UST REMOVAL WORK PLAN
FOR ORGANICS/SUCIAC BLOCK

Pfizer Inc Williamsburg Facility
Brooklyn, New York

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1.0 INTRODUCTION

Roux Associates, Inc. (Roux Associates) has prepared this UST Removal Work Plan (Work Plan) for the removal of underground storage tanks (USTs) at the recently demolished Organics/Suciac Block at the Pfizer Inc (Pfizer), Williamsburg Facility, Brooklyn, New York (Site). The objectives of the Work Plan are to:

- remove the previously closed-in-place petroleum and process USTs that remain beneath the Organics/Suciac Block in connection with ongoing demolition activities of the Block;
- delineate soil impacts previously identified in the vicinity of the former Powerhouse USTs (Tanks 201, 202 and 207) that were removed during June/July, 1993; and
- provide a preliminary scope of work to perform a block-wide soil investigation designed to determine soil-quality conditions beneath each of the former buildings in preparation for future development of the Site.

This Work Plan has been prepared using a phased approach. In this manner, data collection efforts can be rescoped on an ongoing basis during the investigation to ensure that the appropriate data are collected in an efficient manner. Therefore, the Work Plan has been divided into five tasks as follows:

- Task 1: Pre-UST Removal Investigation;
- Task 2: Removal of Petroleum USTs;
- Task 3: Removal of Process USTs;
- Task 4: Preliminary Scope of Work for Block-Wide Soil Investigation; and
- Task 5: Reporting.

A brief discussion of pertinent background information, including a description and status of the USTs, and description of hydrogeologic conditions at the Site are provided below. The Scope of Work is presented in Section 2.0. The schedule to implement the Scope of Work is provided in Section 3.0.

1.1 Site Background and Status of USTs

The Pfizer Williamsburg facility is located at 630 Flushing Avenue, Brooklyn, New York (Figure 1). The Organics/Suciac Block is located in the central portion of the facility and is bounded on the north by Wallabout Street, on the east by Harrison Avenue, on the south by Gerry Street and on the west by Union Avenue (Figure 2).

Pfizer is currently decommissioning the Organics/Suciac Block, along with portions of the adjoining Citric Block, to prepare these properties for future re-development and/or beneficial use. As part of this process, the Organics/Suciac Block buildings have been demolished and the USTs will be removed. The building demolition activities at the Organics/Suciac Block were completed during March 1995. The construction debris from the former buildings were disposed at the Fresh Kills Landfill in Staten Island, New York. Presently, the reinforced concrete slab foundation is the only above-ground remanent of the former buildings. The slab is continuous throughout the entire block and it varies in thickness (i.e., approximately 1 to 3 ft). All below-grade structures, including the building foundations, USTs, piping and utilities still remain in place at this time. Building foundations extend to a depth of approximately 15 feet bls. Five closed-in-place petroleum and 19 process USTs are presently located beneath the slab as shown in Plate 1. The USTs were closed in place prior to 1991 in accordance with federal, state and city guidelines under the direction of Pfizer.

Table 1 lists the former petroleum and process USTs usage, construction date, date of decommissioning/removal, size, capacity and content and is based upon a review of Pfizer's files (e.g., engineering drawings). As part of the closure process, the USTs' contents were emptied and then filled with sand or other inert material. Three USTs (i.e., Tanks 201, 202 and 207), formerly located on Gerry Street near the former Powerhouse, were removed in June/July 1993 with Roux Associates providing oversight.

To date, only limited soil investigations have been performed at the Organics/Suciac Block. A soil quality investigation was performed in July 1993 by Roux Associates around the three former Powerhouse USTs, in advance of removing these tanks. The results of this work were provided in a June 17, 1993 report titled, "Subsurface Investigation at 33 Gerry Street, flowed through this area. Underlying the continuous gray clay layer is the Upper Glacial aquifer, which the top of the clay is present at approximately 30 ft to 40 ft beneath the Organics/Suciac Block (Figure 3).

Depth to ground water is approximately seven to nine feet bls, as observed during the June/July 1993 Powerhouse UST Removal Investigation (Roux Associates 1993). The ground water encountered was perched on top of the low permeability clay layer. Ground-water flow beneath the Organics/Suciac Block within the Upper Glacial aquifer (i.e., 30 ft to 40 ft bls) is to the northwest toward the East River (USGS 1979). Historical ground-water quality data developed from on-site production and diffusion wells at the Site indicate the water supply aquifers beneath the Williamsburg Plant have not been impacted by Site operations.

Brooklyn, New York." This investigation included the collection and analysis of six soil samples (SB-1 through SB-6) to determine potential impacts attributable from the former USTs. The results indicated that the surrounding soil had been impacted from the former USTs. As indicated in the June 17, 1993 report, complete delineation of the extent of petroleum-impacted soil could not be performed due to the presence of the adjoining building structures. Consequently, further soil delineation efforts were delayed until building demolition was completed.

A soil boring and sampling investigation was also conducted in 1989 by Roux Associates in the vicinity of Process USTs 301 through 309 (i.e., former Building 22) in connection with the closure of these tanks. The results were reported in the 1989 report titled, "Investigation of Possible Underground Tank Release." Ten soil samples (SB-1 through SB-10) were collected in and around the UST vaults and analyzed to determine potential soil impacts attributable from the process USTs. Benzene and toluene were detected with concentrations ranging from 13 micrograms per kilogram (μg/kg) to 7,000 μg/kg and 12 μg/kg to 15,000 μg/kg, respectively. All contaminated soil that was accessable within the tank vaults was removed. Excavation outside of the tank vaults was not performed. The extent of the impacted soil outside the tank vaults could not be determined due to the presence of building structures.

1.2 Site Hydrogeology

The Pfizer Williamsburg facility is located one mile east of the East River and is underlain by unconsolidated deposits that are comprised of man-made fill and underlying natural clays and sands. A geologic cross section of the Site is shown in Figure 3. The man-made fill immediately underlies the Organics/Suciac Block to a depth of approximately 10 feet below land surface (bls) (Figure 3). The fill is typically comprised of black to brown coarse sand and gravel that contains varying amounts of bricks, cinders and scrap metal.

The fill is immediately underlain by a thick, low permeability clay layer that varies in thickness from approximately 30 ft to 40 ft beneath the Organics/Suciac Block (Figure 3). The gray clay forms a continuous layer beneath the Organics/Suciac Block, and apparently reflects the former marsh environment that surrounded Wallabout Creek which formerly flowed through this area. Underlying the continuous gray clay layer is the Upper Glacial aquifer, which begins at approximately 30 ft to 40 ft beneath the Organics/Suciac Block (Figure 3).

Depth to ground water is approximately seven to nine feet bls, as observed during the June/July 1993 Powerhouse UST Removal Investigation (Roux Associates 1993). The ground water encountered was perched on top of the low permeability clay layer. Ground-water flow beneath the Organics/Suciac Block within the Upper Glacial aquifer (i.e., 30 ft to 40 ft bls) is to the northwest toward the East River (USGS 1979). Historical ground-water quality data developed from on-site production and diffusion wells at the Site indicate the water supply aquifers beneath the Williamsburg Plant have not been impacted by Site operations.

2.0 SCOPE OF WORK

The Scope of Work includes the following tasks:

- Task 1: Pre-UST Removal Soil Investigation;
- Task 2: Removal of Petroleum USTs;
- Task 3: Removal of Process USTs;
- Task 4: Preliminary Block-Wide Soil Investigation; and
- Task 5: Reporting.

Any amendments to the Work Plan will be verbally communicated to the NYSDEC and memorialized in a field change memorandum(s). All field change memorandums will be provided as an attachment to the investigation report.

All field tasks will be performed in accordance with the Health and Safety Plan which has been prepared for the Site (Appendix A). A description of each task is provided below.

2.1 Task 1: Pre-UST Removal Soil Investigation

The objective of the Pre-UST Removal Soil Investigation is to determine the presence, approximate extent and magnitude of soil contamination around each UST or UST group prior to UST removal efforts. These data will be used to estimate the volume of impacted soil to be removed and guide subsequent soil excavation efforts.

This task is subdivided into the following subtasks:

- Subtask 1.1: Soil Borings and Sampling - Petroleum USTs;
- Subtask 1.2: Soil Borings and Sampling - Former Powerhouse USTs;
- Subtask 1.3: Soil Borings and Sampling - Process USTs; and
- Subtask 1.4: Interim Report.

2.1.1 Subtask 1.1: Soil Borings - Petroleum USTs

Soil borings and sampling will be conducted to characterize the soil quality surrounding each petroleum UST or UST group. The proposed soil boring locations in the vicinity of the petroleum USTs are shown (in blue color) in Plate 1. The borings will be drilled using the Geoprobe™ Method. A hollow-stem auger drill rig or tripod will be used at locations where fill material or subsurface debris precludes the use of Geoprobe™ Methods. It should be noted that prior to soil sampling, the concrete slab at each soil boring location will be cored (i.e. 1 ft diameter by 1 ft to 3 ft in depth) to permit the use of Geoprobe™ equipment.

The following list describes the number of soil borings and their associated designations.

Petroleum USTs	Number of Soil Borings	Soil Boring Designation
Tank 203	4	SB-203A through SB-203D
Tank 205	4	SB-205A through SB-205D
Tank 206	4	SB-206A through SB-206D
Tank 208	4	SB-208A through SB-208D
Tank 209	1	SB-209A

At each boring, soil samples will be collected continuously at 2-ft intervals down to the perched water table (i.e., approximately 7 to 9 feet bls) or to the clay layer (i.e., whichever is first encountered). Each soil sample will be inspected by the field geologist or engineer to characterize lithology and any evidence of contamination (i.e., staining and odors). A portion of each soil sample will be placed in a plastic Ziplock™ bag or glass jar and screened in the field for volatile organic compounds (VOCs) using a photoionization detector (PID). Soil boring and sample procedures are provided in the Roux Associates Standard Operating Procedures (SOPs) (Appendix B).

The soil sample that exhibits the highest degree of contamination (i.e., staining and odors) will be selected for laboratory analysis. However, if no impacts are discernable, the 2-foot interval above the perched water table (or clay layer) will be submitted for analysis. The projected number of soil samples for laboratory analysis is provided in Table 2. In addition, two Shelby tube samples (i.e., undisturbed sample) of the underlying clay layer will be collected to determine vertical permeability. The determination of vertical permeability will be used to evaluate, if necessary, fate and transport of potential contaminants through the clay layer.

Each soil sample will be analyzed using United States Environmental Protection Agency (USEPA) Method 1311 and 8021 for Toxicity Characteristic Leaching Procedure (TCLP) VOCs and using USEPA Method 1311 and 8270 for TCLP base neutral compounds (BNs) in accordance with the NYSDEC Spill Technology and Remediation Series (Memo #1), Petroleum Contaminated Soil Guidance Policy, August 1992 (STARs). The analyses were selected based upon the former contents of the USTs and to determine the initial extent for soil removal.

Prior to the collection of soil samples via the Geoprobe™ Method, the concrete slab will be cut using a coring machine. An approximate 1-foot diameter by 1 ft to 3 ft in depth hole will be made to permit the use of sampling equipment.

Soil borings with Geoprobe™ equipment will be conducted with van or truck mounted probing equipment. The vehicle will be positioned over the selected boring location, and a 2-ft long drive point sampler containing disposable acetate liner will be attached to steel rods and driven to the desired sampling depth. The drive point sampler remains closed while it is being driven to the sampling depth. The sampler is opened by releasing a stop pin from the surface, and the sampler is driven 2 ft into the material to be sampled. Releasing the stop pin allows a piston to retract inside of the sampling tube while it is displaced by the soil core. The soil core is contained within the disposable acetate liner in the sampler. The drive point sampler is removed from the ground by retracting the steel rods. The disposable acetate liner, with the intact soil sample, is then removed from the drive point sampler. The soil sample is then described and collected in the same manner as described above and in the SOPs (Appendix B).

To prevent cross-contamination, all downhole, dedicated equipment will be decontaminated after each use by washing in potable water and non-phosphate laboratory grade detergent, followed by a potable water rinse.

2.1.2 Subtask 1.2: Soil Borings - Former Powerhouse USTs

Six soil borings (SB-7 through SB-12) will be drilled and sampled to further delineate soil impacts previously identified as part of the Former Powerhouse UST Removal Investigation (Roux Associates 1993) for Tank 201, Tank 202 and Tank 207. The proposed soil boring locations in the vicinity of the former Powerhouse are shown (in magenta color) in Plate 1. In addition, two soil borings will be completed as temporary wells to monitor only for free product. The borings to be completed as temporary wells will be determined at the time of drilling based upon visual observation of the soil samples. The temporary wells will consist of 2-inch diameter PVC well casing with a 5-foot screen. No gravel packing or seal material (i.e., bentonite) will be used between the borehole and well.

An electronic product-water interface probe will be used to detect free product and determine its thickness (if present). Each apparent detection of free product will be confirmed using a clear bailer. Product thickness measurements will be accurate to ±0.01 ft.

Soil boring and sampling procedures are described above (Section 2.1.1) and are provided in the Roux Associates SOPs (Appendix B). The soil samples will be analyzed for TCLP VOCs using USEPA Methods 1311 and 8021 and for TCLP BNs using USEPA Methods 1311 and 8270, in accordance with STARs Memo #1. The projected number of soil samples for laboratory analysis is provided in Table 2.

2.1.3 Subtask 1.3: Soil Borings - Process USTs

Soil borings and sampling will be conducted to characterize the soil quality surrounding each process UST or UST group. The proposed soil boring locations in the vicinity of the process USTs are shown (in green color) in Plate 1.

The following list describes the number of proposed soil borings and their associated designations.

