MACTEC

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November 8, 2019

Division of Environmental Remediation
Remedial Bureau C, 11th Floor
New York State Department of
Environmental Conservation
625 Broadway
Albany, New York 12233-7016

Attention: Mr. Justin Starr, Project Manager

Subject: **Phase II Site Characterization Field Activities Plan (Site 360175)**
Work Assignment # D007619-47
MACTEC Engineering and Consulting, P.C., Project # 3611181228

Dear Mr. Starr:

This field activities plan (FAP) has been prepared by MACTEC Engineering and Consulting, P.C. (MACTEC) in response for Work Assignment No. D007619-47 from the New York State Department of Environmental Conservation (NYSDEC) for the Irvington Rugs and Cleaners site (Site) in Greenburgh, New York (Figure 1). On behalf of the NYSDEC under the state superfund program, and in accordance with the April 2011 Superfund Standby Contract No. D007619 between the NYSDEC and MACTEC, MACTEC will conduct a Phase II Site Characterization (SC) to evaluate the following:

- Potential sources of tetrachloroethene (PCE) in indoor air.
- Extent of volatile organic compounds (VOC) groundwater contamination as well as potential soil contamination.
- VOC concentrations in upgradient groundwater.
- Viability of monitored natural attenuation.
- Indoor air at additional apartments, if requested.

MACTEC Engineering and Consulting, P.C.
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SITE HISTORY

It is not known when the Site was first developed, but the Village of Irvington historic downtown street layout was designed in the 1850s (Irvington Historical Society, 2018). Various buildings were present on the property in the early 1900's, and the southern portion of the current Site building may have been constructed as early as 1905 (Ecosystems Strategies, Inc.[ESI], 2005). It is not known when the Site was first used for dry cleaning services. However, the previous owner of the property, and founder of the Irvington Rugs and Cleaners business, purchased the property in 1965 (according to the Town of Greensburgh property card) and it is assumed dry cleaning services began around this time. The current owner purchased the property in 2006. The current owner stated that a dry-cleaning machine that used PCE was present when they purchased the property, but they replaced it with a second-generation hydrocarbon machine that used "Easy Clean" as a solvent. The property continues to operate as a dry-cleaning facility. The site location is shown on Figure 1.

INVESTIGATION SCOPE OF WORK

The Phase II SC includes the activities described below. Proposed soil vapor, groundwater, and soil sampling locations are presented on Figure 2 and Figure 3. Rationale for proposed soil vapor, groundwater, and soil samples are provided in Table 1. Sample identifications and analyses are provided in Table 2. Companion documents to this SC that will govern the execution of the field exploration activities include MACTEC's Site Characterization Field Activities Plan, Irvington Rugs & Cleaners (MACTEC, 2018) and Program Quality Assurance Project Plan (MACTEC, 2011).

Much of the Phase II investigation is focused on evaluating potential PCE indoor air sources and vapor intrusion pathways. This will be completed using a HAPSITE® portable gas chromatograph/mass spectrometer real-time VOC analyzer. The HAPSITE® will run a selective ion monitoring method which will be pre-programmed to detect the contaminant(s) of concern for this investigation. The HAPSITE® will be primarily based in a fixed location, and samples will be collected in tedlar bags and brought to the instrument for analysis. If it is necessary to reuse the tedlar bags, they will be cleaned by filling and emptying three times with ultra high purity nitrogen.

If access to the building is available, the instrument can be used in a portable configuration and be used to collect and analyze grab samples in place without the use of tedlar bags. The decision on which sampling procedure to use will be made in the field based on access to the building. All sampling and analysis will be in accordance with the HAPSITE® standard operating procedure provided in Attachment 1.

For sub-slab soil vapor sampling points, sample will be collected within two-inches of the bottom of the concrete slab. A multi-gas meter will be used to evaluate soil vapor and indoor air concentrations of oxygen and carbon dioxide to ensure that there is a good seal and that the sub-slab samples are representative of soil vapor (carbon dioxide concentrations in soil vapor are typically an order of magnitude greater than concentrations in the indoor air).

Implementation of the Phase II Field Investigation includes:

1) Evaluation of potential sources of PCE in indoor air at both 49 and 53 Main Street with the use of the HAPSITE®. The HAPSITE® will be used first to screen indoor air, and floor and wall cracks in 49 and 53 Main Street (in portable mode, if possible) to try and identify potential areas of higher concentration. Upon completion of the initial screening, the HAPSITE® will be used to conduct the following tasks:
    a. Evaluate mass flux through/from the concrete and wood floors in 53 Main Street by sealing sections of the floor with plastic sheeting attached with Gorilla tape and analyzing the air that is isolated between the plastic and floor.
    b. Evaluate mass flux through the stone basement foundation wall in 49 Main Street by sealing sections of the wall with plastic sheeting attached with Gorilla tape and analyzing the air that is isolated between the plastic and wall.
    c. Analyze indoor air samples collected from various locations across 49 and 53 Main Street (specific locations to be determined based on initial screening results).
    d. Analyze air samples collected in the vicinity of ceiling/wall vents.
    e. Analyze samples collected from up to eight sub-slab soil vapor points (four locations at each property, indicated as "SV" – see Figure 3).
    f. Analyze additional samples collected as needed to identify potential sources of PCE to the indoor air.

    In addition, two duplicate sub-slab soil vapor samples will be collected in 1-liter Summa type canisters for off-site analysis by USEPA Method TO-15 to compare to the on-site results. These samples will be collected as "grab samples" and will be set up to collect samples over an approximate 10-minute period. One duplicate indoor air sample will also be collected and submitted for off-site analysis by Method TO-15.

