Project Plan Addendum C

for

Remedial Investigation/Feasibility Study

Standard Motor Products Site

Site code 2-41-016

Prepared by:

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Prepared for:

Standard Motor Products, Inc.

37-18 Northern Boulevard

Long Island City, New York 11101

April 6, 2007

Contents

List of Acronyms

bgs	below ground surface
CDM	CDM Inc.
CPP	Citizen Participation Plan
ELAP	Environmental Laboratory Approval Program
EPA	United States Environmental Protection Agency
FS	Feasibility Study
FSP	Field Sampling Plan
GPS	Global Positioning System
HASP	Health and Safety Plan
MTA	Metropolitan Transportation Authority
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
PID	photoionization detector
PVC	polyvinylchloride
QAPP	Quality Assurance Project Plan
RI	Remedial Investigation
SAP	Sampling and Analysis Plan
SMP	Standard Motor Products, Inc.
SVOC	semi-volatile organic compound
TAT	turnaround time
TOC	total organic carbon
USCS	Unified Soil Classification System
VOC	volatile organic compound

Section 1 Introduction

Camp Dresser & McKee, Inc. (CDM) is submitting this Addendum C to the project plans for the Standard Motor Products, Inc. (SMP) site located in Long Island City, New York. The final project plans consist of the Final Work Plan, dated August 25, 2000, and the Final Sampling and Analysis Plan (SAP) which includes a Field Sampling Plan (FSP) and a Quality Assurance Project Plan (QAPP), the Final Citizen Participation Plan (CPP), and the Final Health and Safety Plan (HASP). The SAP, CPP, and HASP were finalized and dated September 16, 2002. These project plans contain details for the Phase I and II investigations and were prepared in accordance with the March 30, 1998 Order on Consent between the New York State Department of Environmental Conservation (NYSDEC) and SMP. This Order on Consent stipulates requirements for the development and implementation of a Remedial Investigation/Feasibility Study (RI/FS) for the SMP site.

A Remedial Investigation (RI) report was prepared and submitted to NYSDEC and New York State Department of Health (NYSDOH) for their review on January 30, 2004. Comments from NYSDEC and NYSDOH were received on July 8, 2004 and May 13, 2004, respectively. A meeting with representatives of NYSDEC and NYSDOH was held on July 12, 2004 at NYSDEC to discuss their comments.

On April 29, 2005, a conference call was held with NYSDEC and NYSDOH to review the detailed scope-of-work for the Phase III investigation. The agencies requested that two sub-slab vapor samples be added to the previously agreed upon six soil vapor samples as well as the two additional rounds of groundwater sampling. SMP elected to proceed with the requested Phase III Investigation as amended in Project Plan Addendum B. The second round of groundwater sampling was conducted in September 2005 and the third round of groundwater sampling along with the vapor investigation was conducted in March 2006. An RI Addendum A report was prepared and submitted to NYSDEC and NYSDOH for their review on January 10, 2007.

SMP received comments from NYSDOH and NYSDEC dated January 24, 2007 and March 2, 2007, respectively. A conference call was conducted on March 15, 2007 to review the detailed scope-of-work for the additional Phase IV Investigation. Project Plan Addendum C addends the above referenced project plans to include the scope-of-work for the Phase IV Investigation.

1.1 Site Location

The SMP site is located at 37-18 Northern Boulevard in Long Island City, New York. The site is owned and operated by SMP and is located in an urban and industrial area. The property is approximately rectangular in shape and occupies more than 1 acre of land (Figure 1). The site property contains a large, six-story, industrial building with approximately 42,000 square feet per floor. As the major occupant of the building, SMP manufactures car parts at this facility and the facility serves as SMP's corporate headquarters.

