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ENVIRONMENT

Mr. Brian Jankauskas, Environmental Engineer
New York State Department of Environmental Conservation
Division of Environmental Remediation
Remedial Bureau A, 12th Floor
625 Broadway
Albany, New York 12233-7015

Subject:
Supplemental Investigation Work Plan
25 Melville Park Road Site
Melville, New York

Date:
March 22, 2013

Contact:
Peter Milionis

Phone:
(267) 685-1815

Email:
Peter.Milionis@arcadis-us.com

Our ref:
NY001332.2012.N0012

Dear Mr. Jankauskas:

On behalf of BP Moby Holdings LLC, ARCADIS is submitting this Supplemental Investigation Work Plan (Work Plan) for the above referenced Site. ARCADIS is planning to conduct supplemental subsurface investigation activities in the source area (i.e., northeast portion of the building and loading dock area) and in the vicinity of monitoring wells MW-27D and MW-28D. The northeast portion of the building is currently unoccupied and will be unoccupied when we implement the Work Plan.

The purpose of the supplemental source area investigation is to collect additional data to support potential enhancement of the remedial actions and ultimately expedite Site remediation. The purpose of the supplemental investigation in the vicinity of monitoring wells MW-27D and MW-28D is to support optimization of the groundwater remedial action (i.e., optimization of the in-situ reactive zones [IRZs]) and to evaluate options for modifications to monitoring wells MW-25D, MW-26D, MW-27D, and MW-28D (i.e., wells with two screen intervals).

Proposed Scope of Work

The supplemental investigation activities proposed herein will be performed using an adaptive approach to allow for flexibility in the actual placement of borings and selection of intervals to be tested/sampled based on the analysis of field and analytical data. The supplemental source area investigation will consist of drilling fifteen (15) borings in areas where non-aqueous phase liquid (NAPL) has been observed in monitoring wells (borings NSB-11 through NSB-15) and in areas where it is anticipated that NAPL is not present (borings NSB-1 through NSB-10). The supplemental investigation in the vicinity of monitoring wells MW-27D and MW-28D will consist of drilling four (4) borings along an east-west transect perpendicular to groundwater flow (borings HPT-1 through HPT-4). The proposed locations of the borings are shown on Figure 1. The boring locations will be cleared of utilities to a depth of 5 feet below land surface (ft bls) using soft dig techniques (e.g., hand digging using a hand auger). The supplemental investigation will be implemented in phases as described below.

Phase I – Hydraulic Profiling Tool (HPT)/Vertical Aquifer Profiling (VAP)

The investigation techniques that will be employed at the HPT-1 through HPT-4 locations will include the Geoprobe® Hydraulic Profiling Tool (HPT) and vertical aquifer profiling (VAP). The key objectives of the supplemental investigation in the vicinity of monitoring wells MW-27D and MW-28D are to map the hydrostratigraphy and further understand the aquifer architecture in this area of the Site, and to determine the concentrations of volatile organic compounds (VOCs) in both the shallow and intermediate aquifer zones in the vicinity of these monitoring wells, which have an upper screen interval (40 to 55 feet below land surface [ft bls]) and lower screen interval (75 to 90 ft bls). The options associated with the modifications to the dual-screen wells will be further assessed after the HPT/VAP investigation has been completed.

The Geoprobe® HPT will be employed to map hydrostratigraphy and determine zones of higher (VOC transport zones) and lower permeability (VOC storage zones) and to determine the intervals where to collect VAP groundwater samples. The VAP groundwater samples will generally be collected from select intervals within the higher permeability zones and will allow for an evaluation of the zones where VOC transport is occurring. The VAP sampling will provide the necessary data to determine which screen interval (upper or lower) in monitoring wells MW-27D and MW-28D are appropriate for the performance monitoring moving forward. The HPT borings will be drilled to a depth of approximately 90 ft bls (i.e., bottom of monitoring wells MW-27D and MW-28D lower screen interval). It is anticipated that a minimum of three (3) groundwater samples will be collected from each boring and submitted to the laboratory for the analysis of VOCs. Additional groundwater samples may be collected for laboratory analysis based on the hydrostratigraphy mapping (i.e., adaptive approach). The water collected from each VAP sampling interval will be screened using a photoionization detector (PID) to assist in selecting the samples that will be submitted for laboratory analysis.