Process USTs	Number of Soil Borings	Soil Boring Designation
Tanks 301 through 309	6	SB-301A, SB-303A, SB-303B, SB-308A, SB-308B, and SB-309A
Tanks 310 and 311	4	SB-310A, SB-310B, SB-310C, and SB-311A
Tank 313	4	SB-313A through SB-313D
Tanks 314 through 318	4	SB-314A, SB-316A, SB-316B, and SB-318A
Tank 319	2	SB-319A and SB-319B
Tanks 320	3	SB-320A through SB-320C

Soil boring and sampling procedures are described above (Section 2.1.1) and are provided in the Roux Associates SOPs (Appendix B). The proposed analytical program, along with the projected number of soil samples for laboratory analysis, is provided in Table 2.

2.1.4 Subtask 1.4: Interim Report

Upon completion of Subtasks 1.1 through 1.3, a brief interim summary report will be prepared and will include at a minimum:

- a description of all samples collected;
- the sampling locations;
- a location map showing all sample points;
- all analytical results; and
- recommendations/modifications to Task 2 through Task 4, if necessary.

A final summary report will be prepared following receipt of Pfizer's comments.

2.2 Task 2 - Removal of Petroleum USTs

Five petroleum USTs (i.e., Tanks No. 203, 205, 206, 208 and 209) will be removed and disposed in accordance with the following:

- U.S. Environmental Protection Agency (USEPA) 40 CFR 280, Technical Standards and Corrective Action Requirements for Owners and Operators of USTs;

- NYSDEC Division of Water Regulations, Title 6 NYCRR Part 613;
- NYSDEC Spill Technology and Remediation Series (Memo #1), Petroleum-Contaminated Soil Guidance Policy, August 1992 (STARs);
- Spill Prevention Operation Technology Series (No. 14), Site Assessment at Bulk Storage Facilities, May 15, 1991 (SPOTs);
- Removal and Disposal of Used Underground Petroleum Storage Tanks, American Petroleum Institute Recommended Practice 1604 (1987); and
- A Guide to the Assessment and Remediation of Underground Petroleum Releases, American Petroleum Institute Recommended Practice 1628 (1987).

The UST removal program consists of the uncovering, excavation and removal of remaining USTs; excavation of impacted soils; and the stockpiling, sampling and disposal of excavated soil. The UST removal program is designed to enable the completion of tank removal and impacted soil excavation efforts in one mobilization without interruption or delays. To accomplish this, soil excavation efforts will proceed in a "leap frog" fashion. For example, while awaiting receipt of post-excavation results for an active excavation, the UST removal team will move to the next UST location and complete the UST removal, excavation of impacted soil and post-excavation soil sampling. While awaiting receipt of post-excavation results for this excavation, the UST removal team will proceed back to the first excavation and backfill or continue the excavation, based upon post-excavation results. In this way, UST removal efforts can proceed without interruption.

Excavated soil will be temporarily stockpiled on the fenced-in slab within the Organics/Suciac Block. Three soil stockpiles will be created for temporary storage of:

1. sands contained within the USTs;
2. impacted soil; and
3. clean soil removed during the uncovering of each UST.

UST sands and the impacted soil stockpile will be sampled for waste classification parameters. The clean soil stockpile will be analyzed to determine whether these soils can be used as backfill for the completed excavation.

A description of each component of the UST removal process is provided below.

UST Excavation Oversight

Conceptually, removal of each UST will proceed in the following manner. The UST removal team will mobilize to the first UST and cut and remove the concrete slab overlying the UST. The soil overlying the UST will then be removed. This soil will be inspected for evidence of contamination (i.e., staining and odors). Impacted soil overlying the UST will be stockpiled separate from clean soil.

Following the removal of the overlying soil, the UST will be removed. It should be noted that each UST is currently filled with sand (or other inert material) which may preclude removal in one piece. USTs that cannot be removed in one piece will be cut into sections in-place prior to removal. The sand contained within the UST will be excavated and stockpiled separately for disposal. The UST will then be cleaned and disposed in accordance with the above-referenced guidelines.

After the UST has been removed, the remaining impacted soil within the UST vault will be excavated and stockpiled (i.e., in the stockpile for impacted soil). Following the excavation of impacted soil from the vault, excavation outside the vault may occur depending upon the degree of contamination encountered within the vault and the analytical results of the soil samples collected during the Pre-Removal Investigation. Where necessary, the excavation will proceed outside the vault until the visibly contaminated soil has been removed. At this point, post-excavation soil samples will be collected and sent to the laboratory on an expedited time schedule (i.e., 72 hours). While waiting for the analytical results, the UST removal team will move to the next UST location and begin the above-mentioned procedures. The team will remain with the second UST until the UST is removed, impacted soil excavated, and post-excavation samples collected. When the post-excavation analytical results are received back from the laboratory for the first UST, the UST removal team will "leap-frog" back to the first UST and either backfill or continue the excavation. The need to continue or backfill the excavation will be based upon an evaluation of the post-excavation results and access constraints (e.g., off-site access). If continuation of the excavation is warranted, the volume of soil to be removed will be kept to a minimum. After completion of backfilling the excavation, the UST removal team will return to the second UST and continue the process at the point at which it was left.

Roux Associates will provide environmental oversight for the removal and disposal of the five petroleum USTs (i.e., Tanks 203, 205, 206, 208 and 209) including associated piping, soil excavation, backfilling and site restoration. Monitoring of air quality will be conducted using a PID and explosimeter. In addition, the PID will be used to screen excavated soil for the presence of VOCs. All activities will be documented in a field log book. In addition, a description of the condition of each UST, size of excavation, soil condition within the excavation and ground-water impacts (i.e., sheen), if encountered, will be documented.

Roux Associates will work with on-site NYSDEC and/or other agency personnel in an effort to minimize the volume of soil to be excavated. This will include directing the excavation of only those areas where grossly contaminated soil (i.e., visibly stained soil, areas containing separate phase product) is present. Soil quality data obtained during the Pre-UST Investigation (Task 1) will be used as a guide to assist in determining the limits of each excavation.

Post-Excavation Soil Sampling

Post-excavation soil samples will be collected after completion of each excavation and compared against New York State STARs cleanup level guidelines to verify that impacted soils have been removed. One post-excavation soil sample from each sidewall and two samples from the bottom of the excavation (a maximum of six samples per excavation) will be collected. Sidewall samples will be collected from approximately 2 to 3 feet above the excavation bottom and no less than 6 inches below the exposed sidewall surface using the bucket of the backhoe and hand auger. In addition, two soil samples will be collected from the bottom of the excavation. The soil samples will be immediately containerized into laboratory-cleaned jars for analysis. A portion of each sample will be placed into a plastic Ziplock™ bag, and screened for VOCs using a PID.

The post-excavation soil samples from the petroleum UST excavations will be analyzed for USEPA Method 1311 and 8021 for TCLP VOCs and USEPA Method 1311 and 8270 for TCLP BNs in accordance with STARS Memo #1. The laboratory turnaround time for the post-excavation soil samples will be approximately 72 hours.

To prevent cross contamination, all dedicated sampling equipment will be decontaminated after each use by a thorough washing in potable water and a non-phosphate laboratory grade detergent, followed by a potable water rinse and distilled water rinse.

If the results of the post-excavation soil samples indicate that all of the impacted soil has been removed, further excavation work will not be necessary and the excavation will be backfilled. However, if the results indicate that the impacted soil exceeding STARs cleanup level guidelines has not been completely removed, additional excavation may be required.

<u>Soil Stockpiling, Waste Classification and Disposal</u>

As stated previously, excavated soils will be divided into the following segregated stockpiles:

- sand present within each UST (UST sand);
- clean soil; and
- petroleum-impacted soil.

Soil stockpiles will be located on the concrete slab within the fenced-in area of the former Organics/Suciac Block. Additionally, each stockpile will be covered with polyethylene sheeting.

Following completion of soil excavation efforts, representative samples will be collected from each stockpile and submitted for chemical analysis. Sampling of the UST sand and petroleum-impacted soil will be performed for waste classification purposes. Preliminarily, we anticipate that waste classification parameters may include TCLP VOCs, TCLP BNs, reactivity, ignitability and corrosivity (the specific analytical program will be determined by the receiving disposal facility). In addition, we anticipate that two samples for each stockpile up to 1,000 cubic yards will be required for analysis (the actual number will be determined by the receiving disposal facility). The clean soil stockpile will be sampled and analyzed for TCLP VOCs and BNs according to the NYSDEC STARs protocols. If clean soil concentrations are below STARs guidelines, these soils will be used to backfill the UST excavations. If clean soil concentrations are above STARs guidelines, these soils will be disposed offsite along with the UST sand and petroleum-impacted soil.

2.3 Task 3 - Removal of Process USTs

Nineteen process USTs (i.e., Tanks 301 through 311 and Tanks 313 through 320) will be removed and disposed, and their locations are shown in Plate 1. The UST removal procedures and post-excavation soil sampling for the process USTs will be the same as the removal procedures for the petroleum USTs (Section 2.2). Post-excavation soil samples from the process UST excavations will be analyzed for parameters shown in Table 3.

The impacted soil removed from the process UST excavations will be stockpiled separately from the petroleum UST impacted soil. The process soil stockpile will be further segregated, where possible, into several stockpiles containing impacted soil from solvents, caustics, acids and ammonia. Preliminarily, we anticipate that waste classification parameters will include TCLP VOCs, BNs and ignitability, reactivity and corrosivity (Table 4).

2.4 Task 4 - Block-Wide Soil Investigation

This section provides a preliminary scope of work for a block-wide soil investigation to be performed, following completion of the UST removal program. The purpose of the block-wide soil investigation is to investigate soil quality conditions beneath the former buildings of the Organics/Suciac Block to prepare this property for future development/beneficial use.

The preliminary scope of work has been divided into two subtasks as follows:

- a comprehensive review of historical drawings to identify subsurface structures (e.g., previously unknown USTs, piping, floor drains, sewers, etc.) that may represent potential sources of subsurface contamination; and
- a soil boring and sampling program.

Ground-water quality conditions beneath the Organics/Suciac Block will not be investigated because:

- a thick (i.e., 30 to 40 ft) continuous clay (as shown in Figure 3) underlies the Site which will prevent migration of potential contaminants through the clay down to the aquifer; and

- the historical ground-water quality data for the former on-site production wells indicate that an impact to the Upper Glacial aquifer from the Pfizer Williamsburg facility has not occurred (Roux Associates 1989).

Data collected during the Block-Wide Soil Investigation will be used to re-evaluate whether any ground-water monitoring is necessary.

A description of each subtask is provided below.

2.4.1 Subtask 4.1 - Comprehensive Review of Historical Drawings

A comprehensive review of historical drawings will be performed to identify subsurface structures (e.g., piping, floor drains, sewers, etc.) that may represent potential sources of subsurface contamination. The results of the review will be used to modify, if necessary, the proposed soil boring and sampling program discussed below.

2.4.2 Subtask 4.2 - Soil Boring and Sampling Program

Twenty-one soil borings (i.e., OB-1 through OB-21) will be drilled and sampled to characterize soil-quality conditions beneath the former buildings. The proposed soil boring locations are shown in Plate 2. The borings will be drilled using the Geoprobe™ Method. A hollow-stem auger drill rig or tripod will be used at locations where fill material or subsurface debris precludes the use of Geoprobe™ Methods. It should be noted that prior to soil sampling, the concrete slab at each soil boring location will be cored (i.e. 1 ft diameter by 1 ft to 3 ft in depth) to permit the use of Geoprobe™ equipment.

The following list describes the number of soil borings and their associated designations.

Former Building No.	Number of Soil Borings	Soil Boring Designation
21	2	OB-1, OB-2
21B	3	OB-3, OB-4, OB-7
21A	2	OB-5, OB-6
18	1	OB-8
Yard	1	OB-9
14	1	OB-10
12D	2	OB-11, OB-12
12C	1	OB-13
12B	3	OB-14, OB-15, OB-16
12A	2	OB-17, OB-18
22	2	OB-19, OB-20
22A	1	OB-21

Soil samples will be collected in 2-ft intervals in each boring to the perched water table (i.e., approximately 7 to 9 feet bls) or to the clay layer (i.e., whichever is first encountered). Each soil sample will be inspected by the field geologist or engineer to characterize lithology and any evidence of contamination (i.e., staining and odors). A portion of each soil sample will be placed in a plastic Ziplock™ bag or glass jar and screened in the field for VOCs using a PID. Soil boring and sample procedures are provided in the SOPs (Appendix B).

The soil sample collected from the 0-2 foot interval (i.e., immediately below the concrete slab) and the soil sample that exhibits the highest degree of contamination (i.e., staining and odors) will be selected for laboratory analysis to define the nature and extent of any soil impacts. However, if no impacts are discernable, the 0 to 2-ft interval and the 2-foot interval above the water table will be submitted for analysis. The projected number of soil samples for laboratory analysis is provided in Table 2.

Each soil sample will be analyzed for Target Compound List (TCL) VOCs, TCL Semivolatile Organic Compounds (SVOCs), Target Analyte List (TAL) metals and total organic carbon (TOC) and pH. In addition, one field and trip blank will be collected for the full suite of parameters and only VOCs, respectively, as outlined in Table 2. This analytical program was selected based upon historical chemical use at the Organics/Suciac Block. In addition, a maximum of one soil sample, from the fill material and underlying thick clay will have grain size and permeability (i.e., vertical) determined to assist in evaluating, if necessary, fate and transport of potential contaminants migrating vertically through the clay. All analyses will be performed in accordance with NYSDEC Analytical Sampling Protocols (ASP).