Bordering the site is Northern Boulevard to the north; Sunnyside Freight Railroad Yard to the south; 39th Street, an automobile dealership and a Hess gasoline station to the east; and commercial and industrial properties to the west. Various industrial, commercial, and residential properties are located north from SMP on Northern Boulevard. A narrow strip of land on the south side of the property contains a loading dock and a dirt access path for vehicles. This strip of land is owned by the Metropolitan Transportation Authority (MTA) and is leased to SMP. Contamination has been identified in the soil adjacent to the loading dock. This area is mostly dirt and gravel covered with some concrete remaining from a nearby road-paving project. Access to this area is limited to the doors at the rear of the SMP building, a locked access gate located on the automobile dealership property, a railroad spur from 42nd Place to the east, and to railroad personnel by way of the Sunnyside Yard to the south. A highly industrialized area with a wide variety of activities ranging from small-scale assembly to large-scale manufacturing is located within the general vicinity of the SMP site.

1.2 Project Plan Addendum C Objectives

In addition to the original objectives listed in the September 16, 2002 Field Sampling Plan (GESa 2002) and the Project Plan Addendum B, the Project Plan Addendum C objectives are:

- to further delineate and evaluate the nature and extent of the soil vapor contamination underneath the building
- to further delineate and evaluate the nature and extent of the groundwater contamination by performing one additional round of monitoring well sampling and direct push groundwater sampling
- to further delineate and evaluate the nature and extent of the soil contamination and determine geologic characteristic of the site in the vicinity of the hot spot

Section 2
Phase IV Field Investigation

The field investigation specified in the Final Work Plan, dated August 25, 2000, and the Final SAP, HASP and CPP dated September 16, 2002, was conducted and completed in 2003. A draft RI report was prepared and submitted to the NYSDEC on January 30, 2004. Two additional rounds of monitoring well samplings and a vapor investigation were conducted and completed in 2005 and 2006 as specified in the Project Plan Addendum B, dated August 4, 2005. An RI Addendum A report was prepared and submitted to the NYSDEC on January 10, 2007.

The scope-of-work of Phase IV Field Investigation includes vapor, soil, and groundwater sampling. These activities are detailed in each section herein. The site specific procedures are provided as Appendix A of this document.

2.1 Site Survey

A site survey will be performed at the site to locate all sample points. A New York State licensed surveyor will perform all surveying. Upon completion of field operations, the surveyor will locate all borings and establish elevations and locations of all the monitoring wells. This information will be plotted on a site map and also reported in tabular form. The field measurements will be oriented according to existing benchmarks or property information on or around the site, and plotted according to the New York State Planar Coordinate System and Mean Sea Level Datum of 1929.

The minimum precision for location of each monitoring well and the traverse baseline will be 0.5 feet horizontal distance, 0.01 foot vertical distance and to the nearest 10 seconds for horizontal angle. Each well casing will be marked where the elevation was established. Each traverse station will be set using a hub and tack with a flagged witness lath indicating traverse number.

2.2 Vapor Investigation

2.2.1 Soil Gas Samples

A total of ten soil gas samples will be collected from the area adjacent to the loading dock using direct push boring and SUMMA® canisters (Figure 1). Offsite contingency soil gas samples will be collected across the street only if there is significant detection of volatile organic compounds (VOCs) in the sub-slab vapor samples at locations SB12, SB13, SB14 and SB15, as shown in Figure 1. A total of twelve soil gas samples are anticipated on the project. The soil vapor sample locations will be installed as permanent points to facilitate future sampling events.

Prior to sample collection, vapor sample probes will be purged with a vacuum pump. A permanent port constructed of stainless steel tubing and fittings will be installed in the opening. The annular space between the borehole and the sample tubing will be filled and sealed with anchoring cement. Teflon tubing will be connected to the stainless steel sample port and utilized for sample collection. Tracer gas (such as helium) will also be used to check for surface leakage at the ground surface. Flow rates for both purging and sample collection will not exceed 0.2 liters per minute to minimize ambient air infiltration during sampling. Approximately three dead air volumes of gas will be purged from the subsurface probe. Photoionization detector (PID) readings will be observed from this sample and the highest reading shall be recorded on the appropriate field form. The end of the tubing will be connected directly to the summa canister's regulator intake valve. The sample shall be collected with a laboratory-certified summa canister with dedicated regulator set for 2-hour sample collection. The procedures for sample documentation, identification, quality control and sampling are provided in Appendix A.