2) Evaluate extent of VOC groundwater contamination below 49 and 53 Main Street, as well as potential soil contamination below 53 Main Street.
    a. Collect four groundwater grab samples from below the concrete slab at 49 Main Street to evaluate the anticipated center and downgradient edge of the groundwater plume.
    b. Collect one water grab sample from the standing water in the basement of 49 Main Street to evaluate if this is potentially contaminated with PCE.
    c. Collect four groundwater grab samples from below the concrete slab at 53 Main Street to evaluate the upgradient edge of the groundwater contamination and potential source areas.
    d. Collect additional sump water samples from both 49 and 53 Main Street to evaluate current groundwater concentrations in these areas.
    e. Collect two soil samples from below the basement slab at 53 Main Street to evaluate for potential source areas.
3) Evaluate for VOCs in upgradient groundwater.
    a. Collect two groundwater grab samples from below the concrete slab at the upgradient building 63 Main Street to evaluate if there is any potential groundwater contamination originating from upgradient sources, such as Tappan Cleaners.
4) Evaluate if groundwater conditions at the site are conductive to natural attenuation.
    a. Collect groundwater samples from existing monitoring wells DP-02, DP-04, and DP-05 using low flow purge method. Samples will be analyzed for VOCs and monitored natural attenuation parameters. Monitoring wells DP-04 and DP-05 will also be analyzed for dechlorinating microbes to determine if they are present.
    b. Collect additional groundwater volume from one proposed sub-slab samples at 53 Main Street (Location GW-001-12) for analysis of dechlorinating microbes to determine if they are present.
5) Evaluate indoor air at additional apartments, if requested.
    a. Collect up to four indoor air samples from the second and third floor apartments at 49 Main Street to evaluate current indoor air concentrations on the upper floors of the building.

Subcontractors selected to support the Phase II SC are below.

- Pace Laboratory (standby laboratory) from Melville, New York will perform soil and groundwater analysis based on proximity to the site and laboratory analytical suite of parameters.
- Centek Laboratory (standby laboratory and women-owned business) from Syracuse, New York will provide air sample analysis based on rotation.
- Microbac will perform microbial analysis of groundwater samples.

HEALTH AND SAFETY

MACTEC anticipates that field work will be conducted in Level D personal protection. The project specific health and safety plan is included in the 2018 FAP (MACTEC, 2018).

ACCESS AND CLEARANCE

Locations of proposed investigation activities are on the Site property as well as at 49 and 63 Main Street. MACTEC will coordinate access with the NYSDEC and the property owners prior to mobilization.

DOCUMENTATION

Investigation field work, including documentation, will be conducted as described in the Site Characterization FAP (MACTEC, 2018). HAPSITE® documentation will include field log book entries containing analytical results and calibration records.

REPORTING

Results from this investigation will be incorporated into the Draft Site Characterization Data Summary Report dated May 2019, which will be completed as described in the 2018 FAP (MACTEC, 2018). This includes tables and figures presenting sampling locations and analytical results. In addition, a Data Usability Summary Report will be completed for off-site VOC data.

If you have questions or concerns, please contact Charles Staples at 207-775-5401.

Sincerely,

MACTEC Engineering and Consulting, P.C.

Charles R. Staples, P.G.
Project Manager

Jean Firth, P.G.
Technical Reviewer

Enclosures:

Figure 1	Site Location
Figure 2	Proposed Upgradient Groundwater Sample Locations
Figure 3	Proposed Basement Sample Locations
Table 1	Rationale for Proposed Sampling Activities
Table 2	Proposed Sample Identification and Analyses
Attachment 1	Standard Operating Procedure for Hapsite GC/MS Field Instrument Operation and Onsite Sample Analysis of VOC Grab Samples

REFERENCES

Ecosystems Strategies, Inc. (ESI), 2005. Combined Phase I and Phase II Environmental Site Assessment (ESI File: GI05204.20). December 2, 2005.

Irvington Historical Society, 2018. Historical Society website: http://www.irvingtonhistoricalsociety.org/history.htm . Visited November 11, 2018.

MACTEC, 2018. Field Activities Plan, Irvington Rugs and Cleaners. Prepared for the New York State Department of Environmental Conservation, Albany, New York. 2018.

MACTEC, 2011. Program Quality Assurance Program Plan. Prepared for the New York State Department of Environmental Conservation, Albany, New York. 2011.

LIST OF ACRONYMS AND ABBREVIATIONS

ESI	Ecosystems Strategies, Inc.
FAP	Field Activities Plan
MACTEC	MACTEC Environmental Conservation & Consulting, P.C.
NYSDEC	New York State Department of Environmental Conservation
PCE	Tetrachloroethene
Site	Irvington Rugs & Cleaners
SC	Site Characterization
VOCs	volatile organic compounds