The HPT/VAP investigation will utilize direct push drilling techniques (Geoprobe® rig [e.g., 6610 machine]) for both aquifer hydraulic testing and groundwater sample collection. The HPT is advanced through the subsurface at a constant rate while water is injected through a screen on the side of the probe. An in-line pressure sensor measures the pressure response of the soil to water injection. The pressure response identifies the relative ability of the soil to transmit water. Both pressure and flow rate are logged versus depth. A Geoprobe Systems® document describing the HPT is provided as Attachment 1. After each HPT boring has been drilled to its completion depth and the probe rods have been removed from the subsurface, a separate set of probe rods will be immediately advanced to the completion depth so that the boring can be grouted from the bottom up.

The direct push VAP boring groundwater samples will be collected using the Geoprobe® Screen Point Groundwater Sampling System. The assembled Geoprobe® Screen Point Groundwater Sampler will be driven to the target sampling depth. Extension rods will be used to hold the temporary screen in position while the probe rods and sampler sheath are retracted to expose the screen. The sampler sheath will be retracted to expose a two- to three-foot screen interval. The sampler sheath will form a mechanical annular seal above the screen interval. Polyethylene tubing will be fitted with a check valve assembly (check valve and check ball) and lowered into the screen interval. The tubing and check valve assembly will be oscillated up and down to pump groundwater to the surface and the groundwater sample will be collected. The assembled Geoprobe® Screen Point Groundwater Sampler will then be removed from the subsurface, decontaminated, and driven to the next groundwater sampling interval. After the last groundwater sample has been collected, the boring will be grouted from the terminal depth of the boring to land surface.

Phase II – Laser-Induced Fluorescence/HPT/VAP

The investigation techniques that will be employed at the NSB-1 through NSB-15 locations will include HPT and laser-induced fluorescence (LIF), specifically the ultra-violet optical screening tool (UVOST®). In addition, VAP sampling will be selectively performed at the NSB-1 through NSB-9, and NSB-13 through NSB-15 locations. The number and vertical sample intervals for sample collection at these locations will be based on the LIF data, HPT data, and PID screening results using an adaptive approach. The groundwater quality data will be evaluated in conjunction with the LIF data.

As described above, the HPT will be employed to map hydrostratigraphy and to assist in determining the intervals where VAP groundwater samples will be collected. The UVOST® system will be employed to further define the distribution of NAPL in the source area. The UVOST® system uses a sapphire window in the side of a direct push probe to measure front-face fluorescence of petroleum NAPL as the probe is advanced into the soil. Polycyclic aromatic hydrocarbon (PAH) fluorescence of NAPL is directed back to the surface where it is analyzed and responses are indicated in real-time on a graph of UVOST® signal versus depth. A Dakota Technologies document describing the UVOST is provided as Attachment 2. In conjunction, the HPT and UVOST® systems will allow for a correlation between the NAPL distribution and stratigraphy. Additional step out borings may be drilled, if necessary, based on the LIF and VAP data collected from the borings shown on Figure 1, to fully define the distribution of NAPL.

Prior to proceeding with LIF, a sample of the site-specific NAPL will be collected to evaluate the fluorescence of the NAPL and confirm that LIF is appropriate for the site-specific NAPL. The LIF technology will target the cutting oil since it is the PAHs in petroleum hydrocarbons that fluoresce. Since the tetrachloroethene (PCE) mass has been observed to be mixed/co-located with the cutting oil based on fingerprint analyses, the distribution of the cutting oil NAPL will be relied upon to understand the distribution of the PCE NAPL mass. LIF does not typically detect chlorinated compounds; however, it is anticipated that the mixed PCE/cutting oil NAPL will fluoresce.

The HPT/LIF/VAP investigation will utilize direct push drilling techniques (Geoprobe® rig [e.g., 6610 machine]) for both aquifer hydraulic testing, NAPL distribution definition, and groundwater sample collection. The HPT and LIF borings will be drilled to a target depth of 100 ft bls with the intent of vertically defining the distribution of the NAPL. After each HPT and LIF boring has been drilled to its completion depth and the probe rods have been removed from the subsurface, a separate set of probe rods will be immediately advanced to the completion depth so that the borings can be grouted from the bottom up.

The VAP boring groundwater samples will be collected using the Geoprobe® Screen Point Groundwater Sampling System and the procedures described above. It is anticipated that a minimum of three (3) groundwater samples will be collected from NSB-1, NSB-2, NSB-4, and NSB-6 borings and submitted to the laboratory for the analysis of VOCs. Additional groundwater samples may be submitted for laboratory analysis from any boring to meet the project objectives described above. After the last groundwater sample has been collected, the boring will be grouted from the terminal depth of the boring to land surface.