2.2.2 Sub-Slab Vapor Samples

A total of fifteen sub-slab soil gas samples will be taken from within the SMP building (Figure 1). The sub-slab sample locations will be installed as permanent points to facilitate future sampling events. After the slab has been inspected, the location of any subsurface utilities determined, and the ambient air surrounding the proposed sampling location screened with a PID, a hammer drill will be used to advance a boring to a depth of approximately two inches beneath the building slab.

A permanent port constructed of stainless steel tubing and fittings will be installed in the opening. The annular space between the borehole and the sample tubing will be filled and sealed with anchoring cement. Teflon tubing will be connected to the stainless steel sample port and utilized for sample collection. Flow rates for both purging and sample collection must not exceed 0.1 liters per minute to minimize ambient air infiltration during sampling. Approximately three dead air volumes of gas will be purged from the subsurface probe. PID readings will be observed from this sample and the highest reading shall be recorded on the appropriate field form. A three-way valve will be utilized to allow purging of all the lines. The end of the tubing will be connected directly to the summa canister's regulator intake valve. The sample shall be collected with a laboratory-certified summa canister with dedicated regulator set for 24-hour sample collection. The procedures for sample documentation, identification, quality control and sampling are provided in Appendix A.

Samples will be taken along the north side of the SMP building first and going south and analyzed for the 48-hour turnaround time (TAT). Based on the results of the 48-hour turnaround time of the samples north of the SMP building, offsite contingency soil gas samples will be taken across the street will only be collected if there is significant detection of volatile organic compounds (VOCs) in the vapor samples at locations SB12, SB13, SB14 and SB15, as shown in Figure 1.

2.2.3 Indoor Air Sample Collection

Three indoor air samples will be collected in the SMP building as shown in Figure 1. The NYSDOH Indoor Air Quality Questionnaire and Building Inventory shall be completed for each structure where indoor air testing is being conducted. The procedures for sample documentation, identification, quality control and sampling are provided in Appendix A. The NYSDOH questionnaire is provided in Appendix B.

All indoor air samples will be collected with a laboratory-certified summa canister regulated for a 24-hour sample collection. The summa canister will be placed in such a location as to collect a representative sample from the breathing zone at four or six feet above the floor.

2.2.4 Outdoor (Ambient) Air Sample Collection

One outdoor ambient air sample will be collected per soil vapor sampling event day to represent the outdoor air quality surrounding the SMP building. All outdoor air samples will be collected with a laboratory-certified summa canister regulated for a 24-hour sample collection. The summa canister will be placed upwind of the structures in such a location as to collect a representative sample from the breathing zone at four or six feet above the ground. Field documentation and sampling procedures are provided in Appendix A of this document.

2.3 Groundwater Investigation

2.3.1 Direct Push Groundwater Sampling

Direct push groundwater samples will also be collected from all 25 vapor sampling locations. Groundwater samples will be collected from the water table interface from all 25 vapor sampling locations. In addition, at nine locations, direct push groundwater samples will be collected at two additional depths (10 and 15 feet below ground surface (bgs)). At locations SG01 through SG06 and SB01, SB03 and SB05, a total of three direct push groundwater samples will be collected from the water table interface, 10 feet bgs, and 15 feet bgs. A total of 43 groundwater samples will be collected. Groundwater samples will be shipped to a laboratory for analysis. All groundwater samples collected will be analyzed for TCL VOC. All procedures to be followed during groundwater sampling are provided in Appendix A.