FIGURES

N

0 500 1,000 Feet

Map Copyright:© 2013 National Geographic Society, i-cubed

Prepared/Date: BRP 11/09/18
Checked/Date: ANC 10/12/19

NYSDEC Site # 360175
Irvington Rugs and Cleaners
Irvington, New York

MACTEC

Site Location

Project 3611181228 Figure 1

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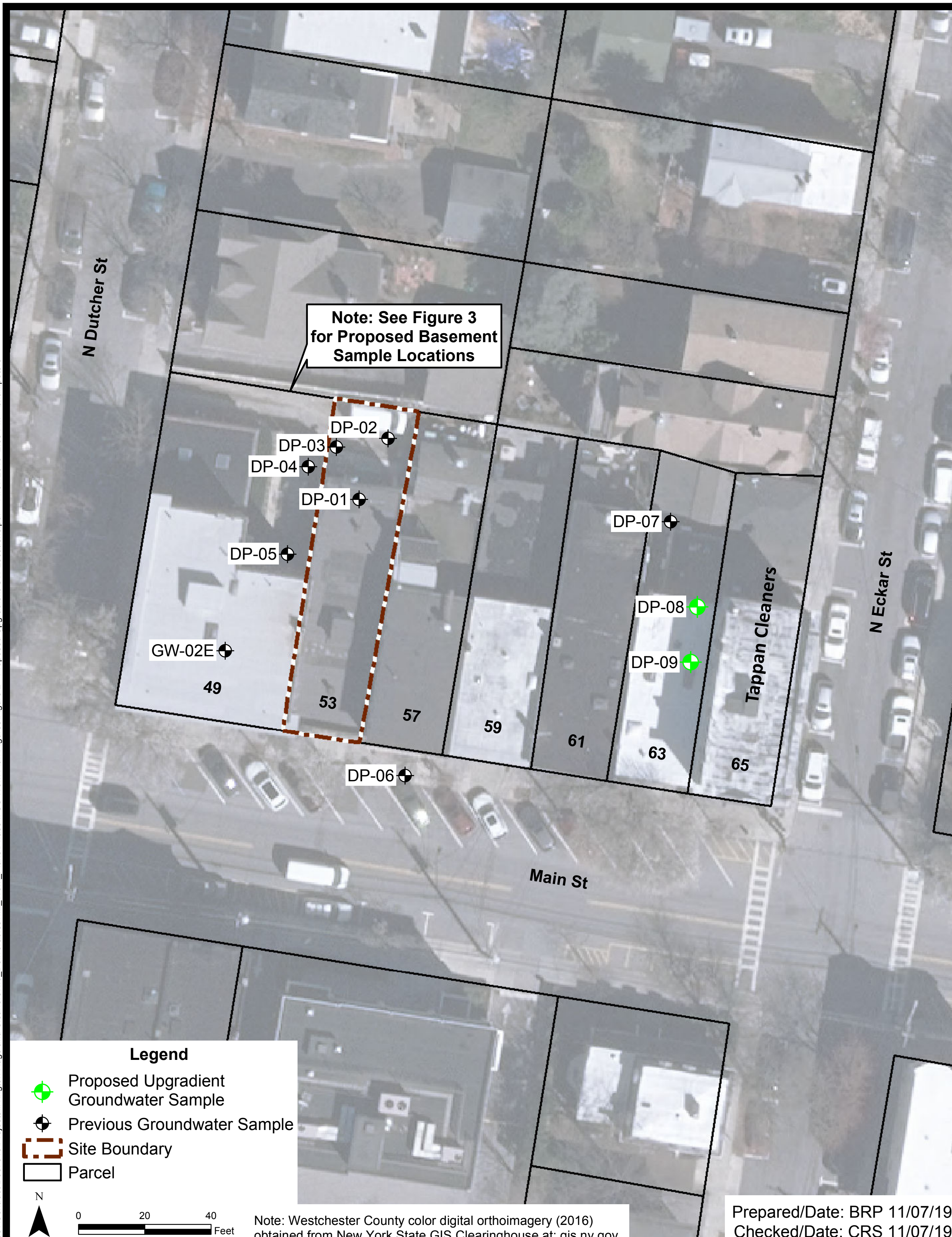
PDF: P:\Projects\nysdec1\Contract D007619\Projects\Irvington Rugs and Cleaners\4.0_Deliverables\4.2_Work_Plans\SC Work Plan\Figure 1.1 - Site Location.pdf 11/09/2018 1:13 PM brian.peters



NYSDEC Site # 360175
Irvington Rugs and Cleaners
Irvington, New York

MACTEC

Proposed Upgradient
Groundwater Sample Locations
Project 3611181228 Figure 2

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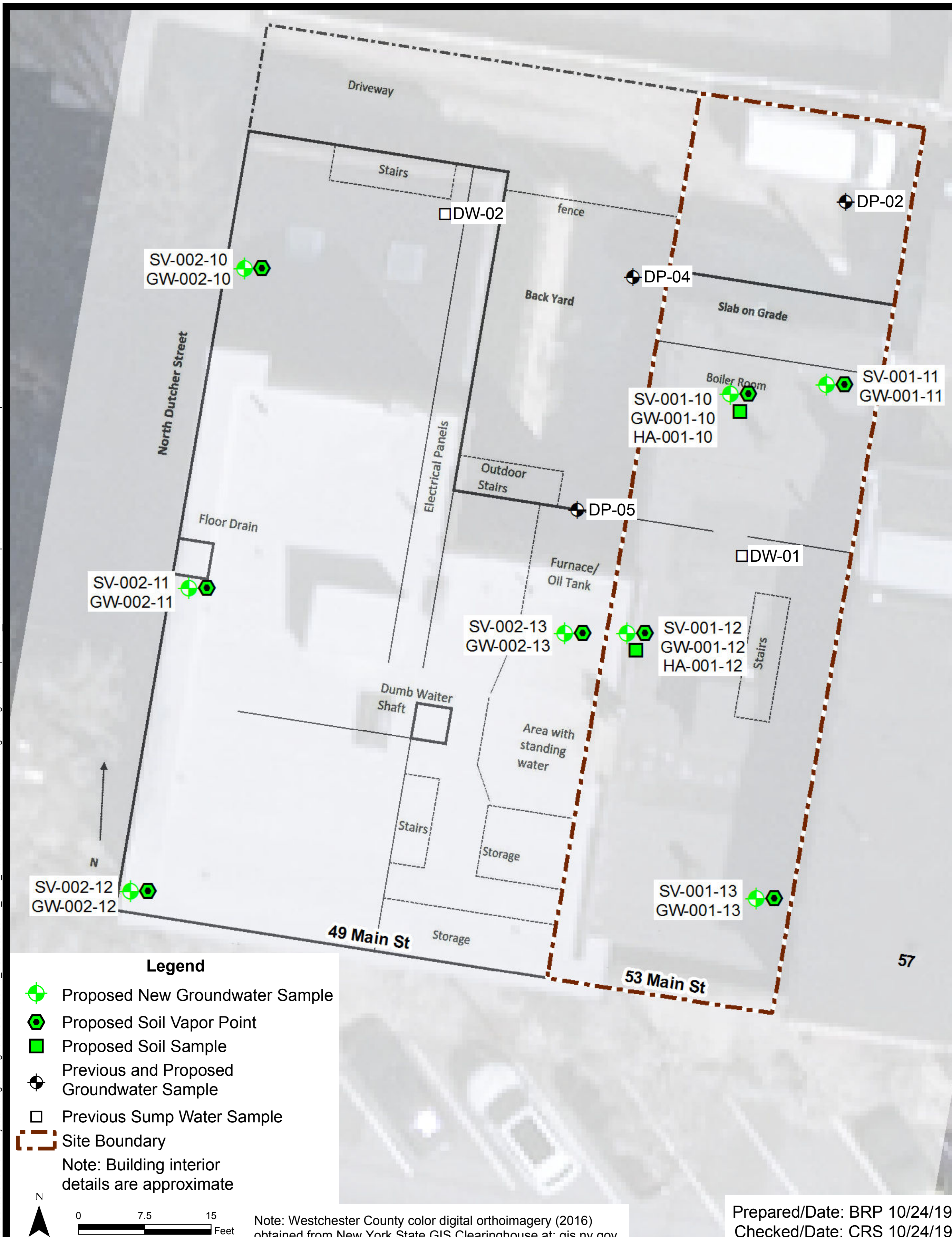
PDF: P:\Projects\nysdec1\Contract D007619\Projects\Irvington Rugs and Cleaners\4.0_Deliverables\4.2_Work_Plans\Phase II SC Work Plan\Figures\Figure 2 - Proposed Upgradient GW Locations.pdf 11/07/2019 2:35 PM brian.peters