The groundwater samples will be submitted to TestAmerica Laboratories, Inc., a New York State Department of Health (NYSDOH) accredited laboratory, and analyzed for VOCs using SW-846 Method 8260. Sample analyses will follow the NYSDEC Analytical Services Protocol (ASP) (most recent version) and will include quality assurance/quality control (QA/QC) samples consisting of trip blanks, equipment blanks, and field duplicate samples. Analytical results will be reported using NYSDEC ASP Category A data deliverables.

The supplemental investigation will be documented and a discussion of the results will be provided in a quarterly progress report at the end of the investigation program and after all of the data have been evaluated. Interim data (e.g., laboratory analytical data) will be provided in the quarterly progress report associated with the period that the data were collected.

Should you have any questions or comments to this Work Plan, please do not hesitate to contact Peter Milionis at (267) 685-1815. ARCADIS respectfully requests an expedited review of this Work Plan so that the work can be implemented while the northeast portion of the building is unoccupied.

Sincerely,

ARCADIS of New York, Inc.

Christopher D. Keen
Senior Scientist

Peter Milionis
Project Manager

Copies:
Raymond Sohmer, Philips International Holding Corp.
Scott Furman, Tannenbaum Helpern Syracuse & Hirschtritt LLP
Sharon McLelland, NYSDOH
Geralyn Rosser, SCDHS
Rosalie Rusinko, NYSDEC
File

