated pump is being used. The initial water level is recorded on the purge form or in the field logbook.

B. Install Pump

Lower pump, safety cable, tubing and electrical lines slowly (to minimize disturbance) into the well to the appropriate depth (may not be the mid-point of the screen/open interval). The Sampling and Analysis Plan/Quality Assurance Project Plan should specify the sampling depth (used previously), or provide criteria for selection of intake depth for each new well. If possible keep the pump intake at least two feet above the bottom of the well, to minimize mobilization of particulates present in the bottom of the well.

Pump tubing lengths, above the top of well casing should be kept as short as possible to minimize heating the groundwater in the tubing by exposure to sun light and ambient air temperatures. Heating may cause the groundwater to degas, which is unacceptable for the collection of samples for VOC and dissolved gases analyses.

C. Measure Water Level

Before starting pump, measure water level. Install recording pressure transducer, if used to track drawdowns, to initialize starting condition.

D. Purge Well

From the time the pump starts purging and until the time the samples are collected, the purged water is discharged into a graduated bucket to determine the total volume of groundwater purged. This information is recorded on the purge form or in the field logbook.

Start the pump at low speed and slowly increase the speed until discharge occurs. Check water level. Check equipment for water leaks and if present fix or replace the affected equipment. Try to match pumping rate used during previous sampling event(s). Otherwise, adjust pump speed until there is little or no water level drawdown. If the minimal drawdown that can be achieved exceeds 0.3 feet, but remains stable, continue purging.

Monitor and record the water level and pumping rate every five minutes (or as appropriate) during purging. Record any pumping rate adjustments (both time and flow rate). Pumping rates should, as needed, be reduced to the minimum capabilities of the pump to ensure stabilization of the water level. Adjustments are best made in the first fifteen minutes of pumping in order to help minimize purging time. During pump start-up, drawdown may exceed the 0.3 feet target and then "recover" somewhat as pump flow adjustments are made. Purge volume calculations should utilize stabilized drawdown value, not the initial drawdown. If the initial water level is above the top of the screen do not allow the water level to fall into the well screen. The final purge volume must be greater than the stabilized drawdown volume plus the pump's tubing volume. If the drawdown has exceeded 0.3 feet and stabilizes, calculate the volume of water between the initial water level and the stabilized water level. Add the volume of the water which occupies the pump's tubing to this calculation. This combined volume of water needs to be purged from the well after the water level has stabilized before samples are collected.

Avoid the use of constriction devices on the tubing to decrease the flow rate because the constrictor will cause a pressure difference in the water column. This will cause the groundwater to degas and result in a loss of VOCs and dissolved gasses in the groundwater samples.

Note: the flow rate used to achieve a stable pumping level should remain constant while monitoring the indicator parameters for stabilization and while collecting the samples.

Wells with low recharge rates may require the use of special pumps capable of attaining very low pumping rates (e.g., bladder, peristaltic), and/or the use of dedicated equipment. For new monitoring wells, or wells where the following situation has not occurred before, if the recovery rate to the well is less than 50 mL/min., or the well is being essentially dewatered during purging, the well should be sampled as soon as the water level has recovered sufficiently to collect the volume needed for all anticipated samples. The project manager or field team leader will need to make the decision when samples should be collected, how the sample is to be collected, and the reasons recorded on the purge form or in the field logbook. A water level measurement needs to be performed and recorded before samples are collected. If the project manager decides to collect the samples using the pump, it is best during this recovery period that the pump intake tubing not be removed, since this will aggravate any turbidity problems. Samples in this specific situation may be collected without stabilization of indicator field parameters. Note that field conditions and efforts to overcome problematic situations must be recorded in order to support field decisions to deviate from normal procedures described in this SOP. If this type of problematic situation persists in a well, then water sample collection should be changed to a passive or no-purge method, if consistent with the site's DQOs, or have a new well installed.