NYSDEC Site # 360175 Irvington Rugs and Cleaners Irvington, New York	MACTEC	Proposed Basement Sample Locations Project 3611181228 Figure 3

TABLES

Table 1: Proposed Field Tasks and Methodology

LOCATION TYPE	DESCRIPTION AND METHODOLOGY	RATIONALE	ANALYTICAL
Water Sampling	Collect up to 16 groundwater samples from: two basement sumps, one basement area of standing water, ten basement sub-slab locations at 49, 53, & 63 Main Street, and three existing on site exterior permanent microwells (DP-02, DP-04, & DP-05).	Evaluate: extent of VOC groundwater contamination below 49 and 53 Main Street; if standing water in 49 Main Street is contaminated; if VOCs are pesent in upgradient groundwater at 63 Main Street; and viability of monitored natural attenuation.	16 water samples plus 1 QA/QC (1 FD, 1 MS, 1 MSD) will be analyzed for TAL VOCs. Three groundwater samples will be analyzed for MNA parameters, and three groundwater samples for dechlorinating microbes.
Soil Sampling	Collect two soil samples from below the basement slab at 53 Main Street.	Soil samples will be collected to evaluate potential contaminant source areas.	Two soil samples plus 1 QA/QC (1 FD, 1 MS, 1 MSD) for TAL VOCs.
Indoor Air and Sub-Slab Soil Vapor Intrusion Sampling	Conduct soil vapor intrusion sampling at two residential and/or commercial buildings (both sub-slab and indoor air samples).	Evaluate potential source areas of VOC contaminationa and potential soil vapor and indoor air migration pathways.	Eight soil vapor and at least 20 indoor air samples for PCE and breakdown products using a HAPSITE (including FD as needed), plus two duplicate samples for TO-15 VOC analysis by an off-site laboratory.

Notes:
bgs = below ground surface
VOC = volatile organic compounds
PCE = Tetracholoroethene
TAL = target analyte list
QA/QC = quality assurance / quality control
FD =field duplicate, MS/MSD = matrix spike and matrix spike duplicate

Prepared by: ANC 10/18/19
Checked by: CRS 11/07/19

Table 2: Proposed Sampling and Analytical Program

Site Type	Media	Property	Location ID	Sampling Interval (feet BGS)	Sample ID	VOCs 8260B	MNA Parameters	Dechloronating Mocrobes	VOCs HAPSITE
UPGRADIENT AND EXTERIOR GROUNDWATER SAMPLING									
Monitoring Well	Groundwater	53 Main	DP-002	8	360175-GW102008	1	1*		
Monitoring Well	Groundwater	53 Main	DP-004	10	360175-GW104010	1	1	1	
Monitoring Well	Groundwater	53 Main	DP-005	10	360175-GW105010	1	1	1	
Monitoring Well	Groundwater	53 Main	DP-005	10	360175-GW105010D	1			
Monitoring Well	Groundwater	53 Main	DP-005	10	360175-GW105010MS	1			
Monitoring Well	Groundwater	53 Main	DP-005	10	360175-GW105010MD	1			
Push Point	Groundwater	63 Main	DP-008	TBD	360175-GW108___	1			
Push Point	Groundwater	63 Main	DP-009	TBD	360175-GW109___	1			
INTERIOR SAMPLING									
Soil Sampling									
Hand Auger	Soil	53 Main	HA-001-10	TBD	360175-HA001-10___	1			
Hand Auger	Soil	53 Main	HA-001-10	TBD	360175-HA001___D	1			
Hand Auger	Soil	53 Main	HA-001-10	TBD	360175-HA001___MS	1			
Hand Auger	Soil	53 Main	HA-001-10	TBD	360175-HA001___MD	1			
Hand Auger	Soil	53 Main	HA-001-12	TBD	360175-HA001-12___	1			
Building Sump Water Sampling									
Sump	Water	53 Main	DW-001	2	360175-DW001	1			
Sump	Water	49 Main	DW-002	2	360175-DW002	1			
Water Sampling									
Push Point	Groundwater	53 Main	GW-001-10	TBD	360175-GW001-10___	1			
Push Point	Groundwater	53 Main	GW-001-11	TBD	360175-GW001-11___	1			
Push Point	Groundwater	53 Main	GW-001-12	TBD	360175-GW001-12___	1		1	
Push Point	Groundwater	53 Main	GW-001-13	TBD	360175-GW001-13___	1			
Push Point	Groundwater	49 Main	GW-002-10	TBD	360175-GW002-10___	1			
Push Point	Groundwater	49 Main	GW-002-11	TBD	360175-GW002-11___	1			
Push Point	Groundwater	49 Main	GW-002-12	TBD	360175-GW002-12___	1			
Push Point	Groundwater	49 Main	GW-002-13	TBD	360175-GW002-13___	1			
Standing Water	Water	49 Main	SW-002-01	0	360175-SW002-01	1			
Indoor Air and Sub-Slab Soil Vapor Intrusion Sampling									
Soil Vapor	Soil Vapor	53 Main	SV-001-10	1**	360175-SV001-10				1
Soil Vapor	Soil Vapor	53 Main	SV-001-10	1**	360175-SV001-10D				1
Soil Vapor	Soil Vapor	53 Main	SV-001-11	1**	360175-SV001-11				1