2.3.2 Monitoring Well Installation

The three proposed monitoring well locations (MW14 through MW16) contain one cluster wells (a shallow and deep well) and two single wells. Thus, a total of four new permanent monitoring wells (3 shallow and 1 deep) will be installed in 3 monitor well locations. The well cluster (MW14) will be installed north to MW13 to replace the existing MW13 and MW09 wells. MW15 and MW16 will be installed at the two highest vapor concentration of detected VOC. These locations will be based on the 48-hour TAT soil vapor samples results. The three proposed shallow wells will be installed utilizing direct push technology and screens to a depth of approximately 20 feet. The 15 foot screened interval will extend from 5 to 20 feet. The one proposed deep wells will also be installed utilizing direct push technology and screens to a depth of approximately 40 feet. The 10 foot screened interval will extend from 30 to 40 feet. The installation procedures are provided in Appendix A of this document.

The monitoring well will be developed in accordance with the procedures presented in Appendix A.

2.3.3 Monitoring Well Sampling

Groundwater samples will be collected from all existing and new monitoring wells during the Phase IV Investigation using low-flow sampling. The interior wells sampled will include MW05, MW06, MW15, and MW16. As noted from the previous investigation, MW05 was not sampled since the well was could not be opened. If during the sampling event, MW05 still can not be opened without significant damage, MW05 will be abandoned in place.

The exterior wells sampled will include MW10, MW11 (shallow and deep), MW12, and MW14 (shallow and deep). MW13 and MW09 will no longer require sampling since SMP is installing MW14 to replace these wells. It is assumed that the sump will not require sampling. A minimum of two weeks will be required after development of the new wells before sampling of the new wells may proceed. Prior to sampling, a round of synoptic water levels will be taken in one day from all wells. Groundwater conductivity, dissolved oxygen, turbidity, pH, temperature, and oxidation/reduction potential will be measured in the field during sampling. All groundwater samples collected from the monitoring wells will be analyzed for TCL VOC. In addition, all groundwater samples will be analyzed for the following parameters: methane, ethane and ethene, nitrate and nitrite, ammonia, alkalinity, sulfate and sulfide, ferrous iron, alkalinity, total organic carbon (TOC), and chloride. All sampling and water levels measurement techniques as provided in Appendix A.

2.3.4 Monitoring Well Abandonment

If monitoring well MW05 cannot be opened without damage, this well will be abandoned. If this monitoring well can be opened without damage, it will be samples along with the other monitoring wells. Even though MW09 and MW13 will not be sampled by SMP in the future, these wells will not be abandoned.

2.4 Soil Investigation

2.4.1 Direct Push Soil Sampling Locations

A total of 25 direct push soil borings will be drilled and two soil samples per location, at the highest PID headspace reading during the soil vapor investigation and one foot above water table, will be collected for a total of 50 samples. Soil samples will be advanced using a direct push drill rig equipped with a dual tube sampler. Continuous sampling will be conducted during the installation of the direct push borings for geological logging of the borehole. All soil samples will be analyzed for Target Compound List (TCL) VOCs, semi-volatile organic compound (SVOCs), and metals. All procedures to be followed during direct push soil sampling and geological logging are provided in Appendix A.

2.5 Laboratory Analysis and Data Validation

Sub-slab samples at the northern perimeter of the SMP building (SB12 to SB15) will be conducted first to establish the lateral boundaries of the contamination. Samples from these borings will be analyzed on a rapid TAT of 48 hours. Collected samples will be sent to a NYSDOH approved Environmental Laboratory Approval Program (ELAP) certified laboratory. If the results show detection of volatile organic compound, the contingency sub-slab samples will be taken at the buildings to the north of the site.

All samples will be analyzed by a NYSDOH approved ELAP certified laboratory. Air samples will be analyzed for VOC using United States Environmental Protection Agency (EPA) Method TO-15. The analysis for air samples will achieve detection limits of 1 $\mu g/m^3$ for each compound. For specific parameters identified by the NYSDOH, where the selected parameters may have a higher detection limit (e.g., acetone), and the higher detection limits will be designated by the NYSDOH.