E. Monitor Indicator Field Parameters

After the water level has stabilized, connect the "T" connector with a valve and the flow-through-cell to monitor the indicator field parameters. If excessive turbidity is anticipated or encountered with the pump startup, the well may be purged for a while without connecting up the flow-through-cell, in order to minimize particulate buildup in the cell (This is a judgment call made by the sampler). Water level drawdown measurements should be made as usual. If possible, the pump may be installed the day before purging to allow particulates that were disturbed during pump insertion to settle.

During well purging, monitor indicator field parameters (turbidity, temperature, specific conductance, pH, ORP, DO) at a frequency of five minute intervals or greater. The pump's flow rate must be able to "turn over" at least one flow-through-cell volume between measurements (for a 250 mL flow-through-cell with a flow rate of 50 mLs/min., the monitoring frequency would be every five minutes; for a 500 mL flow-through-cell it would be every ten minutes). If the cell volume cannot be replaced in the five minute interval, then the time between measurements must be increased accordingly. Note: during the early phase of purging emphasis should be put on minimizing and stabilizing pumping stress, and recording those adjustments followed by stabilization of indicator parameters. Purging is considered complete and sampling may begin when all the above indicator field parameters have stabilized. Stabilization is considered to be achieved when three consecutive readings are within the following limits:

Turbidity (10% for values greater than 5 NTU; if three Turbidity values are less than 5 NTU, consider the values as stabilized),
Dissolved Oxygen (10% for values greater than 0.5 mg/L, if three Dissolved Oxygen values are less than 0.5 mg/L, consider the values as stabilized),
Specific Conductance (3%),
Temperature (3%),
pH (± 0.1 unit),
Oxidation/Reduction Potential (±10 millivolts).

All measurements, except turbidity, must be obtained using a flow-through-cell. Samples for turbidity measurements are obtained before water enters the flow-through-cell. Transparent flow-through-cells are preferred, because they allow field personnel to watch for particulate build-up within the cell. This build-up may affect indicator field parameter values measured within the cell. If the cell needs to be cleaned during purging operations, continue pumping and disconnect cell for cleaning, then reconnect after cleaning and continue monitoring activities. Record start and stop times and give a brief description of cleaning activities.

The flow-through-cell must be designed in a way that prevents gas bubble entrapment in the cell. Placing the flow-through-cell at a 45 degree angle with the port facing upward can help remove bubbles from the flow-through-cell (see Appendix B Low-Flow Setup Diagram). All during the measurement process, the flow-through-cell must remain free of any gas bubbles. Otherwise, the monitoring probes may act erratically. When the pump is turned off or cycling on/off (when using a bladder pump), water in the cell must not drain out. Monitoring probes must remain submerged in water at all times.

F. Collect Water Samples

When samples are collected for laboratory analyses, the pump's tubing is disconnected from the "T" connector with a valve and the flow-through-cell. The samples are collected directly from the pump's tubing. Samples must not be collected from the flow-through-cell or from the "T" connector with a valve.

VOC samples are normally collected first and directly into pre-preserved sample containers. However, this may not be the case for all sampling locations; the SAP/QAPP should list the order in which the samples are to be collected based on the project's objective(s). Fill all sample containers by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence.

If the pump's flow rate is too high to collect the VOC/dissolved gases samples, collect the other samples first. Lower the pump's flow rate to a reasonable rate and collect the VOC/dissolved gases samples and record the new flow rate.

During purging and sampling, the centrifugal/peristaltic pump tubing must remain filled with water to avoid aeration of the groundwater. It is recommended that 1/4 inch or 3/8 inch (inside diameter) tubing be used to help insure that the sample tubing remains water filled. If the pump tubing is not completely filled to the sampling point, use the following procedure to collect samples: collect non-VOC/dissolved gases samples first, then increase flow rate slightly until the water completely fills the tubing, collect the VOC/dissolved gases samples, and record new drawdown depth and flow rate.

For bladder pumps that will be used to collect VOC or dissolved gas samples, it is recommended that the pump be set to deliver long pulses of water so that one pulse will fill a 40 mL VOC vial.

Use pre-preserved sample containers or add preservative, as required by analytical methods, to the samples immediately after they are collected. Check the analytical methods (e.g. EPA SW-846, 40 CFR 136, water supply, etc.) for additional information on preservation.