Prepared By: ANC 10/17/2019
Checked by: CRS 11/07/2019

Table 2: Proposed Sampling and Analytical Program

Site Type	Media	Property	Location ID	Sampling Interval (feet BGS)	Sample ID	VOCs 8260B	MNA Parameters	Dechloronating Mocrobes	VOCs HAPSITE
Soil Vapor	Soil Vapor	53 Main	SV-001-12	1**	360175-SV001-12				1
Soil Vapor	Soil Vapor	53 Main	SV-001-13	1**	360175-SV001-13				1^X
Soil Vapor	Soil Vapor	49 Main	SV-002-10	1**	360175-SV002-10				1
Soil Vapor	Soil Vapor	49 Main	SV-002-11	1**	360175-SV002-11				1
Soil Vapor	Soil Vapor	49 Main	SV-002-12	1**	360175-SV002-12				1
Soil Vapor	Soil Vapor	49 Main	SV-002-13	1**	360175-SV002-13				1^X
Indoor Air	Air	53 Main	IA-001-10	-5	360175-IA001-10				1
Indoor Air	Air	53 Main	IA-001-11	-5	360175-IA001-11				1
Indoor Air	Air	53 Main	IA-001-12	-5	360175-IA001-12				1
Indoor Air	Air	53 Main	IA-001-13	-5	360175-IA001-13				1
Indoor Air	Air	53 Main	IA-001-14	-5	360175-IA001-14				1
Indoor Air	Air	53 Main	IA-001-15	-5	360175-IA001-15				1
Indoor Air	Air	49 Main	IA-002-10	-5	360175-IA002-10				1
Indoor Air	Air	49 Main	IA-002-11	-5	360175-IA002-11				1
Indoor Air	Air	49 Main	IA-002-12	-5	360175-IA002-12				1
Indoor Air	Air	49 Main	IA-002-13	-5	360175-IA002-13				1
Indoor Air	Air	49 Main	IA-002-14	-5	360175-IA002-14				1
Indoor Air	Air	49 Main	IA-002-15	-5	360175-IA002-15				1
Indoor Air	Additional indoor air samples will be collected as needed; numbering will continue as above based on building ID.								
TOTAL SAMPLES						31	3	3	19

NOTES:

For the interior location IDs, the first three digits indicate the building number: 001 = 53 Main Street; 002 = 49 Main Street
BGS = below ground surface; "-" indicates above ground sample; TBD = To Be Determined in field (based on high PID reading for soils)
Sample ID: 360175 = NYSDEC Site No.; followed by location ID and sample depth (three digits); __ represents the 3 digit sample depth to be determined in field;
Field Quality Control samples (duplicates, matrix spike, matrix spiked duplicates) will be collected at a frequency of 5% (1:20 samples) and are indicated by a letter at the end of the sample ID (D, MS, MD)
HAPSITE = on-site VOC analysis with portable GC/MS
MNA Parameters = Monitoring Natural Attenuation Parameters = TOC by USEPA Method 415.1, Nitrate by NYSDEC ASP Method 300, Nitrite by NYSDEC ASP Method 354.1, Sulfate by NYSDEC ASP Method 300, Sulfide by NYSDEC ASP Method 4500, Methane/Ethane/Ethene by RSK-175, Carbon dioxide by RSK-175, Alkalinity by USEPA Method 2320, chloride by USEPA Method 300, and iron and manganese will be analyzed by USEPA Method 6010B.
In addition, oxygen and reduction/oxidation potential will be measured during well stabilization.
1* = MNA Parameters for background well are Chloride (USEPA Method 300), and Alkalinity (USEPA Method2320)
1** = soil vapor samples will be collected within two-inches of the bottom of the basement concrete slab
1^X = duplicate sample will be collected for off-site analysis by USEPA Method TO-15 (one indoor air duplicate will be determined in field).

Prepared By: ANC 10/17/2019
Checked by: CRS 11/07/2019

ATTACHMENT 1

STANDARD OPERATING PROCEDURE FOR HAPSITE GC/MS FIELD INSTRUMENT OPERATION AND ONSITE SAMPLE ANALYSIS OF VOC GRAB SAMPLES

STANDARD OPERATING PROCEDURE FOR HAPSITE GC/MS FIELD INSTRUMENT OPERATION AND ON-SITE SAMPLE ANALYSIS OF VOC GRAB SAMPLES

Wood Environment & Infrastructure Solutions, Inc.
Portland, Maine

Wolfgang Calicchio
Senior Environmental Scientist

Chris Ricardi, NRC-EAC
Principal

Contents

ACRONYMS AND ABBREVIATIONS

Cc	Calculated amount of standard, in mass or concentration units
CCAL	Continuing calibration standard
Ce	Expected amount of standard, in mass or concentration units
cm	centimeter
CTRL	control button on laptop keyboard
GC/MS	gas chromatograph with mass spectrometry
EMR	electromagnetic radiation
ESC	escape button on Hapsite front panel
FCC	Federal Communications Commission
Hapsite	Hazardous Air Pollutants on Site portable GC/MS
ICAL	Initial calibration standard
ID	Identification
IED	improvised explosive device
IS	internal standard
mL	milliliter
PCE	Tetrachloroethene
ppmv	part per million volume
ppbv	parts per billion volume
QC	quality control
RF	radio frequency
RI/FS/PS	Remedial Investigation/Feasibility Study/Pilot Study
RSD	relative standard deviation
SEL	select button on Hapsite front panel
SIM	selected ion monitoring
SOP	Standard Operating Procedure
TCE	Trichloroethene
UHP N2	ultra-high purity nitrogen
UXO	unexploded ordnance
VOCs	volatile organic compounds

1.0 SCOPE AND APPLICABILITY

This Standard Operating Procedure (SOP) is a set of written instructions that document routine procedures for the operation of an Inficon Hapsite Smart (Hapsite) portable gas chromatograph with mass spectrometry detector (GC/MS) followed by Wood Environment & Infrastructure Solutions, Inc. (Wood) personnel. The procedures are applicable to the collection and analysis of ambient air samples for volatile organic compounds (VOCs) and the testing of soil gas collected in Tedlar bags. The purpose of this SOP is to describe the procedures involved in the operation of a Hapsite, including daily start up and shut down routines, preparation of initial and continuing calibration standards, and collection and analyses of samples. The development and use of this SOP minimizes operational variation and promotes quality through consistent implementation of a process with instrument calibration checks, quality control (QC) sample analyses, and sample analyses.