Soil borings with Geoprobe™ equipment will be conducted with van or truck mounted probing equipment. The vehicle will be positioned over the selected boring location, and a 2-ft long drive point sampler containing a disposable acetate liner will be attached to steel rods and driven to the desired sampling depth. The drive point sampler remains closed while it is being driven to the sampling depth. The sampler is opened by releasing a stop pin from the surface, and the sampler is driven 2 ft into the material to be sampled. Releasing the stope pin allows a piston to retract inside of the sampling tube while it is displaced by the soil core. The soil core is contained within the disposable acetate liner in the sampler. The drive point sampler is removed from the ground by retracting the steel rods. The disposable acetate liner, with the intact soil sample, is then removed from the drive point sampler. The soil sample is then described and collected in the same manner as described above and in (Appendix B).

To prevent cross-contamination, all downhole, dedicated equipment will be decontaminated after each use by washing in potable water and a non-phosphate laboratory grade detergent, followed by a potable water rinse.

2.5 Task 5: Reporting

The following reports will be prepared and submitted.

- A brief interim summary report of Subtasks 1.1 through 1.3 results, including recommendations, if necessary, for Tasks 2 through 4.

- A summary report of Task 1 through Task 3 results, including recommendations for finalizing the Block-Wide Soil Investigation.
- Final Scope of Work for the Block-Wide Soil Investigation.
- A summary report of the Block-Wide Soil Investigation results, including recommendations for remedial measures, if necessary.

Each report will be submitted in draft form for review and upon approval, each report will be finalized.

3.0 SCHEDULE

The schedule for implementing the scope of work and report deliverables is shown in Figure 4. Roux Associates can begin to implement the scope of work within 2 weeks of notice to proceed. It is anticipated that Task 1: Pre-UST Removal Investigation will take approximately 9 weeks to complete. Tasks 2 and 3 (i.e., removal of petroleum and process USTs) will take approximately 13 weeks to complete. Task 4: Preliminary Block-Wide Soil Investigation will take approximately 11 weeks to complete. The laboratory turnaround time for Tasks 1 and 4 will be four weeks from the laboratory receipt of the last sampling batch. The laboratory turnaround time for Tasks 2 and 3 will be 48 hours. The expedited turnaround time schedule will permit the excavations to be backfilled as soon as possible, limiting any health and safety issues. The summary reports (Tasks 1 through 4) will be submitted approximately 2 weeks after the receipt of analytical data. The total project time schedule to complete Tasks 1 through 4 will take approximately 35 weeks.

Respectfully Submitted,

ROUX ASSOCIATES, INC.

Scott J. Glash, C.P.G.
Senior Hydrogeologist/
Project Manager

Douglas J. Swanson
Vice President/
Principal Hydrogeologist

Table 1. Underground Storage Tank History for Organics/Suciac Block, Pfizer Inc, Brooklyn, New York

Tank Designation	Usage	Construction Date	Decommissioned*/ Removed Date	Tank size (ft x ft)	Approximate Capacity (gallons)	Contents
Petroleum Tanks						
201	Powerhouse	1932	June/July 1993	19 x 10	10,000	No. 6 Fuel Oil
202	Powerhouse	1932	June/July 1993	19 x 10	10,000	No. 6 Fuel Oil
203	Building #12D	1946	Prior to 1991*	40 x 9	18,000	No. 6 Fuel Oil
205	Building #21B/18	1955	Prior to 1991*	53 x 10	30,000	No. 6 Fuel Oil
206	Building #21B	1955	Prior to 1991*	53 x 10	30,000	No. 6 Fuel Oil
207	Powerhouse	1955	June/July 1993	53 x 10	30,000	No. 6 Fuel Oil
208	Building #21/21A	1955	Prior to 1991*	53 x 10	30,000	No. 6 Fuel Oil
209	Building #12A	Unknown	Prior to 1991*	Unknown	1,500	No. 5 Waste Oil
Process Tanks						
301	Production	1941	Prior to 1991*	8 x 4	550	Solvent (xylol)
302	Production	1941	Prior to 1991*	8 x 4	550	Solvent (Methyl cyclo Hexane)
303	Production	1941	Prior to 1991*	10 x 5	1,500	Solvent (Acetone)
304	Production	1941	Prior to 1991*	10 x 5	1,500	Solvent (Benzol)
305	Production	1941	Prior to 1991*	10 x 5	1,500	Solvent (Ethyl Alcohol)
306	Production	1941	Prior to 1991*	10 x 5	1,500	Solvent (Ethyl Alcohol)
307	Production	1941	Prior to 1991*	10 x 5	1,500	Solvent (Methyl Alcohol)

Table 1. Underground Storage Tank History for Organics/Suciac Block, Pfizer Inc, Brooklyn, New York

Tank Designation	Usage	Construction Date	Decommissioned*/ Removed Date	Tank size (ft x ft)	Approximate Capacity (gallons)	Contents
308	Production	1941	Prior to 1991*	10 x 5	1,500	Methanol (Butyl Alcohol)
309	Production	1941	Prior to 1991*	10 x 5	1,500	Methanol (Butyl Alcohol)
310	Production	Unknown	Prior to 1991*	Unknown	1,600	Solvent
311	Production	Unknown	Prior to 1991*	Unknown	1,600	Solvent
313	Production	1946	Prior to 1991*	40 x 9	18,000	Propionic Acid
314	Production	1951	Prior to 1991*	10 x 5	1,500	Solvent (Ethanol)
315	Production	1951	Prior to 1991*	10 x 5	1,500	Solvent (Ethanol)
316	Production	1951	Prior to 1991*	10 x 5	1,500	Solvent (Ethanol)
317	Production	1951	Prior to 1991*	10 x 5	1,500	Solvent (Ethanol)
318	Production	1951	Prior to 1991*	10 x 5	1,500	Solvent (Ethanol)
319	Production	Unknown	Prior to 1991*	8 x 4	550	Caustic
320	Production	Unknown	Prior to 1991*	Unknown	10,000	Ammonia

* The underground storage tanks that were decommissioned in-place prior to 1991 were filled with sand.

Table 2. Projected Number of Field Samples, UST Removal Work Plan, Pfizer Inc, Organics/Suciac Block, Brooklyn, New York[a]

Task	Parameter	Field Samples	Field Duplicates[b]	Field Blanks[b]	Trip Blanks[c]	Matrix Spike	Matrix Spike Duplicate	Total Laboratory Samples	Laboratory Method
Subtask 1.1 - Soil Borings - Petroleum USTs	TCLP[d] VOCs[e]	17	NA	NA	NA	NA	NA	17	1311/8021
	TCLP BNs[f]	17	NA	NA	NA	NA	NA	17	1311/8270
	grain size	2	NA	NA	NA	NA	NA	2	NA
	permeability	2	NA	NA	NA	NA	NA	2	NA
Subtask 1.2 - Soil Borings - Former Powerhouse USTs	TCLP VOCs	6	NA	NA	NA	NA	NA	6	1311/8021
	TCLP BNs	6	NA	NA	NA	NA	NA	6	1311/8270
	grain size	2	NA	NA	NA	NA	NA	2	NA
	permeability	2	NA	NA	NA	NA	NA	2	NA
Subtask 1.3 - Soil Borings - Process UST									
Tanks 301 through 309 (solvents)	TCL[g] VOCs	6	1	1	1	NA	NA	9	8021
Tanks 310 and 311 (solvents)	TCL VOCs	4	1	1	1	NA	NA	7	8021
Tank 313 (solvents and acid)	TCL VOCs	4	1	1	1	NA	NA	7	8021
	pH	4	1	1	NA	NA	NA	6	9045
Tanks 314 through 318 (solvents)	TCL VOCs	4	1	1	1	NA	NA	7	8021
Tank 319 (caustic)	pH	2	1	NA	NA	NA	NA	3	9045
Tanks 320 (ammonia)	Ammonia	3	1	1	NA	NA	NA	5	350.2M
	Nitrate/Nitrite	3	1	1	NA	NA	NA	5	353.1M/354.1M
	pH	3	1	1	NA	NA	NA	5	9045
	TKN[h]	3	1	1	NA	NA	NA	5	351.2M
Subtask 4.2 - Soil Borings and Sampling Program - (Block-Wide)	TCL VOCs	42	2	2	2	3	3	48	8021
	TCL SVOCs[i]	42	2	2	NA	NA	NA	46	8270
	TAL[j] Metals	42	2	2	NA	NA	NA	46	SW-846
	TOC[k]	42	2	2	NA	NA	NA	46	415.1
	pH	42	2	2	NA	NA	NA	46	9045
	grain size	2	NA	NA	NA	NA	NA	2	NA
	permeability	2	NA	NA	NA	NA	NA	2	NA

[a] These numbers are only estimates. Actual sample numbers are dependent on screening results and conditions encountered in the field.
[b] Field duplicate and field blank frequency estimates based on one per twenty samples or one per day minimum.
[c] Trip blanks are estimated based on one trip blank per cooler.
[d] Toxicity Characteristic Leaching Procedure.
[e] Volatile Organic Compounds.
[f] Base Neutral Compounds.
[g] Target Compound List.
[h] Total Kjeldahl Nitrogen.
[i] Semivolatile Organic Compounds.
[j] Target Analyte List.
[k] Total Organic Carbon.
NA - Not Applicable.

Table 3. Projected Number of Post-Excavation Soil Samples, UST Removal Work Plan, Pfizer Inc, Organics/Suciac Block, Brooklyn, New York

Tanks	Parameter	Field Samples	Field Duplicates	Field Blanks	Trip Blanks	Total Laboratory Samples	Laboratory Method
Post-Excavation Soil Samples							
Petroleum							
203	TCLP VOCs TCLP BNs	6 6	1 1	1 1	1 NA	9 8	1311/8021 1311/8270
205	TCLP VOCs TCLP BNs	6 6	1 1	1 1	1 NA	9 8	1311/8021 1311/8270
206	TCLP VOCs TCLP BNs	6 6	1 1	1 1	1 NA	9 8	1311/8021 1311/8270
208	TCLP VOCs TCLP BNs	6 6	1 1	1 1	1 NA	9 8	1311/8021 1311/8270
209	TCLP VOCs TCLP BNs	6 6	1 1	1 1	1 NA	9 8	1311/8021 1311/8270
Process							
301 through 309	TCL VOCs	6	1	1	1	9	8021
310 and 311	TCL VOCs	6	1	1	1	9	8021
313	TCL VOCs pH	6 6	1 1	1 1	1 NA	9 8	8021 9405
314 through 318	TCL VOCs	6	1	1	1	9	8021
319	pH	6	1	1	NA	8	9045

Table 3. Projected Number of Post-Excavation Soil Samples, UST Removal Work Plan, Pfizer Inc, Organics/Suciac Block, Brooklyn, New York

Tanks	Parameter	Field Samples	Field Duplicates	Field Blanks	Trip Blanks	Total Laboratory Samples	Laboratory Method
320	Ammonia	6	1	1	NA	8	350.2M
	Nitrate/Nitrite	6	1	1	NA	8	353.1M/354.1M
	pH	6	1	1	NA	8	9045
	TKN	6	1	1	NA	8	351.2M

TCLP Toxicity Characteristic Leaching Procedure
VOCs Volatile Organic Compounds
BNs Base Neutrals
TKN Total Kjeldahl Nitrogen
NA Not Applicable

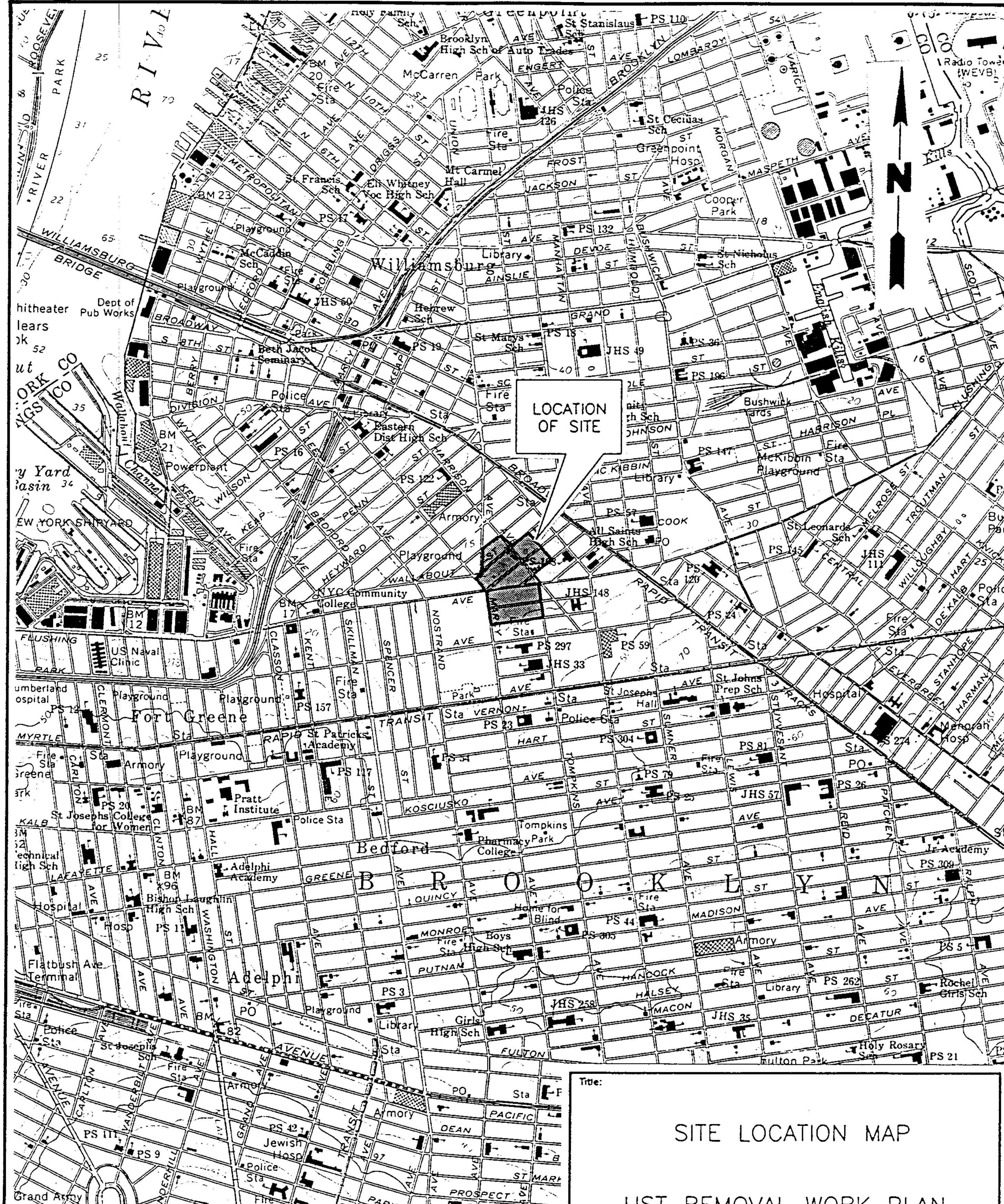
Table 4. Projected Number of Soil Stockpile Samples for Waste Classification, UST Removal Work Plan, Pfizer Inc, Organics/Suciac Block, Brooklyn, New York