If determination of filtered metal concentrations is a sampling objective, collect filtered water samples using the same low flow procedures. The use of an in-line filter (transparent housing preferred) is required, and the filter size (0.45 μm is commonly used) should be based on the sampling objective. Pre-rinse the filter with groundwater prior to sample collection. Make sure the filter is free of air bubbles before samples are collected. Preserve the filtered water sample immediately. Note: filtered water samples are not an acceptable substitute for unfiltered samples when the monitoring objective is to obtain chemical concentrations of total mobile contaminants in groundwater for human health or ecological risk calculations.

Label each sample as collected. Samples requiring cooling will be placed into a cooler with ice or refrigerant for delivery to the laboratory. Metal samples after acidification to a pH less than 2 do not need to be cooled.

G. Post Sampling Activities

If a recording pressure transducer is used to track drawdown, re-measure water level with tape.

After collection of samples, the pump tubing may be dedicated to the well for re-sampling (by hanging the tubing inside the well), decontaminated, or properly discarded.

Before securing the well, measure and record the well depth (to 0.1 ft.), if not measured the day before purging began. Note: measurement of total well depth annually is usually sufficient after the initial low stress sampling event. However, a greater frequency may be needed if the well has a "silting" problem or if confirmation of well identity is needed.

Secure the well.

DECONTAMINATION

Decontaminate sampling equipment prior to use in the first well and then following sampling of each well. Pumps should not be removed between purging and sampling operations. The pump, tubing, support cable and electrical wires which were in contact with the well should be decontaminated by one of the procedures listed below.

The use of dedicated pumps and tubing will reduce the amount of time spent on decontamination of the equipment. If dedicated pumps and tubing are used, only the initial sampling event will require decontamination of the pump and tubing.

Note if the previous equipment blank data showed that contaminant(s) were present after using the below procedure or the one described in the SAP/QAPP, a more vigorous procedure may be needed.

Procedure 1

Decontaminating solutions can be pumped from either buckets or short PVC casing sections through the pump and tubing. The pump may be disassembled and flushed with the decontaminating solutions. It is recommended that detergent and alcohol be used sparingly in the decontamination process and water flushing steps be extended to ensure that any sediment trapped in the pump is removed. The pump exterior and electrical wires must be rinsed with the decontaminating solutions, as well. The procedure is as follows:

Flush the equipment/pump with potable water.

Flush with non-phosphate detergent solution. If the solution is recycled, the solution must be changed periodically.

Flush with potable or distilled/deionized water to remove all of the detergent solution. If the water is recycled, the water must be changed periodically.

Optional - flush with isopropyl alcohol (pesticide grade; must be free of ketones {e.g., acetone}) or with methanol. This step may be required if the well is highly contaminated or if the equipment blank data from the previous sampling event show that the level of contaminants is significant.

Flush with distilled/deionized water. This step must remove all traces of alcohol (if used) from the equipment. The final water rinse must not be recycled.

Procedure 2

Steam clean the outside of the submersible pump.

Pump hot potable water from the steam cleaner through the inside of the pump. This can be accomplished by placing the pump inside a three or four inch diameter PVC pipe with end cap. Hot water from the steam cleaner jet will be directed inside the PVC pipe and the pump exterior will be cleaned. The hot water from the steam cleaner will then be pumped from the PVC pipe through the pump and collected into another container. Note: additives or solutions should not be added to the steam cleaner.

Pump non-phosphate detergent solution through the inside of the pump. If the solution is recycled, the solution must be changed periodically.

Pump potable water through the inside of the pump to remove all of the detergent solution. If the solution is recycled, the solution must be changed periodically.

Pump distilled/deionized water through the pump. The final water rinse must not be recycled.

FIELD QUALITY CONTROL

Quality control samples are required to verify that the sample collection and handling process has not compromised the quality of the groundwater samples. All field quality control samples must be prepared the same as regular investigation samples with regard to sample volume, containers, and preservation. Quality control samples include field duplicates, equipment blanks, matrix spike/matrix spike duplicates, trip blanks (VOCs), and temperature blanks.