2.0 SUMMARY OF METHOD

The Hapsite instrument is a portable GC/MS capable of separating VOC compounds in air samples and identifying and quantifying targeted compounds. The instrument is calibrated with gas standards of known concentration. Samples of unknown air are introduced to the GC/MS using an air inlet device that draws in a known volume of air which is passed through a trap. The trap is then heated and compounds are desorbed into the GC column for separation. Target compounds are identified based on retention times and characteristic ions from mass spectra. Concentrations of target compounds are reported based on comparisons to standard response.

3.0 HEALTH AND SAFETY WARNINGS

Sample analysis warning: Compounds sampled will vent into the room through the exhaust. When sampling hazardous materials either attach tubing and vent into a hood or attach an activated charcoal filter.

Carrier and Internal Standard gas canister warning: Do not re-fill the canisters after use. These canisters are disposable and not designed for refilling. Canisters may fail upon refilling and cause bodily injury.

Probe Nut Assembly Warning: Ferrule orientation is critical to avoid leaks. A leak could be harmful to people if sampling a bag of toxic material.

Wireless operation danger: The Hapsite contains a wireless transmitter/receiver that emits electromagnetic radiation (EMR). This radiation in a tactical or operational environment may potentially be used to locate the Hapsite and its operators. This radiation also has the potential to detonate some types of unexploded ordnance (UXO), or improvised explosive devices (IEDs), or both, if the Hapsite is transmitting in the safety exclusion area around the device(s). There is a hardware switch to turn off the wireless radio so that the Hapsite may still be used in areas where these hazards are a concern. Consult applicable regulations and policies when using the Hapsite with the wireless device active in such environments.

FCC RF exposure statement: To satisfy RF exposure requirements, this device and its antenna must operate with a separation distance of at least 20 cm from all persons and must not be co-located or operating in conjunction with any other antenna or transmitter.

Gas cylinder safety warning: Safety of operations should always take precedence in the working environment. Gas cylinders should be properly affixed to lab benches with clamps, or chained to the wall for safety. A safety certified gas cylinder cart should be available in the vicinity of where the cylinders are normally used, for moving them and replacing empty cylinders. Gas cylinders should never be transported with the regulator attached!

The Hapsite is not intrinsically safe and should not be used in explosive atmospheres or anywhere that monitoring indicates that either the lower explosive limit (LEL) or upper LEL is exceeded.

4.0 PERSONNEL QUALIFICATIONS

Wood operators will be trained on the basic operation of the instrument prior to use. This training includes review of operation manuals and instruction literature provided by the manufacturer and review of operations by experienced field personal at Wood.

Instrument manuals include *Hapsite Smart Chemical Identification System Operation Manual* and the quick start guide *Hapsite Smart Chemical Identification System Basic Smart Starts referenced* in Section 9.

5.0 EQUIPMENT AND SUPPLIES

- Inficon Hapsite Smart/SmartPlus/ER GC/MS
- Hapsite Hand Control Unit (Probe)
- Hapsite Carrier Gas Cylinders
- Hapsite Internal Standard Cylinders
- Hapsite carrier gas quick disconnect and 1/8 inch Teflon tubing
- Laptop with Wi-Fi or Ethernet cable, Hapsite IQ software installed
- One liter tedlar or TO-15 bags, quantity 20 for calibration standards
- One liter gas tight syringe with Luer Lock
- One hundred milliliter gas tight syringe with Luer Lock, quantity 2
- Five hundred microliter gas tight syringe with side hole needle, quantity 2
- Five milliliter gas tight syringe with side hole needle, quantity 2
- One milliliter microliter gas tight syringe with side hole needle, quantity 2
- Compressed cylinder of ultra-high purity nitrogen (UHP N_2) with stainless steel dual stage regulator

- Certified calibration gas with target analytes of concern, ex. Scotty 14L with TCE at 10.7 part per million (ppmv)
- Vac-U-Chamber
- Portable, battery operated vacuum pump
- One liter tedlar or TO-15 bags, quantity dependent upon samples collected

6.0 HAPSITE OPERATION PROCEDURES

Detailed operation procedures for instrument start up, standard preparation, instrument calibration, sample analysis, and instrument standby are provided in the following subsections.

6.1 Start Up

Unpack the Inficon Hapsite from the shipping container. Plug in the external power transformer to an electrical outlet, and then insert the external power cord into the top receptacle located on the left side of the Hapsite. There is a red line marked on the external power connector. This red line should be in the "up" position when plugging in to the Hapsite.

Standing behind the Hapsite, place your thumbs under the upper corners of the instrument and push open the top. Insert a Hapsite battery into the appropriate slot. There is a black arrow on the top of the battery. This arrow must be pointing towards the cylinder wells for proper orientation of the battery during insertion.

Unpack and locate a full carrier gas cylinder (purple striped can) and an internal standard (IS) cylinder (yellow striped can). Place the carrier gas cylinder into the marked slot. Depress the black paddle next to the slot, push the cylinder in and release the paddle. Check to ensure the cylinder is appropriately seated. Observe the carrier gas gauge; the needle should be well into the green zone. Repeat this process with the IS cylinder. The IS cylinder head is fitted with a Teflon ring to prevent accidental loading into the carrier gas slot.

Connect the probe to the Hapsite. Connect the Ethernet cable to the Hapsite. Depress and release the momentary switch located on the underside of the Hapsite lid above the battery. Close the lid. The Hapsite will initiate a startup program within one minute.

Start up the laptop. Open the Hapsite IQ software. If the laptop does not immediately connect to the Hapsite after initializing, select your instruments icon and right click on it. Select the "connect instrument" command. Select the Hapsite Front Panel radio button (turquoise blue).

Upon completion of the initiation program, the Hapsite software will automatically initiate a short autotune run. When the short autotune is completed the results will be displayed. If all results are “OK”, accept the short autotune. If the short autotune does not pass refer to the Autotune Section 6.2.

If the instrument is in “Extended Standby”, press the “ESC” button until you get the select method option. Refer to Section 6.3, Running Methods.

6.2 Autotune

The Hapsite software performs an autotune when the instrument is first started from either a cold start or exiting out of extended standby. A short autotune is also performed every eight hours of operation. The statistics are displayed on the control panel and the tune file is saved when the “OK” radio button is selected.

A short autotune is acceptable when all ions are listed as “OK”. Any ions that are either “OK Low” or “OK High” should be recorded in the field logbook. If the short autotune does not meet criteria, the software will display a message that recommends the long autotune.