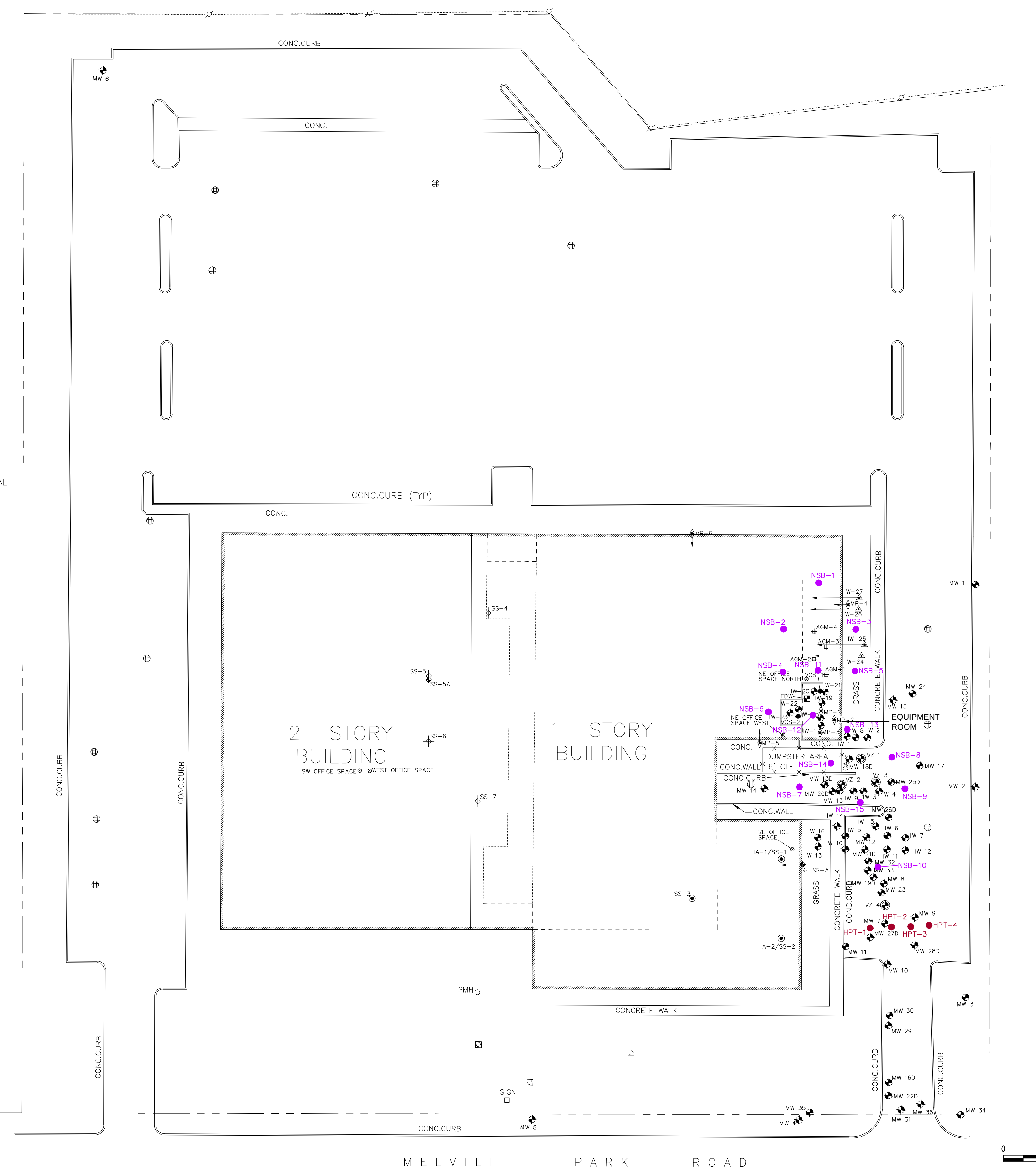
Well Designation	Well Diameter (inches)	Screened Interval (feet bls)	Total Depth (feet bls)	Vertical Zone Designation
IW-1	2	45 to 60	60	Shallow Zone
IW-2	2	45 to 60	60	Shallow Zone
IW-3	2	45 to 60	60	Shallow Zone
IW-4	2	45 to 60	60	Shallow Zone
IW-5	2	45 to 60	60	Shallow Zone
IW-6	2	45 to 60	60	Shallow Zone
IW-7	2	45 to 60	60	Shallow Zone
IW-8	2	75 to 90	90	Intermediate Zone
IW-9	2	75 to 90	90	Intermediate Zone
IW-10	2	75 to 90	90	Intermediate Zone
IW-11	2	75 to 90	90	Intermediate Zone
IW-12	2	75 to 90	90	Intermediate Zone
IW-13	2	75 to 90	90	Intermediate Zone
IW-14	2	60 to 75	75	Intermediate Zone
IW-15	2	60 to 75	75	Intermediate Zone
IW-16	2	45 to 60	60	Shallow Zone
IW-17	2	50 to 70	70	Shallow Zone
IW-18	2	70 to 100	100	Intermediate Zone
IW-19	2	50 to 70	70	Shallow Zone
IW-20	2	70 to 100	100	Intermediate Zone
IW-21	2	50 to 70	70	Shallow Zone
IW-22	2	50 to 70	70	Shallow Zone
IW-23	2	70 to 100	100	Intermediate Zone
IW-24	2	56 to 75	75	Shallow Zone
IW-25	2	77 to 97	97	Intermediate Zone
IW-26	2	56 to 75	75	Shallow Zone
IW-27	2	77 to 97	97	Intermediate Zone
MW-1	4	40 to 60	60	Shallow Zone
MW-2	4	40 to 60	60	Shallow Zone
MW-3	4	40 to 60	60	Shallow Zone
MW-4	4	40 to 60	60	Shallow Zone
MW-5	4	40 to 60	60	Shallow Zone
MW-6	4	40 to 60	60	Shallow Zone
MW-7	2	40 to 60	60	Shallow Zone
MW-8	2	40 to 60	60	Shallow Zone
MW-9	2	40 to 60	60	Shallow Zone
MW-10	2	40 to 60	60	Shallow Zone
MW-11	2	40 to 60	60	Shallow Zone
MW-12	2	46.5 to 56.5	56.5	Shallow Zone
MW-13	2	48 to 58	58	Shallow Zone
MW-13D	2	80 to 90	90	Intermediate Zone
MW-14	2	46 to 56	56	Shallow Zone
MW-15	2	48.5 to 58.5	58.5	Shallow Zone
MW-16D	2	79.5 to 89.5	89.5	Intermediate Zone
MW-17	2	50 to 60	60	Shallow Zone
MW-18D	4	133 to 143	143	Deep Zone
MW-19D	4	160 to 170	170	Deep Zone
MW-20D	4	175 to 185	185	Deep Zone
MW-21D	4	50 to 160	160	Abandoned
MW-22D	4	48 to 138	138	Abandoned
MW-23	2	70 to 85	85	Intermediate Zone
MW-24	2	45 to 60	60	Shallow Zone
MW-25D	4	40 to 55	90	Shallow Zone
	4	75 to 90	90	Intermediate Zone
MW-26D	4	35 to 50	85	Shallow Zone
	4	70 to 85	85	Intermediate Zone
MW-27D	4	40 to 55	90	Shallow Zone
	4	75 to 90	90	Intermediate Zone
MW-28D	4	40 to 55	90	Shallow Zone
	4	75 to 90	90	Intermediate Zone
MW-29	2	45 to 60	60	Shallow Zone
MW-30	4	75 to 90	90	Intermediate Zone
MW-31	4	60 to 70	70	Shallow Zone
MW-32	4	45 to 60	60	Shallow Zone
MW-33	4	70 to 85	85	Intermediate Zone
MW-34	4	70 to 80	80	Intermediate Zone
MW-35	4	70 to 80	80	Intermediate Zone
MW-36	2	115 to 135	135	Deep Zone