FIELD LOGBOOK

A field log shall be kept to document all groundwater field monitoring activities (see Appendix C, example table), and record the following for each well:

Site name, municipality, state.

Well identifier, latitude-longitude or state grid coordinates.

Measuring point description (e.g., north side of PVC pipe).

Well depth, and measurement technique.

Well screen length.

Pump depth.

Static water level depth, date, time and measurement technique.

Presence and thickness of immiscible liquid (NAPL) layers and detection method.

Pumping rate, drawdown, indicator parameters values, calculated or measured total volume pumped, and clock time of each set of measurements.

Type of tubing used and its length.

Type of pump used.

Clock time of start and end of purging and sampling activity.

Types of sample bottles used and sample identification numbers.

Preservatives used.

Parameters requested for analyses.

Field observations during sampling event.

Name of sample collector(s).

Weather conditions, including approximate ambient air temperature.

QA/QC data for field instruments.

Any problems encountered should be highlighted.

Description of all sampling/monitoring equipment used, including trade names, model number, instrument identification number, diameters, material composition, etc.

DATA REPORT

Data reports are to include laboratory analytical results, QA/QC information, field indicator parameters measured during purging, field instrument calibration information, and whatever other field logbook information is needed to allow for a full evaluation of data usability.

Note: the use of trade, product, or firm names in this sampling procedure is for descriptive purposes only and does not constitute endorsement by the U.S. EPA.

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Robert W. Puls and Michael J. Barcelona, *Low-Flow (Minimal Drawdown) Ground-Water Sampling Procedures*, April 1996 (EPA/540/S-95/504).

U.S. Environmental Protection Agency, 1992, *RCRA Ground-Water Monitoring: Draft Technical Guidance*; Washington, DC (EPA/530-R-93-001).

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U.S Environmental Protection Agency, EPA SW-846.

U.S Environmental Protection Agency, 40 CFR 136.

U.S Environmental Protection Agency, 40 CFR 141.

Vroblesky, Don A., Clifton C. Casey, and Mark A. Lowery, Summer 2007, Influence of Dissolved Oxygen Convection on Well Sampling, *Ground Water Monitoring & Remediation* 27, no. 3: 49-58.

APPENDIX A
PERISTALTIC PUMPS

Before selecting a peristaltic pump to collect groundwater samples for VOCs and/or dissolved gases (e.g., methane, carbon dioxide, etc.) consideration should be given to the following:

- The decision of whether or not to use a peristaltic pump is dependent on the intended use of the data.
- If the additional sampling error that may be introduced by this device is NOT of concern for the VOC/dissolved gases data's intended use, then this device may be acceptable.
- If minor differences in the groundwater concentrations could effect the decision, such as to continue or terminate groundwater cleanup or whether the cleanup goals have been reached, then this device should NOT be used for VOC/dissolved gases sampling. In these cases, centrifugal or bladder pumps are a better choice for more accurate results.

EPA and USGS have documented their concerns with the use of the peristaltic pumps to collect water sample in the below documents.

- "Suction Pumps are not recommended because they may cause degassing, pH modification, and loss of volatile compounds" *A Compendium of Superfund Field Operations Methods*, EPA/540/P-87/001, December 1987.
- "The agency does not recommend the use of peristaltic pumps to sample ground water particularly for volatile organic analytes" *RCRA Ground-Water Monitoring Draft Technical Guidance*, EPA Office of Solid Waste, November 1992.
- "The peristaltic pump is limited to shallow applications and can cause degassing resulting in alteration of pH, alkalinity, and volatiles loss", *Low-flow (Minimal drawdown) Ground-Water Sampling Procedures*, by Robert Puls & Michael Barcelona, April 1996, EPA/540/S-95/504.
- "Suction-lift pumps, such as peristaltic pumps, can operate at a very low pumping rate; however, using negative pressure to lift the sample can result in the loss of volatile analytes", USGS Book 9 Techniques of Water-Resources Investigation, Chapter A4. (Version 2.0, 9/2006).