Soil Stockpile	Parameters	Estimated Volume (cubic yards)	Total Laboratory Samples	Laboratory Method
Clean Soil Stockpile	TCLP VOCs	1,200	9	1311/8021
	TCLP BNs	1,200	9	1311/8270
Sand Stockpile				
Petroleum	TCLP VOCs	350	2	1311/8021
	TCLP BNs	350	2	1311/8270
	Ignitability	350	2	1010
	Reactivity	350	2	SW-846
	Corrosivity	350	2	9040/9045
Process	TCLP VOCs	500	2	1311/8240
	TCLP BNs	500	2	1311/8270
	Ignitability	500	2	1010
	Reactivity	500	2	SW-846
	Corrosivity	500	2	9040/9045
Impacted Soil Stockpile				
Petroleum	TCLP VOCs	2,100	4	1311/8240
	TCLP BNs	2,100	4	1311/8270
	Ignitability	2,100	4	1010
	Reactivity	2,100	4	SW-846
	Corrosivity	2,100	4	9040/9045

Table 4. Projected Number of Soil Stockpile Samples for Waste Classification, UST Removal Work Plan, Pfizer Inc, Organics/Suciac Block, Brooklyn, New York

Soil Stockpile	Parameters	Estimated Volume (cubic yards)	Total Laboratory Samples	Laboratory Method
Process				
Potential Non-Hazardous	TCLP VOCs	500	2	1311/8240
	TCLP BNs	500	2	1311/8270
	Ignitability	500	2	1010
	Reactivity	500	2	SW-846
	Corrosivity	500	2	9040/9045
Potential Hazardous	TCLP VOCs	1,000	2	1311/8240
	TCLP BNs	1,000	2	1311/8270
	Ignitability	1,000	2	1010
	Reactivity	1,000	2	SW-846
	Corrosivity	1,000	2	9040/9045

TCLP Toxicity Characteristic Leaching Procedure
VOCs Volatile Organic Compounds
BNs Base Neutral Compounds



Title:

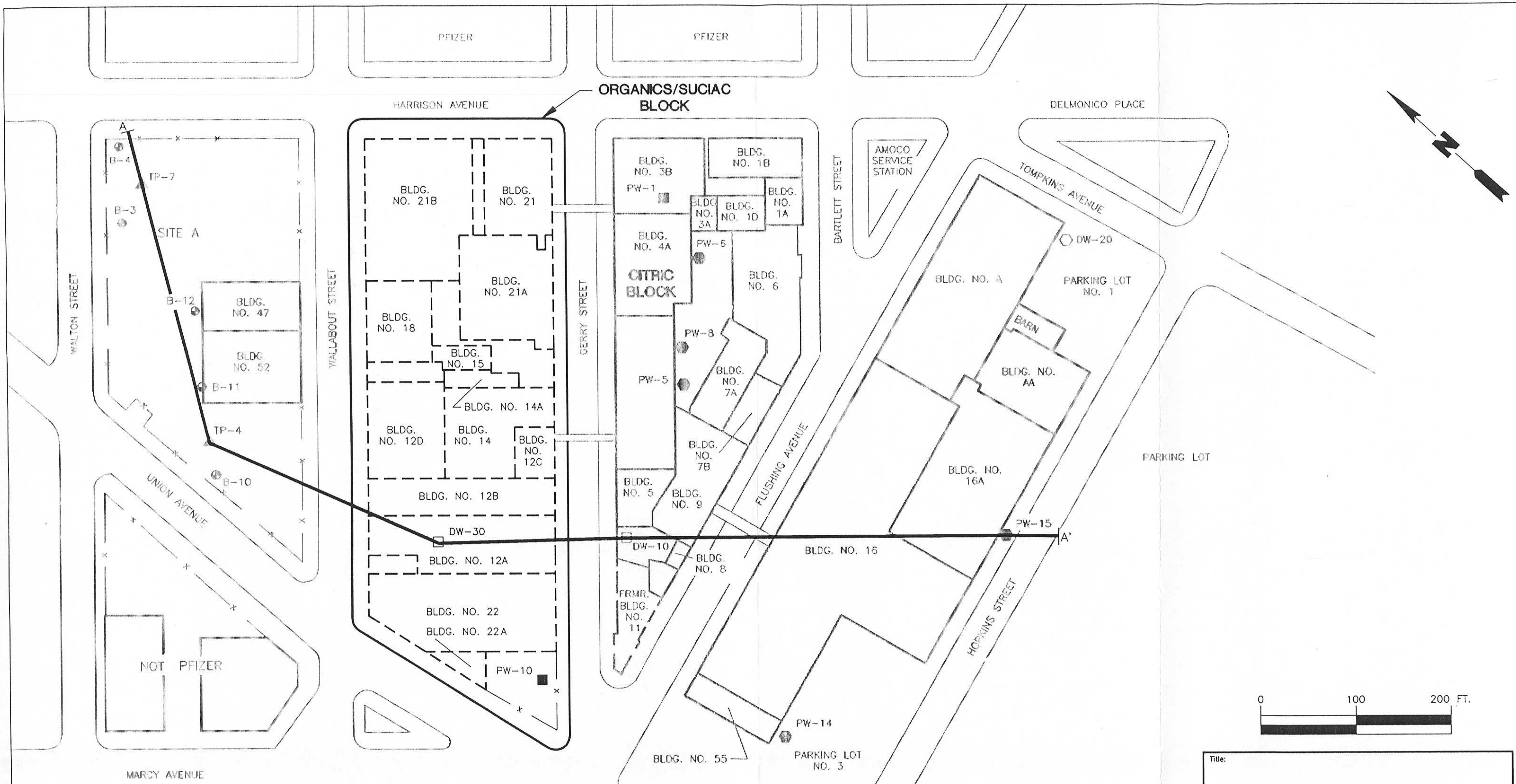
SITE LOCATION MAP

UST REMOVAL WORK PLAN

Prepared For: PFIZER INC
WILLIAMSBURG FACILITY, BROOKLYN, NEW YORK

ROUX ROUX ASSOCIATES INC Consulting Ground-Water Geologists & Engineers	Compiled by: S.J.G.	Date: 4/95	FIGURE 1
	Prepared by: J.R.	Scale: 1" = 2000'	
	Project Mgr: S.J.G.	Revision:	
	File No: 04744Y	Project: 04744Y	

SOURCE: USGS BROOKLYN, NY QUADRANGLE, 1979
7.5 MINUTE SERIES TOPOGRAPHIC



EXPLANATION

PW-10 ■	LOCATION AND DESIGNATION OF FORMER PFIZER PRODUCTION WELL
PW-5	LOCATION AND DESIGNATION OF PFIZER PRODUCTION WELL
DW-30 □	LOCATION AND DESIGNATION OF FORMER PFIZER DIFFUSION WELL
DW-20 ⬡	LOCATION AND DESIGNATION OF PFIZER DIFFUSION WELL
TP-1 ▲	LOCATION AND DESIGNATION OF ROUX TEST PIT
B-10	LOCATION AND DESIGNATION OF SOIL MECHANICS BORING
A├──┤A'	LOCATION OF GENERALIZED GEOLOGIC CROSS-SECTION
— — —	FORMER BUILDING

NOTE: BUILDINGS LOCATED ON ORGANICS/SUCIAC BLOCK AND SITE A HAVE BEEN DEMOLISHED.

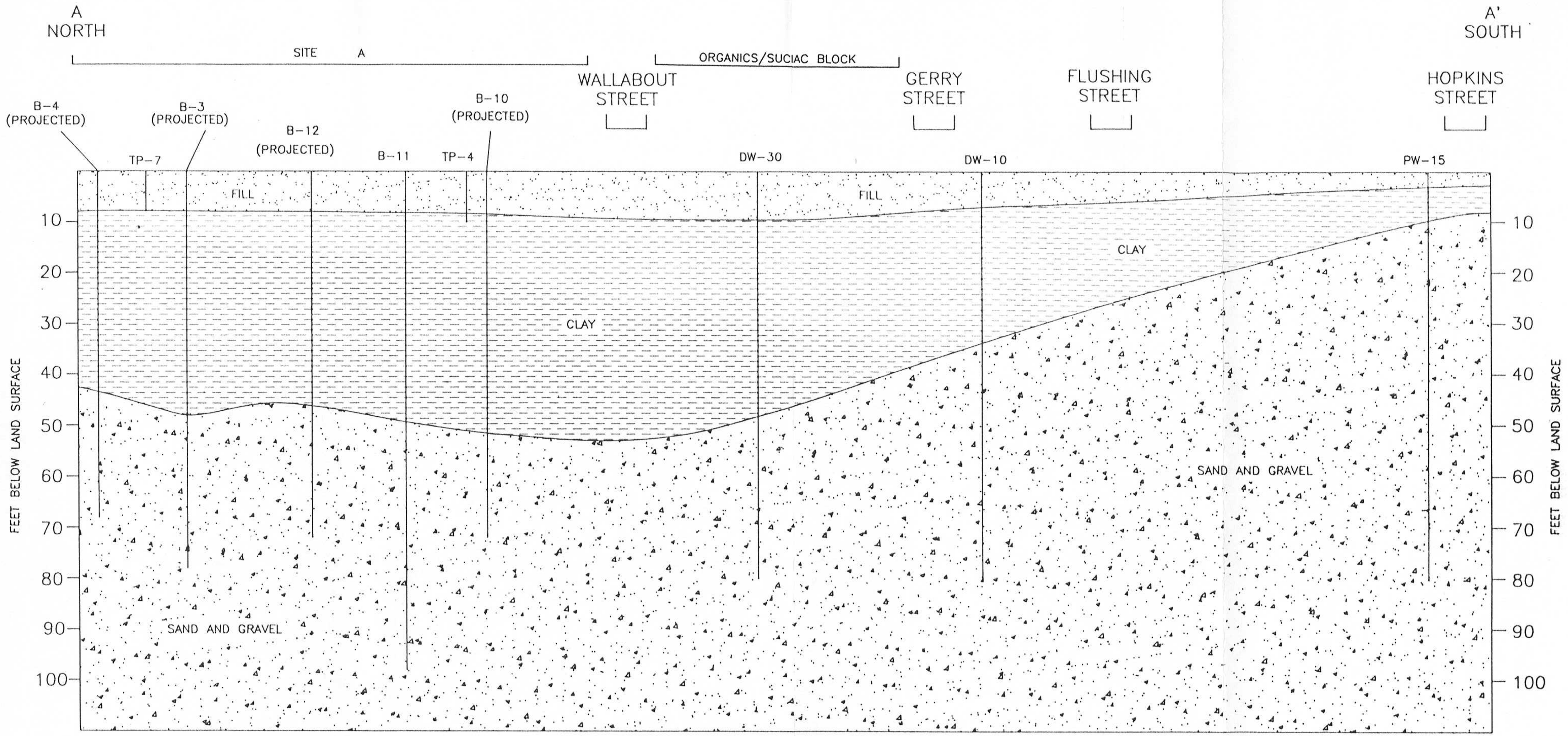
Title:

SITE PLAN

UST REMOVAL WORK PLAN

Prepared For: PFIZER INC
WILLIAMSBURG FACILITY, BROOKLYN, NEW YORK

ROUX ASSOCIATES INC Consulting Ground-Water Geologists & Engineers	Compiled by: S.J.G.	Date: 4/95	FIGURE
	Prepared by: J.R.	Scale: SHOWN	2
	Project Mgr: S.J.G.	Revision:	
	File No: 04744007	Project: 04744Y	



EXPLANATION

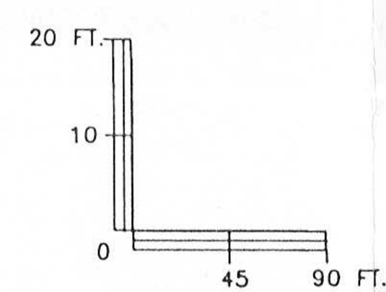
TP-7	LOCATION AND DESIGNATION OF ROUX TEST PIT
DW-10	LOCATION AND DESIGNATION OF ABANDONED DIFFUSION WELL
PW-15	LOCATION AND DESIGNATION OF PFIZER PRODUCTION WELL
B-11	LOCATION AND DESIGNATION OF SOIL MECHANICS BORING