The groundwater samples will be analyzed for VOC analysis via EPA Method 8260. Alkalinity will be analyzed via EPA 310.2; nitrate/nitrite, sulfate, and chloride will be analyzed via EPA 300; sulfide will be analyzed via EPA 376.1/376.2; TOC will be analyzed via EPA 415.1. Ferrous iron will be analyzed using field colorimetric HACH Method 8146, and methane/ethane/ethene will be analyzed using the standard operating procedures from Robert S. Kerr Environmental Research Laboratory.

Soil samples will be analyzed in accordance with TAGM No. 4046 for VOC by EPA method 8021B, SVOC by EPA method 8270C, and metals by EPA method 7000. A NYSDEC ASP Category B data deliverable will be provided for these analyses. Table 1 presents a summary of the analytical program for the site.

All samples collected will be validated in accordance the NYSDEC's *Guidance for the Development of Data Usability Summary Reports* (NYSDEC 1997). The Data Usability Summary Report (DUSR) will be developed by a party that is independent of the laboratory which performed the analyses. The DUSR will be prepared by a qualified data validator and submitted to NYSDEC.

Section 3
Reporting

The analytical data reported from the laboratory will be reviewed and evaluated. All of the data reported from the laboratory will be reviewed in detail and data usability summary reports for these data will be prepared to determine whether or not the data meet the project specific criteria for data quality and data usability.

The analytical data collected during this phase of the investigation will be assembled, reviewed, and evaluated to satisfy the objectives of the investigation. The data collected will be used to verify the nature and extent of soil and groundwater contamination and to determine the nature and extent of vapor contamination underneath the building.

Tabular summaries will be prepared to compare and evaluate the results from previous investigations with the current results. The results of the evaluation will be presented as Addendum B to the SMP RI Report (GES 2004).

Section 4
Project Management

Project tasks, organization, and responsibilities will remain the same as outlined in the Quality Assurance Project Plan (GESb 2002) with CDM replacing Groundwater & Environmental Services (GES), the previous prime contractor. Project management activities will adhere to CDM's internal Project Quality Management process and other internal CDM policies.

The proposed project schedule is outlined in the following table:

TASK DESCRIPTION	***DATES OF PERFORMANCE***
Project Planning Phase	
Development of Work Plan Scoping	5/13/98 - 7/02/98
NYSDEC Review and Comment on Scoping	7/02/98 - 3/29/00
Revise Scoping Document/Develop Draft Work Plan	3/30/00 - 5/23/00
NYSDEC Review and Comment on Draft Work Plan	5/23/00 - 6/23/00
Develop Draft SAP/HASP/CP	6/23/00 - 8/25/00
NYSDEC Review and Comment on SAP/HASP/CPP	8/25/00 - 6/28/02
Finalize SAP/HASP/CPP	6/28/02 - 9/16/02
Obtain NYSDEC Approval	9/16/02 -10/09/02
Field Investigation Phase I	
Perform Phase I Field Investigation	11/04/02 - 11/29/02
Phase I Sample Analysis	11/29/02 - 12/27/02
Data Usability Summary Report (DUSR)	12/27/02 - 1/24/03
Development of Phase I Database	1/24/03 - 2/21/03
Field Investigation – Phase II	
Phase II Scoping	2/21/03 – 4/18/03
Project Plan Addendum for Phase II	4/21/03 – 5/23/03
NYSDEC Review and Approval of Phase II Addendum	5/26/03 – 6/20/03
Phase II Field Investigation	7/7/03 – 8/15/03
Phase II Sample Analysis	8/18/03 – 9/12/03
Phase II DUSR	9/15/03 – 10/10/03
Field Investigation – Phase III	
Phase III Scoping and Access Agreements	05/02/05 – 08/05/05
Project Plan Addendum B for Phase III Investigation	07/05/05 – 08/05/05
NYSDEC/NYSDOH Review and Comment on Addendum B	08/08/05 - 09/30/05
Round 2 Monitoring Well Sampling	09/12/05 – 09/16/05
Round 3 Monitoring Well Sampling and Vapor Investigation	03/27/06 – 03/31/06
Phase II Sample Analysis	04/03/06 – 05/26/06
Phase III DUSR	05/29/06 – 07/21/06
Field Investigation – Phase IV	
Phase IV Scoping and Access Agreements	03/02/07 – **03/15/07 (conf. call)**
Project Plan Addendum C for Phase IV Investigation	03/15/07 – 04/06/07
NYSDEC/NYSDOH Review and Comment on Addendum C	04/07/07 - 05/04/07