APPENDIX B

SUMMARY OF SAMPLING INSTRUCTIONS

These instructions are for using an adjustable rate, submersible pump or a peristaltic pump with the pump's intake placed at the midpoint of a 10 foot or less well screen or an open interval. The water level in the monitoring well is above the top of the well screen or open interval, the ambient temperature is above 32°F, and the equipment is not dedicated. Field instruments are already calibrated. The equipment is setup according to the diagram at the end of these instructions.

1. Review well installation information. Record well depth, length of screen or open interval, and depth to top of the well screen. Determine the pump's intake depth (e.g., mid-point of screen/open interval).

2. On the day of sampling, check security of the well casing, perform any safety checks needed for the site, lay out a sheet of polyethylene around the well (if necessary), and setup the equipment. If necessary a canopy or an equivalent item can be setup to shade the pump's tubing and flow-through-cell from the sun light to prevent the sun light from heating the groundwater.

3. Check well casing for a reference mark. If missing, make a reference mark. Measure the water level (initial) to 0.01 ft. and record this information.

4. Install the pump's intake to the appropriate depth (e.g., midpoint) of the well screen or open interval. Do not turn-on the pump at this time.

5. Measure water level and record this information.

6. Turn-on the pump and discharge the groundwater into a graduated waste bucket. Slowly increase the flow rate until the water level starts to drop. Reduce the flow rate slightly so the water level stabilizes. Record the pump's settings. Calculate the flow rate using a graduated container and a stop watch. Record the flow rate. Do not let the water level drop below the top of the well screen.

If the groundwater is highly turbid or colored, continue to discharge the water into the bucket until the water clears (visual observation); this usually takes a few minutes. The turbid or colored water is usually from the well being disturbed during the pump installation. If the water does not clear, then you need to make a choice whether to continue purging the well (hoping that it will clear after a reasonable time) or continue to the next step. Note, it is sometimes helpful to install the pump the day before the sampling event so that the disturbed materials in the well can settle out.

If the water level drops to the top of the well screen during the purging of the well, stop purging the well, and do the following:

> Wait for the well to recharge to a sufficient volume so samples can be collected. This may take awhile (pump maybe removed from well, if turbidity is not a problem). The project manager will need to make the decision when samples should be collected and the reasons recorded in the site's log book. A water level measurement needs to be performed and recorded before samples are collected. When samples are being collected, the water level must not drop below the top of the screen or open interval. Collect the samples from the pump's tubing. Always collect the VOCs and dissolved gases samples first. Normally, the samples requiring a small volume are collected before the large volume samples are collected just in case there is not sufficient water in the well to fill all the sample containers. All samples must be collected, preserved, and stored according to the analytical method. Remove the pump from the well and decontaminate the sampling equipment.

If the water level has dropped 0.3 feet or less from the initial water level (water level measure before the pump was installed); proceed to Step 7. If the water level has dropped more than 0.3 feet, calculate the volume of water between the initial water level and the stabilized water level. Add the volume of the water which occupies the pump's tubing to this calculation. This combined volume of water needs to be purged from the well after the water level has stabilized before samples are be collected.

7. Attach the pump's tubing to the "T" connector with a valve (or a three-way stop cock). The pump's tubing from the well casing to the "T" connector must be as short as possible to prevent the groundwater in the tubing from heating up from the sun light or from the ambient air. Attach a short piece of tubing to the other end of the end of the "T" connector to serve as a sampling port for the turbidity samples. Attach the remaining end of the "T" connector to a short piece of tubing and connect the tubing to the flow-through-cell bottom port. To the top port, attach a small piece of tubing to direct the water into a calibrated waste bucket. Fill the cell with the groundwater and remove all gas bubbles from the cell. Position the flow-through-cell in such a way that if gas bubbles enter the cell they can easily exit the cell. If the ports are on the same side of the cell and the cell is cylindrical shape, the cell can be placed at a 45-degree angle with the ports facing upwards; this position should keep any gas bubbles entering the cell away from the monitoring probes and allow the gas bubbles to exit the cell easily (see Low-Flow Setup Diagram). Note,

make sure there are no gas bubbles caught in the probes' protective guard; you may need to shake the cell to remove these bubbles.