If a long autotune is required, select the “tune” button (tuning fork symbol) from the tool bar. The short tune and long tune radio buttons on the tool bar will become active.

Select the long autotune. The instrument should tune “OK” with the long autotune, if not, the instrument must be sent back to the rental agency for replacement.

6.3 Running Methods

The Hapsite can be run from the laptop screen, the control panel on the Hapsite, or from the hand control probe unit. Using the ESC, SEL, arrow up, arrow down buttons, or numerical key buttons, go to the menu where “Run Method” is displayed.

Scroll to “Run Method” and hit the “SEL” key.

Scroll to the method sub directory and hit the “SEL” key.

Scroll to the method and hit the “SEL” key.

For the first time a method is selected, the software will display a “START” button that needs to be selected before the Hapsite will initiate a run. Each subsequent run will start immediately upon hitting the “RUN” button located in the upper left corner of the control panel display.

After exiting from extended standby or running the instrument for the first time of the day, the Hapsite will perform a short autotune. When the short autotune is completed the results will be displayed. If all results are “OK”, accept the short autotune. If the short autotune does not pass refer to the Autotune Section 6.2. Refer to Sample Analysis, Section 6.5 for performing sample analyses. Refer to Initial Calibration, Section 6.4 for performing an initial calibration.

6.4 Initial Calibration

Prior to analysis of samples a multipoint initial calibration method will be set up on the instrument. This will require the preparation of multiple standards as described in Section 6.4.1 and the analysis of standards as described in Section 6.4.3. The multi point initial calibration can be prepared by the operator onsite or can be pre-calibrated by the rental company.

If the pre-calibration scenario is set up, the operator must prepare and analyze a continuing calibration check standard prior to the analysis of samples.

6.4.1 Standard Preparation

Using the Certified Calibration Gas Cylinder and regulator, fill a one-liter tedlar bag with the Stock Mix. Write "Stock Mix" on the tedlar bag label and the concentration and units. Prepare a sufficient number of tedlar bags to make calibration standards covering the calibration range.

Tedlar bags are prepared by using the 1-Liter syringe to fill each bag with exactly one liter of UHP N_2. Label each bag for the initial calibration standards. Using the 100 mL syringe, remove the appropriate volume of UHP N_2 from each initial calibration bag as outlined in the preparation list below. Using separate 100 mL, 5 mL, and 1 mL syringes, add the appropriate volume of working standard to each bag. Close the valve on the tedlar bag and mix by alternately pressing in opposite corners using your fingers for a count of twenty. Switch corners and repeat.

6.4.2 Standards Preparation List

- Japan Calibration Mix -Stock TCE and PCE 1 ppmv/1,000 ppbv
- ICAL 500 ppbv: 500 mL x 1,000 ppbv Stock =1,000 mL x 500 ppbv ICAL
- ICAL 200 ppbv: 200 mL x 1,000 ppbv Stock =1,000 mL x 200 ppbv ICAL
- ICAL 100 ppbv: 100 mL x 1,000 ppbv Stock =1,000 mL x 100 ppbv ICAL
- ICAL 50 ppbv: 500 mL x 1,000 ppbv Stock =1,000 mL x 50 ppbv ICAL
- ICAL 20 ppbv: 20 mL x 1,000 ppbv Stock =1,000 mL x 20 ppbv ICAL
- ICAL 10 ppbv: 10 mL x 1,000 ppbv Stock =1,000 mL x 10 ppbv ICAL
- ICAL 5 ppbv: 5 mL x 1,000 ppbv Stock =1,000 mL x 5 ppbv ICAL
- ICAL 1 ppbv: 1 mL x 1,000 ppbv Stock =1,000 mL x 1 ppbv ICAL

6.4.3 Initial Calibration Method

Once the method has been selected, the initial calibration standards can be analyzed. Beginning with the lowest concentration calibration standard, connect a tedlar bag, filled with calibration standard to the probe. This is accomplished by placing the sample port of the tedlar bag into the 1/8 inch Swagelok fitting on the probe and tightening the fitting finger tight. Open the valve on the tedlar bag to the point where the valve body separates, screw the valve back in ¼ turn. The Hapsite Smart is not equipped with a mass flow controller. The sample pump is timed and is set to collect 100 mL of sample nominally. Any restriction or over-pressure on the pump will cause a fault with the sample collection volume and will potentially skew the aliquot of that sample and for several pump cycles after. It is important that the tedlar bag is not filled to overpressure, has sufficient volume to account for purging and sampling across the trap, or that the valve body is open sufficiently to prevent back pressure on the pump.

After running the initial calibration standards, close the control panel on the laptop and select the "Calibrate" radio button. Select GC/MS method. Select the method that the CCAL was run under. After the method has loaded, select the "Save" button and rename the file to today's date. Follow the next steps in order:

- On the left side of the screen, the filenames of the previous calibration are listed. Using the laptop keyboard delete key, delete each file.
- On the right side of the screen are the calibration points listed with the linear regression. Delete each of these from the display.
- Using the "browse" button, find the initial calibration files. Using the CTRL key on the laptop keyboard, select each ICAL file and press "OK".
- The software will bring in the files. Due to a glitch in the programming, error messages will appear on the screen. Continue to hit the "Yes to All" button until all the error messages are gone.
- Type in the concentration for each calibration file.
- There is a box located between each file and concentration listed. Select the box for all calibration files.
- Below the file list is a "Calibrate Library" button. Select "Calibrate Library" and hit start. The software will calculate the linear regression and display the linear regression line and statistics on the right side of the screen.
- Review the linear regression statistics. Correlation coefficient should be 0.99 or better and the percent relative standard deviation (RSD) should be less than 30. Review the linear regression line for any outlying points if the regression statistics

are not in control. Delete an outlier point and re-calculate to correct. The linear regression should be forced through the origin.

- Record the method filename, the calibration files used for the regression, the correlation coefficient and the percent RSD in the field log book.
- Saved the method file; examples: for indoor air “Wood_SIM_IS_12042012.mth”, for soil vapor “Wood_SIM_SV_12042012.mth”.
- The indoor air method calibration levels should include 100, 50, 20, 10, 5.0, and 1.0.
- The soil vapor method calibration should include the indoor air calibration levels as well as the 500, 200, 100, 50, 20, 10, 5.0, and 1.0.