LEGEND:

- IW-24 — LOCATION AND DESIGNATION OF ANGLE WELL
- MW-17 — LOCATION AND DESIGNATION OF MONITORING WELL
- VZ-3 — LOCATION AND DESIGNATION OF VADOSE ZONE WELL
- VCS-1 — LOCATION AND DESIGNATION OF VCS EXTRACTION POINT
- MP-1 — LOCATION AND DESIGNATION OF VCS MONITORING POINT
- AGM-1 — LOCATION AND DESIGNATION OF GEOPROBE SOIL AND SOIL VAPOR BORING
- FDW — FORMER DIFFUSION WELL
- NE OFFICE SPACE NORTH — LOCATION AND DESIGNATION OF INDOOR AIR QUALITY SAMPLE
- IA-1/SS-1 — LOCATION AND DESIGNATION OF SUB-SLAB SOIL VAPOR AND CO-LOCATED INDOOR AIR QUALITY SAMPLE
- SS-4 — LOCATION AND DESIGNATION OF SUPPLEMENTAL SUB-SLAB SOIL VAPOR SAMPLE
- SE SS-A — LOCATION AND DESIGNATION OF PERMANENT SUB-SLAB SOIL VAPOR PROBE
- STORM DRAIN
- bls — BELOW LAND SURFACE
- NSB-1 — PROPOSED UVOST/HPT LOCATION
- HPT-1 — PROPOSED HPT LOCATION

NOTES:

1. THE LOCATION OF WELL MW-36 IS ESTIMATED.
2. THE LOCATIONS OF ALL INDOOR AIR QUALITY AND SOIL VAPOR SAMPLES ARE ESTIMATED.
3. BASE MAP BY NELSON & POPE, TITLED MONITORING WELL LOCATION PLAN, DATED AUGUST 2003, DRAWING FILE NAME 85049T.



BROAD HOLLOW ROAD (NYS ROUTE 110)

25 MELVILLE PARK ROAD
MELVILLE, NEW YORK

PROPOSED BORING LOCATIONS

ARCADIS

FIGURE 1

CITY:MELVILLE DIV/GROUP:ENV DB:ALS LD: PIC: PM:SF TM:CK LYR:ON=*;OFF=*REF* G:\ENVCAD\SYRACUSE\ACT\NY001332\2012\N0012\NY1332_2012_N0012 F01.dwg LAYOUT: 1 SAVED: 3/19/2013 4:27 PM ACADVER: 18.1S (LMS TECH) PAGESETUP: PDF 11X17 PLOTSTYLETABLE: ARCADIS_MELVILLE.CTB PLOTTED: 3/22/2013 12:52 PM BY: SANCHEZ, ADRIAN
IMAGES: PROJECTNAME: NY001332.0011.00005
XREFS: Xref_Site Xref_sp Loca