8. Turn-on the monitoring probes and turbidity meter.

9. Record the temperature, pH, dissolved oxygen, specific conductance, and oxidation/reduction potential measurements. Open the valve on the "T" connector to collect a sample for the turbidity measurement, close the valve, do the measurement, and record this measurement. Calculate the pump's flow rate from the water exiting the flow-through-cell using a graduated container and a stop watch, and record the measurement. Measure and record the water level. Check flow-through-cell for gas bubbles and sediment; if present, remove them.

10. Repeat Step 9 every 5 minutes or as appropriate until monitoring parameters stabilized. Note at least one flow-through-cell volume must be exchanged between readings. If not, the time interval between readings will need to be increased. Stabilization is achieved when three consecutive measurements are within the following limits:

Turbidity (10% for values greater than 5 NTUs; if three Turbidity values are less than 5 NTUs, consider the values as stabilized),
Dissolved Oxygen (10% for values greater than 0.5 mg/L, if three Dissolved Oxygen values are less than 0.5 mg/L, consider the values as stabilized),
Specific Conductance (3%),
Temperature (3%),
pH (± 0.1 unit),
Oxidation/Reduction Potential (±10 millivolts).

If these stabilization requirements do not stabilize in a reasonable time, the probes may have been coated from the materials in the groundwater, from a buildup of sediment in the flow-through-cell, or a gas bubble is lodged in the probe. The cell and the probes will need to be cleaned. Turn-off the probes (not the pump), disconnect the cell from the "T" connector and continue to purge the well. Disassemble the cell, remove the sediment, and clean the probes according to the manufacturer's instructions. Reassemble the cell and connect the cell to the "T" connector. Remove all gas bubbles from the cell, turn-on the probes, and continue the measurements. Record that the time the cell was cleaned.

11. When it is time to collect the groundwater samples, turn-off the monitoring probes, and disconnect the pump's tubing from the "T" connector. If you are using a centrifugal or peristaltic pump check the pump's tubing to determine if the tubing is completely filled with water (no air space).

All samples must be collected and preserved according to the analytical method. VOCs and dissolved gases samples are normally collected first and directly into pre-preserved sample containers. However, this may not be the case for all sampling locations; the SAP/QAPP should list the order in which the samples are to be collected based on the project's objective(s). Fill all sample containers by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence.