FILL

CLAY

SAND AND GRAVEL (UPPER GLACIAL AQUIFER)

SOURCE:
1. PHASE II, HYDROGEOLOGY OF THE PFIZER, WILLIAMSBURG PLANT AREA, WILLIAMSBURG, NEW YORK (ROUX ASSOCIATES, INC., FEBRUARY 1989)
2. EVALUATION OF SOIL QUALITY CONDITIONS AT THE SOLID WASTE MANAGEMENT UNITS LOCATED AT SITE "A", PFIZER, INC., WILLIAMSBURG, NEW YORK (ROUX ASSOCIATES, INC., AUGUST 1989)
3. SUPPLEMENTAL SOILS INVESTIGATION FOR SITE "A", PFIZER, INC., WILLIAMSBURG, NEW YORK (ROUX ASSOCIATES, INC., NOVEMBER 1989)



VERTICAL EXAGGERATION EQUALS 4.5X

Title:

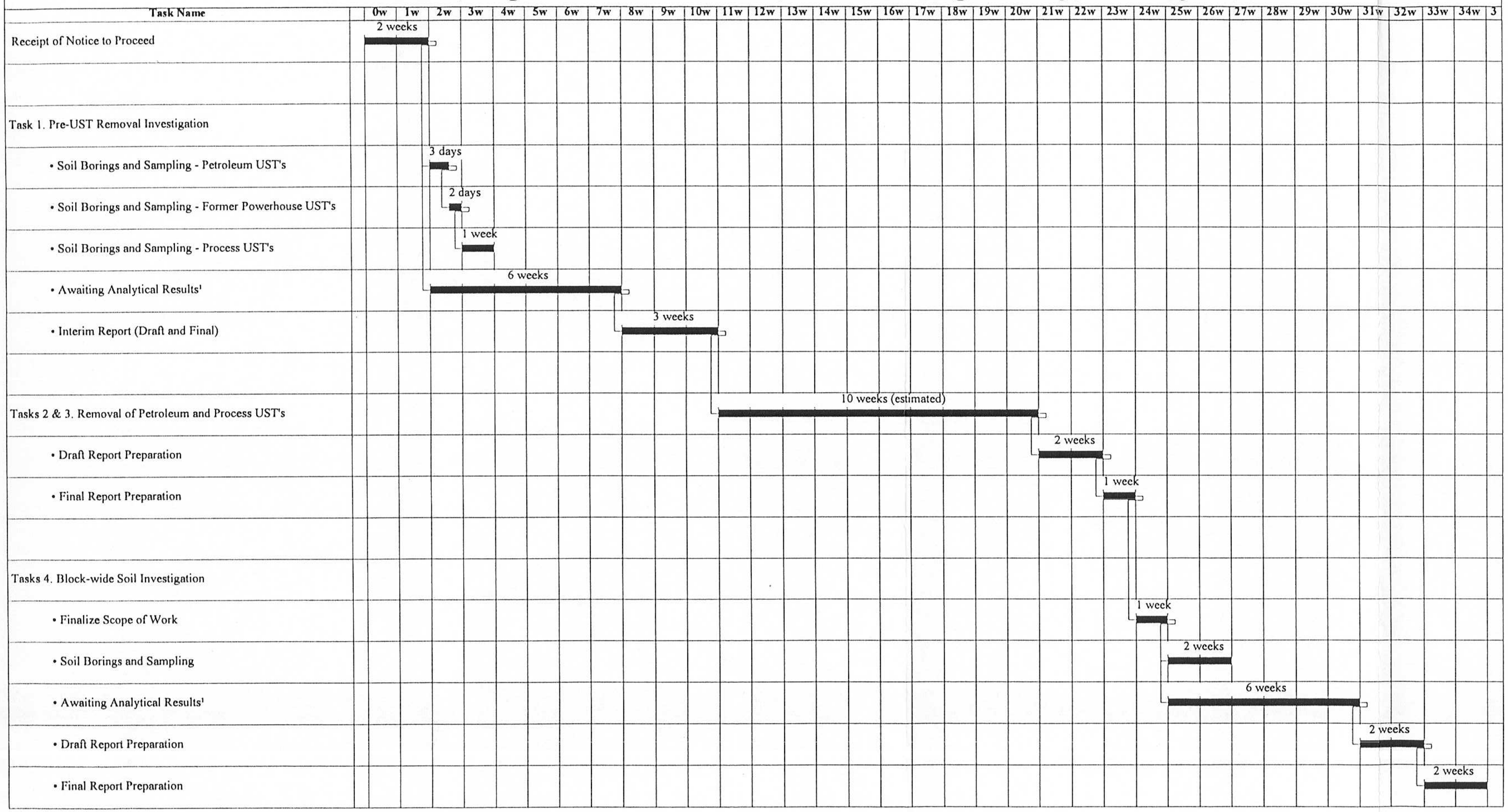
GENERALIZED GEOLOGIC CROSS-SECTION A-A'

UST REMOVAL WORK PLAN

Prepared For: PFIZER INC
WILLIAMSBURG FACILITY, BROOKLYN, NEW YORK

ROUX ASSOCIATES INC Consulting Ground-Water Geologists & Engineers	Compiled by: S.G.	Date: 4/95	FIGURE
	Prepared by: J.R.	Scale: SHOWN	3
	Project Mgr: D.S.	Revision:	
	File No: 04744Y	Project: 04744Y	

Figure 4. Estimated Project Schedule To Implement UST Removal Work Plan
Pfizer Inc, Organics/Suciac Block, Williamsburg Facility, Brooklyn N.Y.



[1] - Laboratory trunaround time will take approximately four weeks from the receipt of the last sampling batch.

PF04744Y.1.18/F4

APPENDIX A

Health and Safety Plan

HEALTH AND SAFETY PLAN

Pfizer Inc
Willliamsburg, New York

Appendix A

April 14, 1995

Approvals:

Roux Associates, Inc. Project Manager	Scott J. Glash	Date
Roux Associates, Inc. Health and Safety Manager	Linda M. Wilson	Date
Roux Associates, Inc. Site Health and Safety Manager		Date

CONTENTS

CONTENTS (Continued)

TABLES

FIGURES

ATTACHMENTS

1.0 GENERAL

This site-specific Health and Safety Plan (HASP) has been prepared in accordance with 29 CFR 1910.120 Occupational Safety and Health Act (OSHA) Hazardous Waste Operations, and Roux Associates, Inc. (Roux Associates) Standard Operating Procedures (SOPs). It addresses all activities to be performed during the focused investigation at the Pfizer Inc Organics/Suciac Block, Williamsburg Facility, Brooklyn, New York (Site). The HASP will be implemented by the designated Site Health and Safety Officer (SHSO) during work at the Site.

Compliance with this HASP is required for all Roux Associates employees and third parties who enter this Site. Assistance in implementing this HASP can be obtained from Roux Associates' Health and Safety Manager (HSM). 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' HSM or her designee.

Scope of Work:

The Scope of Work for this investigation will include implementation of the following tasks:

- Soil Boring and Sampling;
- Removal of Petroleum USTs; and
- Removal of Process USTs.

Each task is described in detail in Section 2 of the Work Plan.

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		(718) 963-5311
Fire		(718) 636-1700
Hospital	Woodhull Medical Center	(718) 963-8000
Ambulance		
National Response Center		(800) 424-8802
Poison Control Center		(800) 526-8816
Roux Associates' Site Health and Safety Officer	Ann Farrell	work: (516) 232-2600

The route to Woodhull Medical Center is shown in Figure A-1.

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
Health and Safety Manager (HSM)	Implementation and modification of the HASP. Will assign health and safety duties. Provides adequate resources for field health and safety personnel. Ensures that field personnel are trained and aware of Site conditions. Schedules adequate personnel and equipment to perform job safely.
Site Health and Safety Officer (SHSO)/ Site Emergency Coordinator	Conducts safety briefings and worker awareness meetings. Ensures compliance with HASP. Notifies OHSS of accidents/incidents. Coordinates health and safety activities. Makes contact with local emergency groups prior to beginning work on-site. Responsible for evacuation, emergency treatment, and emergency transport of Site personnel.
Field Crew Personnel	Report unsafe or hazardous conditions to SHSO. Understand the information contained in this HASP.

4.0 SITE HISTORY AND PHYSICAL DESCRIPTION

This section provides a brief summary of the history and physical description of the Site, as documented in part by CDM in the Corrective Action Prior to Loss of Interim Status Final Report.

4.1 Location

The Williamsburg facility is located at 630 Flushing Avenue, Brooklyn, New York. The Organics/Suciac block is situated in the central portion of the facility. It is bounded on the north by Wallabout Street, on the east by Harrison Avenue, on the south by Gerry Street, and on the west by Union Avenue.

4.2 History

The facility was established in 1849. Pharmaceuticals and industrial organic chemicals were manufactured. Fermentation and organic chemical synthesis processes were conducted at this facility.

Pfizer submitted Resource Conservation and Recovery Act (RCRA) Part A permit applications for a storage and neutralization unit, a container storage area and three injection wells in 1980. In 1981, Pfizer added several spent solvent storage tanks to the permit. Inspections by the New York State Department of Environmental Conservation (NYSDEC) and the United States Environmental Protection Agency (USEPA) cited several satellite waste accumulation areas throughout the facility. Pfizer submitted a closure plan for the container storage area and solvent storage tanks on July 20, 1984. NYSDEC approved the closure plan and the units were certified closed on November 16, 1987.

Based on a review of Pfizer files, 24 USTs were abandoned in place. Five of the USTs contained petroleum, while the other 19 contained solvents or other process chemicals. Three additional USTs were removed in 1993. Post excavation sampling indicated that soil had been impacted by release from these USTs. The NYSDEC was notified, and based on the proposed demolition of the building, it was agreed that an investigation would be performed when the demolition was completed.

5.0 HAZARD ASSESSMENT

The potential hazards associated with the anticipated investigation 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 organic compounds, including benzene and toluene. The toxicological, physical, and chemical properties of these potential contaminants are presented in Table A-1. This table includes action levels (permissible exposure levels) which will establish the level of protection. The potential for encountering these contaminants exists during invasive activities such as drilling.

5.2 Physical Hazards

A variety of physical hazards may be present during Site 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. These hazards are not unique and are generally familiar to most field personnel. In addition, at this Site there is also the potential for the ground to cave in due to the settlement of buried wastes (e.g., drums). Additional task-specific requirements will be covered during safety briefings.

5.2.1 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 exposures exceeding 85 dBA must be included in a hearing conservation program in accordance with 29 CFR 1910.95.

5.2.2 Heat Stress

Heat stress is a significant potential hazard and can be associated with heavy physical activity and/or the use of personal protective equipment (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 protective equipment (semipermeable or impermeable) which 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 work load 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.

5.2.3 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.

6.0 TRAINING REQUIREMENTS

The Hazardous Waste Operations and Emergency Response Rule (29 CFR 1910.120) requires that all personnel be trained to recognize on-site 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 personnel who will perform work in areas where the potential for toxic exposure exists will be health and safety-trained prior to performing work on-site, per OSHA 29 CFR 1910.120(e). Training records will be submitted to and maintained by the SHSO on-site, as described in Section 7.4.

6.2 Site Specific Training

Health- and safety-related training that will specifically address the activities, procedures, monitoring and equipment for the Site operations will be provided to all Site personnel and visitors by the SHSO. It will include Site and facility layout, hazards, emergency services at the Site 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, before work is begun at each location, and each Monday morning. Records of safety briefings will be kept as part of the project records.

6.4 Record Keeping Requirements

All record keeping requirements mandated by OSHA 29 CFR 1910.120 will be strictly followed. Specifically, all personnel training records, injury/incident reports, medical examination records and exposure monitoring records will be maintained by Roux Associates and each contractor for a period of at least thirty years after the employment termination date of each employee. Pertinent health and safety training and medical certifications will be kept onsite during the field operations. The SHSO shall maintain a daily written log of all health and safety monitoring activities, and monitoring results shall become part of the project records.

7.0 MONITORING PROCEDURES FOR SITE OPERATIONS

The SHSO will record wind direction and temperature during monitoring in the logbook. All monitoring equipment will be calibrated per the owner's manual which will be kept onsite, or at least monthly according to Site inspection rules.

7.1 Intrusive Operations

Data from previous investigations have identified the presence of organic compounds in soil. Air monitoring will be performed to establish the concentrations of these constituents during intrusive activities (e.g., well installation) using a photoionization detector (PID), and Dräeger tubes (for benzene).

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 permissible exposure level (PEL) for all constituents of concern (except benzene). If the PID indicates the 5 ppm level is exceeded, the SHSO will order cessation of the activity until all personnel within the work zone have donned a full face air purifying respirator, or until the nature of the hazard has been more thoroughly evaluated.

Dräeger tubes will be used to provide direct readings to establish the levels of benzene if the PID indicates the 5 ppm level is exceeded, to determine that personal protection is adequate. The Dräeger tubes will not be chemical specific to benzene, but will be conservatively biased high, and the readings will enable the SHSO to make an immediate decision on the level of protection. If any detections of benzene are noted based upon the Dräeger tube readings, the SHSO will order cessation of the activity until:

- all potentially exposed personnel have donned Level B respiratory protection (supplied air);
- the benzene levels are not detectable by the Dräeger tubes; or
- the nature of the hazard has been more thoroughly evaluated and it has been determined that the measured compound(s) was not benzene.

7.2 Non-Intrusive Operations

Based on the current understanding of Site conditions, monitoring may be performed using Dräeger tubes on the first day of non-intrusive operations and periodically thereafter, if the PID readings indicate a more accurate assessment is warranted.