ARCADIS

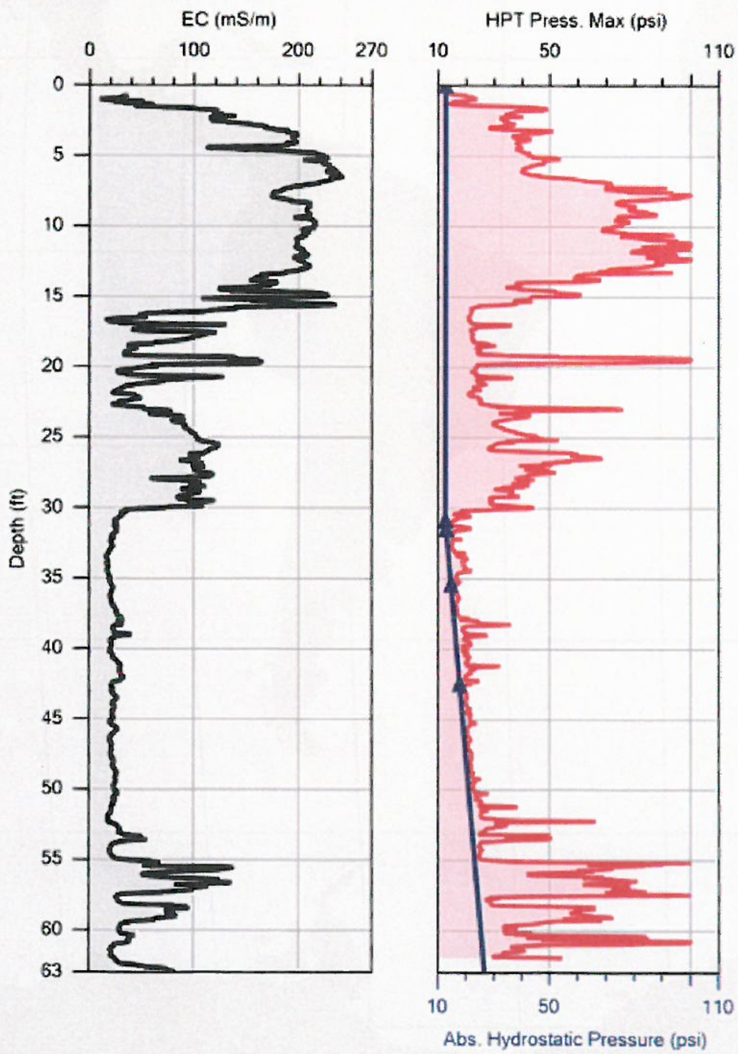
Attachment 1

Geoprobe Systems® Hydraulic Profiling Tool Information

Hydraulic Profiling Tool (HPT)

HPT Introduction:

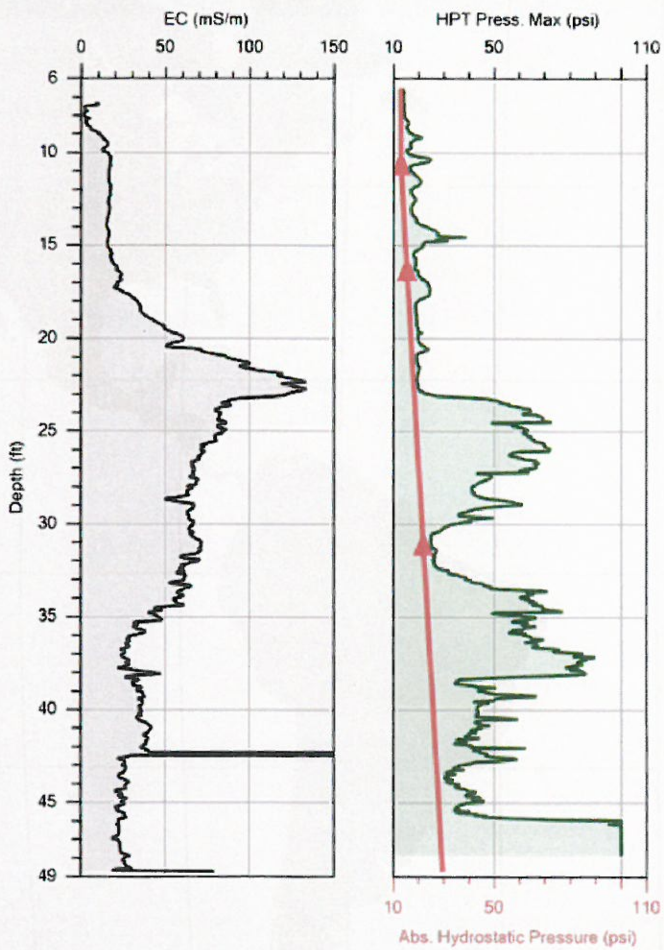
The Hydraulic Profiling Tool is a logging tool that measures the pressure required to inject a flow of water into the soil as the probe is advanced into the subsurface. This injection pressure log is an excellent indicator of formation permeability (Figure 1). In addition to measurement of injection pressure, the HPT can also be used to measure hydrostatic pressure under the zero flow condition. This allows the development of a hydrostatic pressure graph for the log and prediction of the position of the water table.



- HPT produces a detailed hydrostratigraphic log
- Can be used to estimate hydraulic conductivity in the saturated zone
- Logs both HPT injection pressure and electrical conductivity
- Measures hydrostatic pressure and depth to water table
- HPT logging is easy to learn and operate
- Interpretation of HPT logs is straight forward and intuitive

Hydraulic Profiling Tool (HPT)

The HPT is also useful for the detection of brines or other high electrical conductivity fluids in soil. These brines may originate from oilfield production or storage activities. Other high ionic fluids amenable to this technique include road salts and remediation fluids. Detection of these fluids is detected as an anomaly between the EC and HPT log. This occurs when the EC increases, in some cases even above that observed in background logs, while the HPT indicates a zone of high permeability.