Finalize Addendum C	05/07/07 – 05/25/07
NYSDEC Approval of Addendum C	06/1/07
Collect Vapor and DP samples and Install Wells	06/11/07 – 06/22/07
Monitoring Well Sampling	07/09/07 – 07/13/07
Phase IV Sample Analysis	07/16/07 – 08/10/07
Phase III DUSR	08/13/07 – 08/31/07
Report Development	
Remedial Investigation (RI) Report Development	10/13/03 – 1/30/04
NYSDEC Review and Comment on RI	02/02/04 –07/12/04
NYSDOH Develop Soil Vapor Intrusion Guidance	07/12/04 -10/30/06
Draft Addendum A RI Report	09/11/06 - 11/29/06
Final Addendum A RI Report	01/03/07 – 01/10/07
NYSDEC/NYSDOH Addendum A Comment	12/18/06 – **01/03/07 (conf. call)**
NYSDOH/NYSDEC Request for Phase IV Investigation	02/02/07 & 03/02/07
Draft Addendum B RI Report	09/03/07 – 10/12/07
NYSDOH/NYSDEC Addendum B RI Comments	10/15/07 – 11/9/07
Focused Feasibility Study (FFS) Scoping Meeting	11/05/07
Draft FFS Development	11/12/07 – 12/21/07
NYSDEC Review and Comment on FS Report	12/24/07 – 01/18/07
Finalize FS	01/21/07 – 02/15/07
DEC Review/Approval/Submit RI/FS to Record	02/18/07 – 02/22/07

Section 5
References

Camp Dresser McKee (CDM) 2005. Project Plan Addendum B for Remedial Investigation/Feasibility Study Standard Motor Products, Inc. Site. August 2005

Groundwater and Environmental Services, Inc. (GESa) 2002. Field Sampling Plan for Remedial Investigation/Feasibility Study Standard Motor Products, Inc. Site. September 2002

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Groundwater and Environmental Services, Inc. (GESd) 2002. Health and Safety Plan for Remedial Investigation/Feasibility Study Standard Motor Products, Inc. Site. September 2002

Groundwater and Environmental Services, Inc. (GESe) 2002. Citizen Participation Plan for Remedial Investigation/Feasibility Study Standard Motor Products, Inc. Site. September 2002

Groundwater and Environmental Services, Inc. (GES) 2003. Project Plan Addendum A for Remedial Investigation/Feasibility Study Standard Motor Products, Inc. Site. May 2003