8.0 MEDICAL SURVEILLANCE REQUIREMENTS

Medical surveillance specifies any special medical monitoring and examination requirements as well as stipulates that all Roux Associates, Inc. personnel and contractors are required to pass the medical surveillance examination or equivalent for hazardous waste work required by 29 CFR 1910.120. As a minimum, the examination will include:

- complete medical and work histories;
- EKG;
- urinalysis;
- physical exam;
- eye exam;
- blood chemistry;
- pulmonary function test; and
- audiometry.

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 HSM or OHSS 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.

9.0 ZONES, PROTECTION AND COMMUNICATIONS

Work zones, levels of personal protection, and means of communication are described below.

9.1 Site Zones

Roux Associates employs the following three zone approach to Site operations.

- the Work Zone;
- the Contamination Reduction Zone; and
- the Support Zone.

9.1.1 Work Zone

The Work Zone is the area where work will be conducted. The Work Zone will be designated by a temporary barrier consisting of red barricade tape. No personnel shall work in the Work Zone without a buddy. All workers within the Work Zone shall wear the proper personal protective equipment (see Section 10.2). No unauthorized persons will be allowed in the Work Zone during Site activities.

No personnel are allowed in the Work Zone without:

- a buddy;
- the proper personal protective equipment;
- medical authorization; and
- training certification.

9.1.2 Contamination Reduction Zone

A Contamination Reduction Zone (CRZ) will be established between the Work Zone and the Support Zone. The CRZ will provide for full personnel and portable equipment decontamination (Section 9.3). The CRZ will also contain safety and emergency equipment such as first aid equipment (bandages, blankets, eye wash) and containment equipment (adsorbent, fire extinguisher).

9.1.3 Support Zone

The Support Zone is considered the uncontaminated area and will provide for team communications and emergency response. Appropriate safety and support equipment will be located in this zone. The Support Zone 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 except appropriately packaged/decontaminated and labeled samples and drummed wastes.

9.2 Personal Protection

This section describes the levels of protection which will be required by on-site personnel during the remediation 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 with approval of the HSM. 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.

During intrusive activities, continuous monitoring will be performed using the PID. Dräeger tubes will also be used for initial and periodic real-time measurements of benzene. 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 PEL for benzene has been exceeded, work will cease in this area until:

- workers have donned a full face air purifying respirator; or
- the concentration levels for benzene are below the Dräeger tube detection levels.

Protection may be upgraded or downgraded by the SHSO in conjunction with the HSM based upon the PID instrument and Dräeger tube results.

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. PPE:
   - Cotton coveralls
   - Cotton gloves
   - Boots/shoes, leather or chemical-resistant, steel toe and shank
   - Boots (outer), chemical-resistant (disposable)
   - Safety glasses or chemical splash goggles
   - Hard hat
   - Escape mask

2. Criteria for selection

   PID readings in the breathing zone are less than 5 ppm, and benzene is not detected using Dräeger tubes. Work functions preclude splashes, immersion, or potential for unexpected inhalation of any chemicals.

NOTE: Modifications of Level D will be used to increase the level of skin protection during activities which increase the degree of contact with chemical hazards. These modifications include the use of chemical/corrosion resistant coveralls (e.g., tyveks), and chemical resistant gloves.

Level C Protection

1. PPE:
   - Full-face, air-purifying, cartridge-equipped respirator (MSHA/NIOSH approved)
   - Chemical-resistant clothing (coverall; hooded, two- piece chemical splash suit; chemical-resistant hood and apron; disposable chemical-resistant coveralls)
   - Cotton or synthetic coveralls*

- Gloves (outer), chemical-resistant - nitriles
- Gloves (inner), chemical-resistant - latex
- Boots (outer), chemical-resistant, steel toe and shank
- Boots (outer), chemical-resistant (disposable)
- Hard hat (face shield)
- Escape mask*
- 2-Way radio communications (intrinsically safe)*

*Optional

2. Criteria for selection
   - Continuous total vapor readings register between 5 ppm and 25 ppm on PID, and benzene is not detected with Dräeger tubes.
   - Measured air concentrations of identified substances (organic vapors) will be reduced by the respirator to at or below the substance's exposure limit, and the concentration is within the service limit of the canister.
   - Atmospheric contaminant concentrations do not exceed Immediately Dangerous to Life and Health (IDLH) levels.
   - Atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect the small area of skin left unprotected by chemical-resistant clothing.
   - Job functions have been determined not to require self-contained breathing apparatus.

<u>Level B Protection</u>

1. PPE:
   - 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)
   - Coveralls
   - Gloves (outer), chemical-resistant

- Gloves (inner), chemical-resistant
- Boots (inner), chemical-resistant, steel toe and shank
- Boots (outer), chemical-resistant, (disposable)
- Hard hat (face shield)
- 2-way radio communications (intrinsically safe)

2. Criteria for Selection

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

- PID readings in the breathing zone are greater than 25 ppm and less than 500 ppm, or benzene is detected, but less than 100 ppm utilizing Dräeger tubes.
- 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
  or
  -- exceeding limits of protection afforded by a full-face, air-purifying mask
  or
  -- containing substances requiring air-supplied equipment, but substances and/or concentrations do not represent a serious skin hazard.
- The atmosphere contains less than 19.5% oxygen.
- Operations at the Site make it highly unlikely that the small, unprotected arc of the head or neck will be contacted by splashes of extremely hazardous substances.
- If work is performed in an enclosed space.

9.3 Decontamination Procedures

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

9.3.1 Contamination Prevention

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

Personnel

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

Sampling/Monitoring

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

Heavy Equipment

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

9.3.2 Decontamination

All personnel and equipment exiting the Work Zone shall be thoroughly decontaminated. Figures C-2, C-3 and C-4 illustrate decontamination procedures for Levels D, C and B. 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 the Site. 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 Standard Operating Procedures/Safe Work Practices

This section discusses safe work practices to be used during all activities. In addition, non-monitoring safety related procedures are described.

9.4.1 Communications

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

The following hand signals will be used, if needed:

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

9.4.2 General Safe Work Practices

- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand to mouth contact and ingestion of material is prohibited onsite except in lunch room or designated office areas.
- Hands must be washed thoroughly upon leaving the Work Zone or before eating, drinking, or any other activities.
- Contaminated protective equipment shall not be removed from the Site until it has been decontaminated and properly packaged and labeled.
- Portable eyewash stations shall be located in the decontamination staging area in the Support Zone.
- No facial hair, which interferes with a satisfactory fit of respiratory equipment, will be allowed on personnel that may be required to wear respiratory protective equipment.
- An emergency first aid kit and fire extinguisher shall be onsite in the Support Zone at all times.
- All respiratory protection selected to be used onsite shall meet NIOSH/MSHA requirements for the existing contaminants.
- Any skin contact with surface and ground water shall be avoided.
- No contact lenses may be worn.

9.4.3 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.

9.4.4 Heavy Equipment and Drill Rig Safety

Typical machinery to be found at this site may include pumps, compressors, generators, portable lighting systems, fork lifts, trucks, dozers, backhoes, and drill rigs. From a safety standpoint, it is important for all site workers to be continually aware of the equipment around them. It poses a serious hazard if not operated properly, or if personnel near machinery cannot be seen by operators.

Drilling crews are confronted with all of these heavy equipment hazards. They must be responsible for housekeeping around the rig because of the rods, auger sections, rope, and hand tools cluttering the operation. Maintenance is a constant requirement. Overhead and buried utilities require special precautions because of electrical and natural gas hazards. Electrical storms may seek out a standing derrick. The hoist or cathead rope poses specific hazards that must be respected. A clean, dry, sound rope should always be used. Hands should be kept away from the test hammer. Hearing loss, while not an immediate danger, is considerable over time. Hearing protection must be worn.

9.4.5 Excavation and Backfill Operations

The SHSO will be present on-site during all excavation and backfill operations and will ensure that appropriate levels of protection and safety procedures are utilized. The proximity of chemical, water, sewer and electrical lines ,if any, will be identified by the Site Manger before any subsurface activity is attempted.

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. Personnel will not be allowed to enter the excavations.

9.4.6 Confined Space Entry

The scope of work does not require personnel to enter any confined space during the conduct of this project. 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.

A permit-required confined space is one that meets the definition of confined space, and 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.

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 OSHA 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 Emergency Coordinator(s)

The SHSO shall act as the Site 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 the Site 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 the Site warrant such action. The coordinator(s) will be responsible for assuring the evacuation, emergency treatment, emergency transport of Site 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 shutdown 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 A-1). Any other excavation 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 9.2); and
- notify fire department and security.

10.4 Environmental Incident (Release or Spread of Contamination)

The SHSO shall instruct a person on-site 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 #
Fire Department		(718) 636-1700
Hazardous Material Emergency Response		911
Police Department		(718) 963-5311
Ambulance		
Poison Control Center		1-800-526-8816
Hospital	Woodhull Medical Center	(718) 963-8000
National Response Center (Release or Spill)		(800) 424-8802
Site Health and Safety Officer	Ann Farrell	(516) 232-2600
Health and Safety Manager	Linda Wilson	(516) 232-2600
Site Manager	Scott Glash	(516) 232-2600

10.5 Personal Injury

Emergency first aid shall be applied on-site 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 on-site as follows:

Skin Contact:	Wash/rinse affected area thoroughly with copious amounts of soap and water, then provide appropriate medical attention. An eyewash and/or emergency shower or drench system will be provided on-site 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.

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 all 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 H & S monitoring equipment or gear; and
- potential for accidents.

11.0 AUTHORIZATIONS

Personnel authorized to enter the Site 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 the Site. Authorization will require completion of appropriate training courses, medical examination requirements as specified by OSHA 29 CFR 1910.120, and review and sign-off of this HASP.

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

1.	Scott Glash	6.	
2.	Douglas Swanson	7.	
3.	Linda Wilson	8.	
4.		9.	
5.		10.	

Other personnel authorized to enter the Site are:

1.		6.	
2.		7.	
3.		8.	
4.		9.	
5.		10.	

12.0 FIELD TEAM REVIEW

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

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

Site/Project: ______________________________

Name Printed	Signature	Date

Table A-1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at Organic and Suciac Block, Williamsburg Facility, Brooklyn, New York

Compound	CAS#	TLV (mg/m^3)	IDLH (ppm)	PEL (mg/m^3)	Routes of Exposure	Toxic Properties	Target Organs	Physical/ Chemical Properties
Ethylbenzene	100-41-4	435 100 ppm	2,000 ppm	435 100 ppm	Dermal; inhalation; ingestion	CNS depression Sensory irritant Narcosis	eyes resp system	Liquid, aromatic BP = 277°F FP = 59°F
Benzene	71-43-2	30 10 ppm	0	3 1 ppm	Dermal; inhalation ingestion	CNS depression Hematopoietic depression Dermatitis	CNS blood skin eyes resp system bone marrow	Liquid BP = 80.093°C flammable LEL = 1.4% UEL = 8.0%
Toluene	108-88-3	375 100 ppm	2,000 ppm	375 100 ppm	Dermal; inhalation; ingestion	CNS depression Liver damage Kidney damage Defatting of skin	CNS liver kidney skin	Liquid benzene odor BP = 11.04°C flammable LEL = 1.2% UEL = 7.1%
Xylenes	1330-20-7	100 ppm	1,000 ppm	100 ppm	Dermal; inhalation; ingestion;	CNS depression Sensory irritant Dermatitis Abdominal pain	CNS eyes GI tract blood liver kidney	Liquid, aromatic BP = 281°F -292°F FP = 81-90°F
Petroleum hydrocarbons (Petroleum distilled)	8002-05-9	1600 400 ppm	10,000	1600 400 ppm	Dermal; inhalation; ingestion	CNS depressant Respiratory irritant Dried/cracked skin	CNS respiratory tract skin	Colorless liquid BP = 86-460° UEL = 5.9% LEL = 1.1% Flammable

-- No values were available.

Table A-1. Toxicological, Physical, and Chemical Properties of Compounds Potentially Present at Organic and Suciac Block, Williamsburg Facility, Brooklyn, New York

Compound	CAS#	TLV (mg/m^3)	IDLH (ppm)	PEL (mg/m^3)	Routes of Exposure	Toxic Properties	Target Organs	Physical/ Chemical Properties
Aroclor 1260	11096-82-5	0.001	NA	NA	Dermal; inhalation; ingestion	Liver damage Nausea Abdominal pain	liver skin	

TLV - Threshold Unit Value - must not be exceeded over 8 hour shift
IDLH - Immediately Dangerous to Life and Health - maximum concentration from which one could escape in 30 minutes without a respirator
PEL mg/m^3 - Permissible Exposure Limit - must net be exceeded over 8 hour shift
PPM - Part Per Million
CNS - Central Nervous System
CVS - Cardiovascular System
GI tract - Gastrointestinal tract
BP - Boiling Point
FlPt - Flash Point
UEL - Upper Explosive Limit
LEL - Lower Explosive Limit

References

U.S. Department of Labor. 1990. OSHA Regulated Hazardous Substances, Industrial Exposure and Control Technologies Government Institutes, Inc.

Hawley's Condensed Chemical Dictionary, Sax, N. Van Nostrand and Reinhold Company, 11th Edition, 1987.

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.

Guide to Occupational Exposure Values. 1990. American Conference of Governmental Industrial Hygienists.

-- No values were available.

ATTACHMENT A-1

Incident Report

INCIDENT REPORT

Site ______________________________

Site Location ______________________________

Report Prepared By ______________________________

Name Printed   Title

Incident Category (Check all that apply)

____ Injury	____ Illness	____ Property Damage
____ Near Miss	____ On-Site Equipment	____ Chemical Exposure
____ Motor Vehicle	____ Fire	____ Electrical
____ Mechanical	____ Other	

Date and Time of Incident ______________________________

Names of Persons Injured (see end of report for details)

____

____

____

NARRATIVE REPORT OF INCIDENT

(Provide sufficient detail so that the reader may fully understand the actions leading to or contributing to the incident, the incident occurrence, and actions following the incident. Append additional sheets of paper if necessary.)