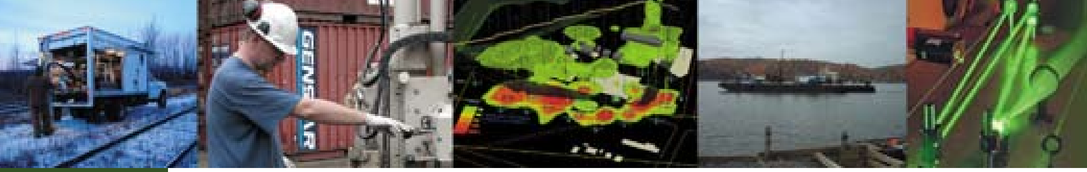
An example of the detection of salt or brine contaminated groundwater using the HPT and EC logs. In this case (Left), the EC increases from baseline to maximum value in the 15 to 23 feet interval. At the same time the HPT pressure remains low, indicating that this is a zone of high permeability. The rise in EC in this case is caused by in increase in salt content in the groundwater, yielding specific conductance values in groundwater samples that are several times above background. The shape of the EC curve in this interval is also characteristic of salt contamination.

The equipment to perform HPT logging is simple. In addition to the Field Instrument (FI6000) for data acquisition, HPT requires the use of the K6300 Controller. This instrument provides the pump and pressure and flow measurement required to perform HPT logging.

HPT probes are available in both 1.75 in. (44.5mm) diameter for use with 1.5 inch (38mm) probe rods and 2.25 in. (57mm) diameter probes for use with 2.25 in. probe rods. Tools string diagrams for these probes may be found at: geoprobe.com/hpt-tool-string-diagrams. HPT probes are robust, driveable under all Geoprobe® 54 series and 60 series hammers, and can be factory rebuilt when they wear out (provided remaining thread life is deemed sufficient).

Attachment 2

Dakota Technologies Ultra-Violet
Optical Screening Tool Information



DAKOTA TECHNOLOGIES

UVOST® Ultra-Violet Optical Screening Tool

At Dakota Technologies, we understand the challenges involved in combining high tech with demanding field conditions.

Our Ultra-Violet Optical Screening Tool (UVOST®) is the culmination of over a decade of field experience as LIF service providers. Its highly sophisticated yet rugged design allows the UVOST to reliably delineate nearly any petroleum NAPL including gasoline, diesel, crude oil, kerosene, and many others. It can be deployed by any type of direct push platform. UVOST is simply the world's finest commercial laser-induced fluorescence (LIF) system and it was built to do one thing – find petroleum NAPL.

UVOST benefits include:

- Real-time data—allows for "on-the-fly" guidance of the next bore-hole location, leading to better bounding of source term
- No IDW—true in-situ information without investigation derived waste, carryover, or handling and storage of samples
- Fast—production rates of 300 to 500 feet per day (typical direct push conditions)
- Flexible—percussion (i.e. Geoprobe®) or cone penetration test (CPT)
- Color-coded logs—the ultimate in qualitative and semi-quantitative information at-a-glance
- High data density—one inch/data point
- Sensitive—low detection limits and baselines that only laser-based systems provide
- Selective—fluorescence time-domain waveforms offer positive identification and interference rejection
- Proven— you'll be offering technology with over 10 years experience built in
- Quality— you'll be trained to operate, maintain, and provide LIF service by the scientists who pioneered commercial LIF

Petroleum hydrocarbons contain significant amounts of naturally fluorescent PAHs. Laser-induced fluorescence systems consistently detect them. The UVOST system was specifically designed to respond to these challenging NAPLs and precisely log their presence versus depth.

Our innovative UVOST mates with direct-push platforms such as Geoprobe and CPT. UVOST is percussion-drivable… a Dakota Technologies, Inc. exclusive!

The UVOST system uses a sapphire window in the side of the direct push probe to measure front-face fluorescence of the petroleum NAPL as the probe is advanced into the soil with nearly any DPT platform.

PAH fluorescence of fuels/oils is directed back to the surface where it is analyzed. Responses are indicated in real-time on a graph of UVOST signal vs. depth.

Randy St. Germain, President
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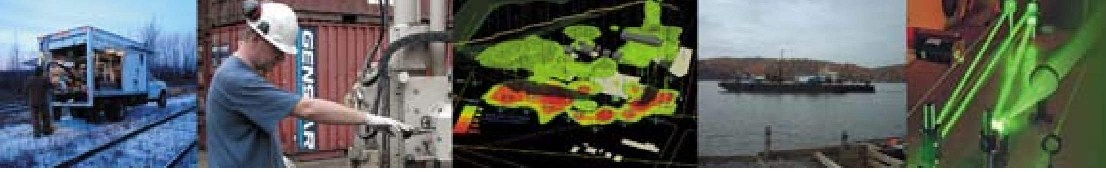