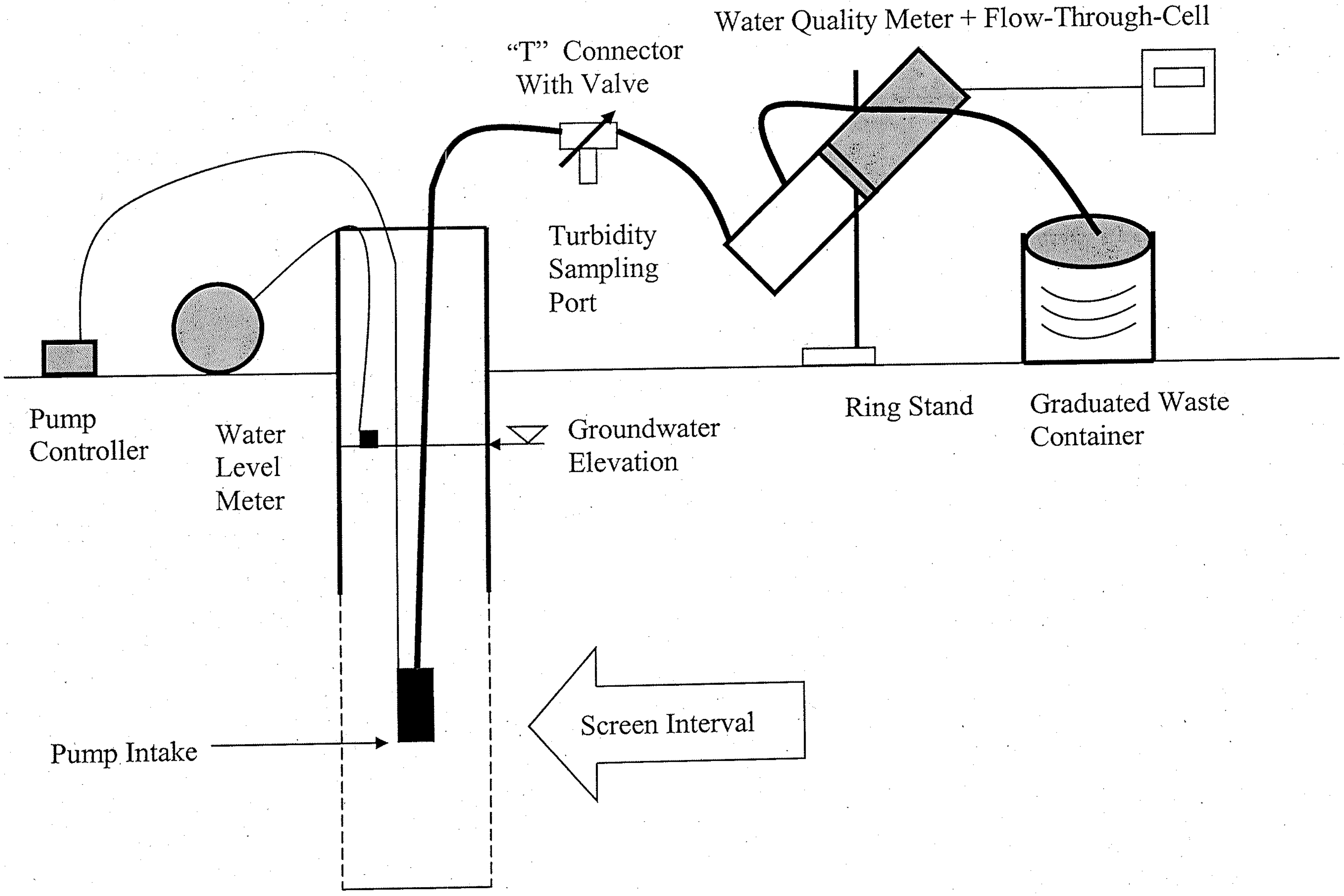
If the pump's tubing is not completely filled with water and the samples are being collected for VOCs and/or dissolved gases analyses using a centrifugal or peristaltic pump, do the following:

> All samples must be collected and preserved according to the analytical method. The VOCs and the dissolved gases (e.g., methane, ethane, ethene, and carbon dioxide) samples are collected last. When it becomes time to collect these samples increase the pump's flow rate until the tubing is completely filled. Collect the samples and record the new flow rate.

12. Store the samples according to the analytical method.

13. Record the total purged volume (graduated waste bucket). Remove the pump from the well and decontaminate the sampling equipment.

Low-Flow Setup Diagram



APPENDIX C

EXAMPLE (Minimum Requirements)

WELL PURGING-FIELD WATER QUALITY MEASUREMENTS FORM

Location (Site/Facility Name)____________________
Well Number____________ Date____________
Field Personnel____________________
Sampling Organization____________________
Identify MP____________________

Depth to ______/______ of screen
(below MP) top bottom
Pump Intake at (ft. below MP)________
Purging Device; (pump type)________
Total Volume Purged ________

Clock Time 24 HR	Water Depth below MP ft	Pump Dial[1]	Purge Rate ml/min	Cum. Volume Purged liters	Temp. °C	Spec. Cond.[2] µS/cm	pH	ORP[3] mv	DO mg/L	Turb-idity NTU	Comments
Stabilization Criteria					3%	3%	±0.1	± 10 mv	10%	10%	

1. Pump dial setting (for example: hertz, cycles/min, etc).
2. µSiemens per cm(same as µmhos/cm)at 25°C.
3. Oxidation reduction potential (ORP)