____

____

____

____

____

____

Project # ______________________
Project Name: ______________________
Location: ______________________
Date: ______________________

WITNESSES TO INCIDENT

1. Name ______________________ Company ______________________
   Address ______________________

   Telephone No. ______________________

2. Name ______________________ Company ______________________
   Address ______________________

   Telephone No. ______________________

PROPERTY DAMAGE

Brief Description of Property Damage ______________________

____

____

____

____

Estimate of Damage ______________________

INCIDENT LOCATION

____

____

____

INCIDENT ANALYSIS

Causative agent most directly related to accident (object, substance, material, machinery, equipment, conditions): ______________________

____

____

Project # ______________________
Project Name: ______________________
Location: ______________________
Date: ______________________

Was weather a factor? ______________________

Unsafe mechanical/physical/environmental condition at time of incident (be specific) ______________________

____

Unsafe act by injured and/or others contributing to the incident (be specific, must be answered)

____

Personal factors (improper attitude, lack of knowledge or skill, slow reaction, fatigue) ______________________

____

ON-SITE INCIDENTS

Level of personal protection equipment required in Site Safety Plan ______________________

____

____

____

Modifications ______________________

____

____

Was injured using required equipment? ______________________

____

Project # ______________________
Project Name: ______________________
Location: ______________________
Date: ______________________

INCIDENT FOLLOW-UP

Date of Incident ____

Site ____

Brief Description of Incident ____

____

____

Outcome of Incident ____

____

____

Physician's Recommendations ____

____

____

Date Injured Returned to Work ____

ATTACH ANY ADDITIONAL INFORMATION TO THIS FORM

ATTACHMENT A-2

Site Safety Follow-Up Report

Project # ____________________
Project Name: ____________________
Location: ____________________
Date: ____________________

SITE SAFETY FOLLOW-UP REPORT

This section must be filled out and returned to the Site Safety Officer after each site visit or task.

Person Responsible for Follow-up Report ______________________________

Actual Date of Work ____

ACTUAL SITE INVESTIGATION TEAM

Roux Personnel	Responsibility

Other Interested Parties	Affiliation	Purpose of Visit

Project #
Project Name:
Location:
Date:

PERSONAL PROTECTIVE EQUIPMENT

Level of Respiratory Protection Used	Activity Performed

Field Dress	Activity

MONITORING EQUIPMENT

HNU/OVA/CGI

- Background reading ______________________
  - Readings above background? ______________________
  - Location of high readings ______________________

Radiation

- Readings above background? _____ Yes _____ No
- If yes, specify where readings were found and what action was taken

Project # ______________________
Project Name: ______________________
Location: ______________________
Date: ______________________

GENERAL SAFETY

Were any safety problems encountered while on site?
Explain ______________________

____

____

____

____

ACCIDENT REPORT INFORMATION

Did Any Team Member Report	Yes	No
• Chemical exposure	____	____
• Illness, discomfort, or unusual symptoms	____	____
• Environmental problems (heat, cold, etc.)	____	____

Explain ______________________

____

____

____

____

Was an Employee Exposure/Injury Incident Report Completed? ____ Yes ____ No

INJURIES

Injured Person

Name of Address of Injured ______________________________

____

SSN ______________ Age ______________ Sex ______________

Years of Service ______________ Time on Present Job ______________

Title/Classification ______________________________

Severity of Injury or Illness

______	Disabling	______	Non-Disabling
______	Fatality	______	Medical Treatment

Estimated Number of Days Away From Job ______________________________

Nature of Injury or Illness ______________________________

____

____

Classification of Injury

____	Fractures	____	Heat Burns	____	Cold Exposure
____	Dislocations	____	Chemical Burns	____	Frostbite
____	Sprains	____	Radiation Burns	____	Heat Stroke
____	Abrasions	____	Bruises	____	Heat Exhaustion Concussion
____	Lacerations	____	Blisters	____	Toxic
____	Punctures	____	Bites	____	Toxic Respiratory Exposure
____	Faint/Dizziness	____	Dermal Allergy	____	Ingestion
____	Other			____	Respiratory Allergy

Part of Body Affected ______________________________

Degree of Disability ______________________________

Date Medical Care was Received ______________________________

Where Medical Care was Received ______________________________

Address (if off-site) ______________________________

If Hospitalized, Name, Address and Telephone of Hospital ______________________________

____

____

Name, Address and Telephone Number of Physician ______________________________

____

____

ATTACHMENT A-3

Health and Safety
Field Change Request Form

Project # ____________________
Project Name: ____________________
Location: ____________________
Date: ____________________

FIELD CHANGE REQUEST

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

____

____

____

____

____

Reason 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 Supervisor ____________________ Date __________

Evaluation of Site Safety Plan

Was the Safety Plan adequate? ____ Yes ____ No

What changes would you recommend? ______________________________________

____

____

____

____

APPENDIX B

Roux Associates
Standard Operating Procedures

APPENDIX B

Table of Contents for Standard Operating Procedures

STANDARD OPERATING PROCEDURE
FOR COLLECTION OF SOIL SAMPLES
FOR LABORATORY ANALYSIS

Date: May 15, 1990

Revision Number: 0

Corporate QA/QC Manager: Michael A. DeLellis

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.

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

Date: May 15, 1990 Revision Number: 0

Corporate QA/QC Manager: Michael A. DeCillis (signature)

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.

Date: December 21, 1989

Revision Number: 0

Corporate QA/QC Manager: Michael A. DeCillis (CAM)

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., rinsate 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.

Date: May 15, 1990

Revision Number: 0

Corporate QA/QC Manager: Michael A. DeCillis (signature)

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., Teflon™) 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., Teflon™). 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 indivudual 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.

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

Date: May 15, 1990

Revision Number: 0

Corporate QA/QC Manager: Michael A. DeCillis

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 onsite.

b. Name, date, and time of arrival onsite 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 onsite 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 onsite.

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.

STANDARD OPERATING PROCEDURE FOR HAND BAILING WELLS CONTAINING SEPARATE-PHASE ORGANIC LIQUIDS

Date: May 15, 1990

Revision Number: 0

Corporate QA/QC Manager: Michael A. DeCillis

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for hand bailing wells containing immiscible, separate-phase organic liquids. The hand bailing of immiscible, separate-phase organic liquids requires special health and safety considerations, equipment, and procedures.

Separate-phase layers can either be "floaters" or "sinkers." "Floaters" (non-aqueous phase liquids [NAPLs]) are separate-phase liquids that are less dense than water and float on the ground-water surface. "Sinkers" (dense non-aqueous phase liquids [DNAPLs]) are separate-phase liquids that are more dense than water and tend to migrate downward through aquifers due to gravitational forces until a low permeability layer is encountered (i.e., they accumulate at the bottom of the aquifer). For the purpose of this SOP, only the hand bailing of floating separate-phase liquids will be addressed.

The objectives for hand bailing wells containing floating separate-phase liquids (e.g., petroleum, petroleum products) may include the following: 1) removal of product before ground-water sampling; 2) remediation technique; 3) sampling product for constituent or characterization analysis; and 4) conducting product recharge tests to evaluate "true" versus "apparent" product thickness.

2.0 CONSIDERATIONS

The primary considerations when conducting hand bailing of wells are health and safety, and waste collection and disposal.

2.1 Health and Safety

All separate-phase products must be assumed to possess health and safety hazards equivalent to the most hazardous suspected on-site source. For example, if fuel oil is being removed from wells where polychlorinated biphenyls (PCBs) are known (or suspected) to be present, then the potential for PCBs to be present in the fuel oil must be considered. When bailing flammable materials, it is imperative that all possible sources of ignition be eliminated. Minimum requirements include (NO EXCEPTIONS) no smoking or open flames, use of intrinsically safe downhole monitoring equipment, use of static free bailing cord (e.g., absorbent cord [cotton]), and use of properly vented and grounded product collection containers. When product collection containers will be stored onsite, the local fire code official must be consulted regarding product storage requirements (e.g. venting, grounding, labeling, permits, secondary containment, etc.). A detailed, comprehensive explanation of health and safety procedures must be outlined in the site health and safety plan (HASP).

2.2 Waste Collection and Disposal

All product and product-contaminated waste materials must be properly stored, characterized, and disposed. A detailed, comprehensive explanation of waste (product) collection and disposal must be developed in accordance with regulatory agency requirements and must be outlined in the work plan/scope of work. Minimum requirements will include:

a. Collection of solid waste materials in a Department of Transportation (DOT) approved open-top drum (17C).

b. Collection of separate-phase product in a properly grounded and vented, DOT approved closed-top drum (17E).

c. Appropriate labeling of all drums with THIS SIDE UP, FLAMMABLE, and HAZARDOUS WASTE labels in accordance with Resource Conservation and Recovery Act (RCRA) and DOT requirements.

d. Collection and analysis of product sample for characterization prior to disposal, as required.

Any bailing operations which generate more than 100 kilograms per month (or approximately half of a 55 gallon drum) or that involve the storage of more than 1,000 kg of a RCRA hazardous waste must meet additional RCRA storage and disposal requirements (see 40CFR 261.5).

3.0 EQUIPMENT AND MATERIALS

The list of equipment and materials which may be needed for hand bailing floating separate-phase product from a well includes, but may not be limited to, the following:

a. Site HASP.

b. Appropriate health and safety equipment, as specified in the HASP.

c. A work plan which describes bailing requirements.

d. Oil/water interface probe.

e. Clear, acrylic product bailer (graduated).

f. Absorbent, nonstatic cord (e.g., cotton).

g. Sorbent pads.

h. Disposable PVC gloves.

i. Well construction log(s).

j. Two graduated buckets and funnels (dedicated to separate-phase product activities).

k. DOT approved product collection drum(s).

l. DOT approved solid waste collection drum(s).

m. Roux Associates' field forms and field notebook.

n. Non-phosphate, laboratory-grade detergent.

o. Distilled/deionized water.

p. Potable water.

q. Paper towels, clean rags.

r. Calculator.

s. Black pen and indelible marker.

t. Well location and site map.

u. Tools (e.g., pipe wrench, screwdrivers, hammer, pliers, flashlight, pen knife, etc.)

v. Extra batteries (probe, flashlight).

w. Steel tape measure with 0.01-foot measurement increments, graduated measurement stick.

x. Plastic sheeting.

y. Specific gravity instruments.

4.0 DECONTAMINATION

4.1 Complete decontamination of a clear acrylic bailer which is dedicated to the removal of separate-phase product can be very difficult. When the primary task is the removal of product as a remedial technique, then decontamination should involve removal of gross contamination before entering and exiting the site or moving to different areas of separate-phase product accumulation. Special care must be taken to make sure that a "product bailer" never enters a "clean" well which does not contain separate-phase product. This can be ensured by measuring separate-phase thickness in all wells before starting bailing operations. The oil/water interface probe must be thoroughly cleaned according to the field equipment decontamination SOP before entering each well. Based on historical data, the order of measuring separate-phase thickness should be from the cleanest well to the dirtiest well to further reduce the potential for cross-contamination. If bailing is being conducted for product samples, it may be necessary to utilize a dedicated, disposable bailer as defined in the work plan.

5.0 PROCEDURE

5.1 Document, and initial and date the monitoring well identification and any problems encountered on the appropriate field form and in the field notebook.

5.2 Inspect the product collection drum or tank, and note any items of concern such as dents, holes, leaks, deformation, unauthorized access, etc. Document, and initial and date findings on an appropriate field form and in the field notebook.

5.3 Ensure that all equipment is properly decontaminated and cleaned.

5.4 Place plastic sheeting adjacent to the well to protect decontaminated equipment.

5.5 Remove the well cap and clean it off with a clean rag. Place the cap on the plastic sheeting. If fumes or gases are present, then diagnose these with the proper safety equipment. Never inhale the vapors.

Refer to Section 2.1 for the minimum health and safety considerations to prevent fire or explosion. Additional health and safety precautions based on site specific considerations must be outlined in the site HASP.

5.6 Place sorbent pads around the well to be bailed to prevent any loss of product in the event of spillage.

5.7 Determine the depth to product (DTP), depth to water (DTW), and product thickness within the well using an oil/water interface probe. Refer to the SOP for Measuring the Thickness of Floating Separate-phase Layers for the procedure to measure product thickness.

5.8 Lower the bailer into the product zone using absorbent, nonstatic cord (e.g., cotton). Refer to the work plan/scope of work to determine the method for draining off any excess water collected in the bailer (i.e., into the well or in a bucket). Drain off the water by slightly dislodging the capture ball (check valve) from the bailer seat with your finger; PVC gloves must be worn. Drain the product only into a separate, dedicated bucket.

5.9 Continue bailing until product thickness as observed in the bailer is reduced to less than 1/4 inch (0.02 feet). If possible, then bail until no product is evidenced in the well (i.e., no more product is entering the well). Verify thickness measurements in the well using an oil/water interface probe. When bailing is completed, dispose of any excess water collected according to the specifications in the work plan/scope of work.

5.10 Wipe the well cap with a clean rag, replace the well cap and protective cover (if present). Lock the protective cover.

5.11 If required in the work plan, collect specific gravity measurements on representative samples of the product collected.

5.12 Transfer the product collected in the bucket to an on-site storage vessel. Record the volume of product collected and confirm by measuring the on-site storage vessel contents with an oil/water interface probe both before and after transferring the product from the bucket.

5.13 Place all contaminated sorbent pads, cord, and other solid waste materials into the open top drum and secure the lid.