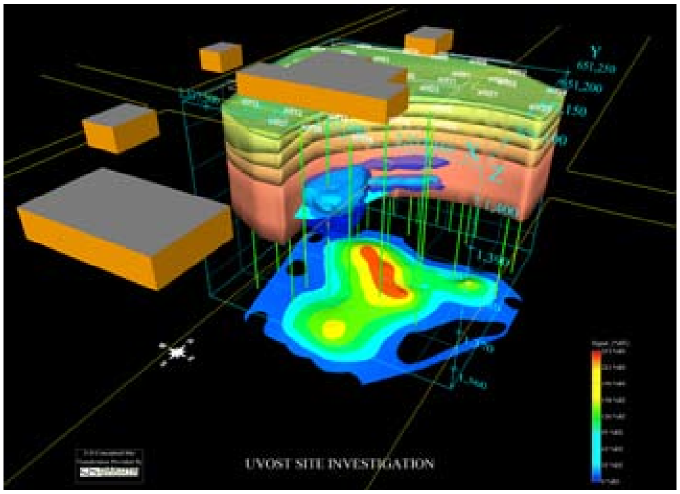
DAKOTA TECHNOLOGIES

UVOST®
Ultra-Violet Optical Screening Tool

Successful remediation and treatment systems require detailed knowledge of NAPL location and distribution. UVOST provides your client with a conceptual site model at unprecedented speed, detail, and efficiency. Sampling simply can't compete with UVOST's production rates.

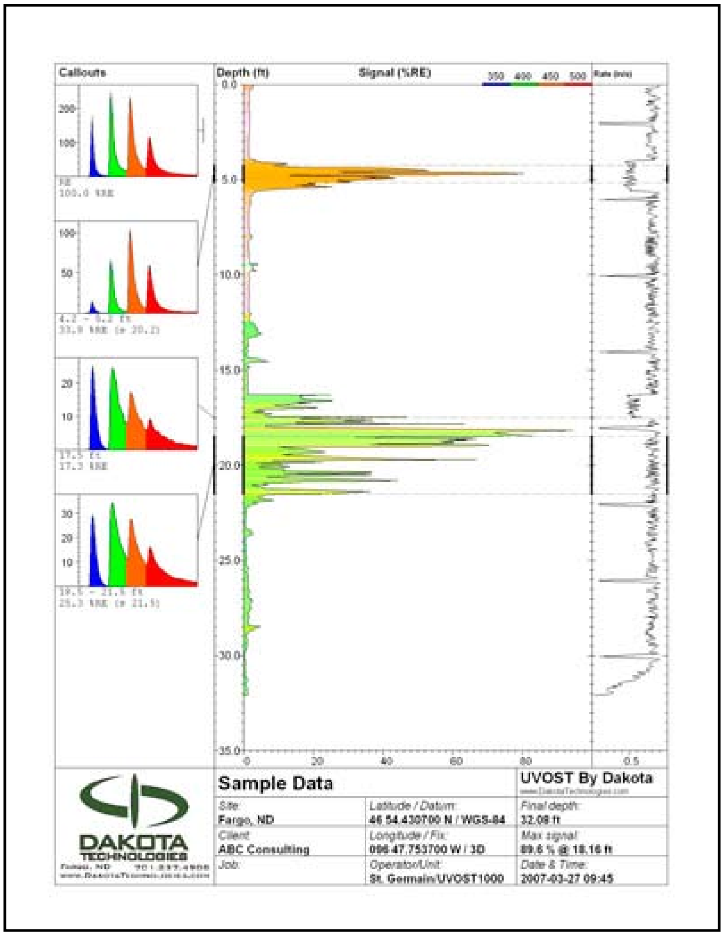
Since the first full-scale site characterization project with UVOST LIF technology in 1997, the UVOST system has been successfully applied and validated across a wide range of site conditions and deployment platforms, including Geoprobe and CPT. Nearly every major consulting firm in the U.S. has used UVOST to generate CSMs of petroleum NAPL.

UVOST Data—Conceptual Site Model (CSM)



The end result of a UVOST boring is a high-density, non-subjective electronic data log (left) readily incorporated into accurate conceptual site models (top). Accurate source term models lead to knowledgeable decisions, accurate treatment and removal designs, and realistic cost estimates—saving time and money.

Example Field UVOST Log



Each UVOST system includes a 1 year warranty and comes "ready to log". Dakota supplies you with all the tools, spares, and consumables necessary to start booking jobs as soon as you become certified (training takes 2-3 days).

Once certified, you and your UVOST crew will confidently generate detailed colorized logs like the one at left – clearly painting a picture of your client's NAPL in the subsurface. The unique ability to offer LIF will set you and your company apart from your competitors. Once a client tries UVOST they are typically "hooked" – leading to more work at the same site or other NAPL sites they manage.

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