6.5 Sample Analysis

Once the method has been selected, there are two ways to analyze a sample with the Hapsite. The first is to place the hand held probe in the area that you want to collect a sample and depress the “RUN” button. The pump will initiate and purge the probe line, followed by drawing sample across the activated carbon trap.

The second process involves connecting a tedlar bag, filled with sample to the probe. This is accomplished by placing the sample port of the tedlar bag into the 1/8 inch Swagelok fitting on the probe and tightening the fitting finger tight. Open the valve on the tedlar bag to the point where the valve body separates, screw the valve back in ¼ turn. The Hapsite Smart is not equipped with a mass flow controller. The sample pump is timed and is set to collect 100 mL of sample nominally. Any restriction or over-pressure on the pump will cause a fault with the sample collection volume and will potentially skew the aliquot of that sample and for several pump cycles after. It is important that the tedlar bag is not filled to overpressure, has sufficient volume to account for purging and sampling across the trap, or that the valve body is open sufficiently to prevent back pressure on the pump.

A typical, daily sample analysis process is as follows:

- Start up or remove the instrument from “Extended Standby”.
- Instrument performs short autotune.
- Run indoor air at office location. This allows the instrument to warm up prior to running either an initial or continuing calibration.

- If working with an ongoing method, run a continuing calibration standard (CCAL).
- Calculate the percent difference of the CCAL, acceptance criteria is 30.

Calculating the percent difference is determined by using the following equation:

$$\text{Percent difference} = \frac{Cc - Ce}{Ce} \times 100$$

where:

Cc = Calculated amount of standard, in mass or concentration units.
Ce = Expected amount of standard, in mass or concentration units.

The absolute value of the percent difference between these two amounts for the continuing calibration level should be less than or equal to 30%.

- If performing an Initial Calibration, analyze all the initial calibration standards and refer to Section 6.4.3, Initial Calibration Method for the calibration curve set up.

- Using the acceptable method from the CCAL or the new Initial Calibration method, run a tedlar bag filled with UHP N_2. This is the method blank and confirms the method reporting limit for the day. Because the Site is contaminated due to vapor intrusion, all equipment and materials that are left on site have a baseline level of target analytes. An acceptable method blank should have less than 0.50 ppbv of analytes reported.

- Analyze ten samples.

- Analyze a CCAL, calculate percent difference, if the percent difference is outside of control, re-run a CCAL.

- If the CCAL re-run continues to be out of control, evaluate and perform an initial calibration. Qualify the last ten samples as estimated “J”.

- If the CCAL is in control, run method blank, then ten more samples.

- Run a duplicate once every twenty samples (five percent).

- Repeat until completed for the day.

- End the day’s analyses with a CCAL.

- Set the instrument to extended standby for the night, refer to Section 6.6 Extended Standby.

Upon completion of the sample analysis (approximately six minutes) press the “SEL” button and then the arrow down button until the target analytes and result is listed on the screen report. Record the sample ID, file number, sample volume, dilution factor, analytical result and any other pertinent comments in the field logbook.

6.6 Extended Standby

At the end of the sample analysis day, the Hapsite must be set to extended standby during the overnight. The following steps need to be followed:

- Plug the Hapsite into an operating electrical outlet.
- Using the "ESC" button, back out to the menu where "5.Exit" is an option.
- Using the arrow keys or key pad, go to "5.Exit" and hit the "SEL" button.
- Using the arrow keys, go to the "4.Standby" option and hit "SEL".
- Using the arrow keys, go to the "2.Extended Standby" option and hit "SEL".
- The front panel display will indicate that the column is cooling down.
- When the column has reached the set point, the front panel will display remove the carrier gas.
- Open the top of the Hapsite. Taking care not to hit the momentary switch on the underside of the cover, remove the battery and place it into the battery charger. The battery is removed by pressing down on it first, and while holding down, depress the black release button. The battery can now be removed from the Hapsite.
- To remove the carrier gas and IS canisters, gently press down on the canister, then press the black paddle next to the canister and release the canister. Remove from the sleeve.
- Shut down the IQ software program on the laptop and shut down the laptop.

7.0 DATA AND RECORDS MANAGMENT

Documentation of instrument operation is accomplished using a dedicated instrument logbook. This logbook is used to record a complete chronological description of all tuning, calibration, QC blank, and sample analyses that are completed. The logbook is completed by the instrument operator in real time during each day of operation.

Barometric pressure data will be recorded in the logbook for each day of operation. If weather conditions vary greatly during a day of operation, barometric pressure data will be obtained during several time periods as appropriate as determined by the Wood instrument operator. Meteorological data, including barometric pressure, for the sampling event will be downloaded from the Weather Underground website or will be measured with a hand-held portable barometer.

Supporting documents also include certification records for calibration standards, carrier gases, and internal standards that are supplied by the suppliers.

Sample target compounds results are reported on Excel tables that are created by the field operator. Samples are identified using field sample IDs that are created using codes that identify sample location. Sample location codes may represent a specific sample types such as soil vapor points (SV), indoor air (IA) location, background location ambient air (AA) and codes or numbers that identify buildings and/or sections within a building. Building and location codes will be developed for each project with the Wood technical lead or project manager. Sample codes also include the numerical listing of the sample ID for that code (example: 01, 02 …10).

8.0 QUALITY CONTROL

Initial Calibration: Multipoint calibration with a correlation coefficient of 0.99 or better and a percent RSD ≤ 30.

Continuing Calibration Check: Analyzed daily before samples and after every 10 samples. Percent difference goal of ≤ 30 percent of expected value.

Method Blanks: Analyzed daily after the continuing calibration check and after each subsequent continuing calibration check. Additional method blanks may be analyzed after samples with high concentrations of contamination (> 2X the upper SV calibration range of 500 ppbv) or at the discretion of the field operator.

9.0 REFERENCES

Inficon Hapsite Smart Chemical Identification System, 2004. "074-397-P1D Hapsite Smart Chemical Identification System Operation Manual", IPN 074-397-P1D, Inficon Inc., October 2004.

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