5.14 Report any significant problems or deviations in product thickness measurements immediately (e.g., significant increase in product thickness or a substantial change in appearance).

5.15 Document all data (e.g., MP, DTP, DTW, product thickness, volume of product removed and disposed) on an appropriate field form and in the field notebook, and initial and date entries.

5.16 Secure storage containers and verify integrity.

5.17 Decontaminate all equipment as discussed in the decontamination section (4.0). 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 accepted procedures.

STANDARD OPERATING PROCEDURE FOR MEASURING THE THICKNESS OF FLOATING SEPARATE-PHASE ORGANIC LIQUIDS

Date: May 15, 1990 Revision Number: 0

Corporate QA/QC Manager: Michael A. DeCillis (GDM)

1.0 PURPOSE

The purpose of this standard operating procedure (SOP) is to establish guidelines for measuring the thickness of floating separate-phase organic liquids in a well, tank or drum. Measuring the thickness of floating, separate-phase organic liquids requires special health and safety considerations, equipment, and procedures.

Separate-phase layers can either be "floaters" or "sinkers". "Floaters" (non-aqueous phase liquids [NAPLs]) are separate-phase liquids that are less dense than water and float on the ground-water surface. "Sinkers" (dense non-aqueous phase liquids [DNAPLs]) are separate-phase liquids that are more dense than water and tend to migrate downward through aquifers due to gravitational forces until a low permeability layer is encountered (i.e., they accumulate at the bottom of the aquifer). For the purpose of this SOP, only measuring the thickness of floating separate-phase liquids will be addressed.

The objectives for measuring separate-phase organic liquids may include the following: 1) determination of the thickness of the free product in a well, tank or drum; 2) estimation of the volume of free product to be removed from a well before sampling, or from a tank or drum before removal; and 3) calculation of the "true" (non-free product depressed) elevation of the water table.

2.0 CONSIDERATIONS

The primary considerations when measuring the thickness of floating separate-phase liquids are health and safety, and proper equipment selection.

2.1 Health and Safety

All separate-phase products must be assumed to possess health and safety hazards equivalent to the most hazardous suspected on-site source. For example, if fuel oil is being measured in wells where polychlorinated biphenyls (PCBs) are known (or suspected) to be present, then the potential for PCBs to be present in the fuel oil must be considered. When measuring the thickness of flammable materials, it is imperative that all possible sources of ignition be eliminated. Minimum requirements include (NO EXCEPTIONS) no smoking or open flames, use of intrinsically safe downhole monitoring equipment, use of static free bailing cord (e.g., absorbent cord [cotton]), and use of properly vented and grounded product collection containers. When product collection containers will be stored onsite, the local fire code official must be consulted regarding product storage requirements (e.g. venting, grounding, labeling, permits, secondary containment, etc.). A detailed, comprehensive explanation of health and safety procedures must be outlined in the site health and safety plan (HASP).

2.2 Equipment Selection

There are several methods which may be employed to measure the thickness of separate-phase petroleum product in a monitoring well, tank or drum. The actual method to be utilized should be outlined in the work plan. Considerations in selecting a method shall include: the type and consistency of the product; the level of accuracy desired; the expected depth and thickness of the product; and the diameter of the well or port.

Measurements of floating separate-phase product thicknesses can be performed using 1) an electronic oil/water interface probe; 2) a graduated, clear acrylic bailer; or 3) a weighted steel measuring tape (or graduated "stick") in conjunction with oil and water paste.

An oil/water interface probe is capable of providing rapid and accurate (±0.01 foot) results under most field situations. However, viscous product or oil/water emulsions may interfere with performance by coating the probe and/or disguising the interface. In these situations, a clear, acrylic bailer may be used in wells, or oil and water paste in a tank or drum.

A clear, acrylic bailer may be used if simply the presence or absence of product or an approximate product thickness is desired. In certain situations (e.g., viscous product or product/water emulsions) a clear acrylic bailer may be the best available method. However, when product thicknesses are greater than approximately three feet, a bailer will be unable to provide approximate product thickness measurements. If the oil/water interface probe will not work, and the product thickness is too great to be measured by a bailer, then the best available technique may be oil and water paste.

A graduated "stick" or weighted steel tape in conjunction with oil and water paste may be appropriate for measuring residual water or product in a tank or drum. This method is not recommended for use in monitoring wells because of possible cross-contamination from the paste itself. In certain situations where no other method can provide the necessary data, oil and water paste may be used in monitoring wells containing product. This method is less accurate than an oil/water interface probe, but frequently more accurate than a clear, acrylic bailer.

It should be noted that erroneous data may be collected by all three methods when measurements are collected through the fill ports of tanks which are equipped with drop tubes. Whenever possible, product thickness measurements should be collected from ports with unobstructed access to the tank contents. When measurements must be collected from a fill port with a drop tube, it should be understood that there may be significant differences between the drop tube measurements and the actual thicknesses of the water and product in the tank.

3.0 CALIBRATION

3.1 Oil/Water Interface Probe

There is no specific calibration procedure for an oil/water interface probe. However, you should verify that the unit operates properly prior to taking it out in the field by testing it in a jar containing product and water. This jar should be stored in a flammable liquid cabinet and be dedicated to oil/water interface probe testing. Since most oil/water interface probes have a heavy probe assembly and a rigid graduated tape, kinking, stretching or twisting of the tape is not a significant concern. In order to ensure proper operation, the unit should be kept warm prior to use (e.g. hotel room or cab of truck).

3.2 Clear Acrylic Bailer

There is no specific calibration procedure for an acrylic bailer. However, since you only get one chance to measure the thickness correctly, you should verify that the check valve operates properly with distilled water. Based on previous data, if available, you should ensure that the length of the bailer is sufficient to measure the entire thickness of the product.

3.3 Oil/Water Paste

There is no specific calibration procedure for using oil and water paste. However, these pastes may not behave reliably if they are old or have been exposed to extreme temperatures. The pastes should be tested prior to taking them out in the field to confirm they work. The stick measure or weighted steel tape should be carefully examined to confirm that it is properly graduated and has not been damaged or modified.

4.0 DECONTAMINATION

4.1 Complete decontamination of a clear acrylic bailer which is dedicated to the measurement of separate-phase product thicknesses can be very difficult. Decontamination should involve removal of gross contamination before entering and exiting the site or moving to different areas of separate-phase product accumulation. Special care must be taken to make sure that a "product bailer" never enters a "clean" well which does not contain separate-phase product. This can be ensured by measuring separate-phase thickness in all wells before starting bailing operations. The oil/water interface probe must be thoroughly cleaned according to the field equipment decontamination SOP before entering each well. If historical data is available, then the order of measuring separate-phase thickness should be from the cleanest well to the dirtiest well to further reduce the potential for cross-contamination. If samples are also being collected for constituent or characterization analysis, then a disposable, dedicated bailer may be necessary for product collection.

5.0 EQUIPMENT AND MATERIALS

Depending on the method used to measure the thickness of separate-phase organic liquids, both method-specific and general equipment and materials are needed.

5.1 Regardless of the method used, general equipment and materials will include, but may not necessarily be limited to, the following:

a. Site Health and Safety Plan (HASP).

b. Appropriate health and safety equipment, as specified in the HASP.

c. Roux Associates' field forms and field notebook.

d. Non-phosphate, laboratory-grade detergent.
e. Distilled/deionized water.

f. Potable water.

g. Paper towels, clean rags.

h. Plastic sheeting.

i. Sorbent pads.

j. Well location and site map.

k. Well keys.

l. Disposable gloves.

m. Calculator.

n. Black pen and indelible marker.

o. Tools (e.g., pipe wrench, screw drivers, hammer, pliers, flashlight, pen knife, etc.).

p. Buckets for decontamination.

5.2 Clear Acrylic Bailer - the following will also be needed:

a. Clear acrylic bailer

b. Non-static cotton cord

c. Steel tape (10 foot)

5.3 Oil/Water Interface Probe - the following will also be needed:

a. Oil/water interface probe

5.4 Oil/Water Paste - the following will also be needed:

a. Oil paste

b. Water paste

c. Graduated stick or weighted steel tape

6.0 PROCEDURE

6.1 Oil/Water Interface Probe

6.1.1 Make sure the bottom five (5) feet of the probe and measuring tape have been decontaminated according to the field equipment decontamination SOP before entering each well.

6.1.2 Based on previous data, if any, ensure that non-product wells are measured prior to product wells to reduce the possibility of cross-contamination.

6.1.3 Remove the well cap or plug and clean the top of the well with a clean rag. Place the cap or plug on clean plastic on the ground to protect it from potential contamination.

6.1.4 Slowly lower the thoroughly decontaminated probe to the product surface. A distinct tone or beep will indicate the presence and level of product. The depth to product (DTP) from the measuring point will be recorded in the field notebook and on appropriate field forms. Continue lowering the probe until the tone or beep indicates the presence of water. The oil/water interface is best measured by lowering the probe about six inches into the water and then raising it to the interface. The depth to water (DTW) from the measuring point will be recorded in the field notebook and on appropriate field forms. The product thickness is the difference between the DTW and DTP.

6.1.5 Replace locking and/or protective caps on the well.

6.1.6 Thoroughly clean the probe and the portion of the tape which entered the product according to the field equipment decontamination SOP.

6.2 Clear Acrylic Bailer

6.2.1 Make sure all equipment is cleaned of gross contamination before entering and exiting the site or moving to different areas of product accumulation.

6.2.2 Remove the well cap or plug and clean the top of the well with a clean rag. Place the cap or plug on clean plastic on the ground to protect it from potential contamination.

6.2.3 Slowly lower a clear, decontaminated bottom-filling acrylic bailer into the well until the bottom of the bailer contacts the fluid surface.

6.2.4 Using a reference point on the bailer line, slowly lower the bailer into the fluid a distance less than the bailer length so that at its deepest point the top of the bailer remains above the air/fluid contact.

6.2.5 Slowly raise the bailer out of the well.

6.2.6 The thickness of the floating free product will be approximated by placing a tape measure along side the bailer. The data will be documented in the field notebook and on appropriate field forms.

6.2.7 Dispose of the product in an appropriate manner as specified in the work plan. This may include draining the product back into the well or tank, or containerization if the measurement is in conjunction with bailing for removal purposes.

6.2.8 Replace locking and/or protective caps on the well.

6.2.9 Thoroughly clean the bailer as described in Section 6.2.1. Discard the cotton cord in an appropriate manner. Wrap decontaminated bailer in a suitable material (e.g., clean plastic bag, aluminum foil).

6.2.10 If the free product is extensive or thicker than the height of the bailer, then an electronic interface probe should be used to measure product thickness.

6.3 Oil/Water Paste - (Generally not applicable for monitoring wells)

6.3.1 Make sure all equipment is decontaminated and cleaned before use according to the field equipment decontamination SOP.

6.3.2 Secure access to the tank or drum to be measured only after the contents are known and properly addressed in the HASP. Attempt to estimate the depth and thickness of product and the depth to water so the entire stick or weighted steel tape does not have to be coated with oil and water paste.

6.3.3 Coat one side of the stick or steel tape with oil paste and the other with water paste. Since these are typically different colors, confusion should not result. Depending upon information needs, lower the tape to just below the water interface or to the bottom of the tank or drum.

6.3.4 If only DTP and DTW data is required, then the top of the tape is held at an even-foot increment at the measuring point (MP). This is called the "held" value, and is recorded as such. If the depth to the bottom of the tank is also required, then the held value can't be specifically selected at an even-foot increment.

6.3.5 The steel tape or graduated stick is removed and the "water cut" and "product cut" levels are recorded. The difference between the "held" value and the "product cut" value is the DTP. The difference between the "held" value and the "water cut" is the DTW. The difference between the "product cut" and the "water cut" is the product thickness. If the diameter of a horizontal tank is desired, then the difference between the "held" value (to the bottom of the tank) and the depth of the fill pipe is required.

6.3.6 All pertinent data will be recorded in the field notebook and on appropriate field forms.

6.3.7 Make sure all equipment is decontaminated before use in the next tank or drum according to the field equipment decontamination SOP. All disposable materials must be discarded in a manner consistent with site conditions.

MEMORANDUM

TO: East Providence Project File
East Providence Field Staff
FROM: Drew Baris
DATE: November 10, 1994
RE: Standard Operating Procedure for Screening Soil Samples for Volatile Organic Vapors

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The Standard Operating Procedure for the field screening of all soil samples collected during the field activities at the Mobil Oil Corporation East Providence Terminal is provided below. Conformance with the procedures should be documented in accordance with record keeping requirements specified in the Field Sampling Plans for the project.

- Calibrate the PID according to manufacturer's specifications at the beginning of each day. Check the calibration during operation with standard gases if PID results appear erratic or inconsistent with field observations. Recalibrate the instrument if necessary.

- Extract the soil sample from the sampler, quickly measure the recovery, and separate the wash from the true sample.

- Place the sample in a clean ziplock bag or glass jar (as quickly as possible to avoid loss of VOCs) filling the bag or jar half full. If using glass jars, aluminum foil should be placed over the mouth of the jar prior to securing the lid.

- Label the bags 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.

- Log the sample in detail and record sediment characteristics (color, odor, moisture, texture, density, consistency, organic content, and layering).

- After the sample has been collected, allow approximately 10 minutes as an equilibration period prior to PID screening. Immediately prior to PID screening, agitate the sample for five seconds. Then open the ziplock seal the minimum amount necessary insert PID probe. If using glass jars, pierce the aluminum foil the minimum amount necessary to insert the probe. Measure the relative concentration of VOCs in the headspace of the soil sample. The initial (peak) reading must be recorded.

- Record the PID reading in the field notebook.