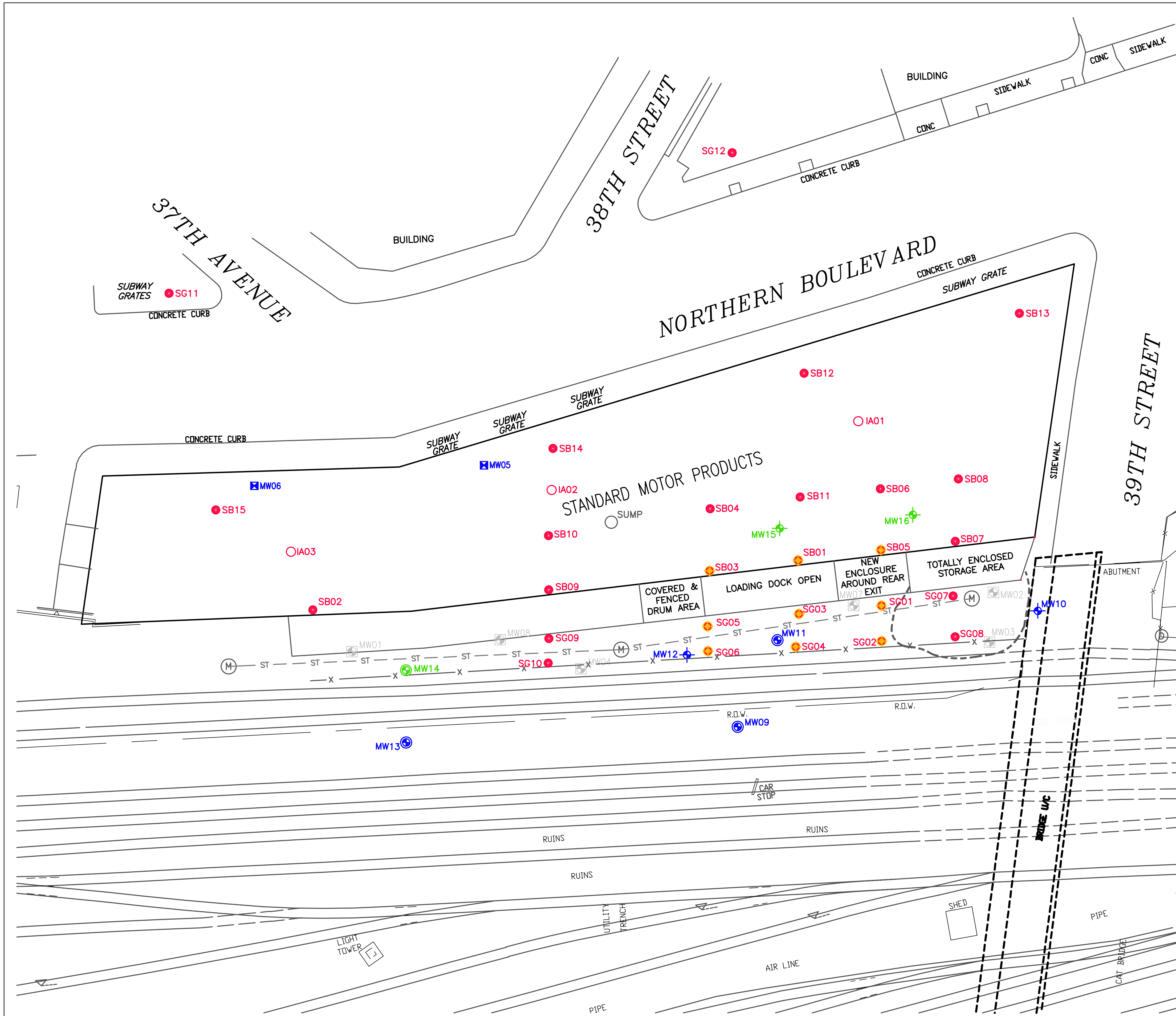
Groundwater and Environmental Services, Inc. (GES) 2004. Remedial Investigation Report for Remedial Investigation/Feasibility Study Standard Motor Products, Inc. Site. January 2004

IT Corporation (IT) 2000. Project Work Plan for Remedial Investigation/Feasibility Study Standard Motor Products, Inc. Site. August 2000

Table 1
Analytical Program Summary
Standard Motor Products, Inc.
Long Island City, New York

Analytical Parameter	Sample Matrix	Number of Samples	Analytical Method	Field Duplicates (a)	MS/MSDs	Field Blank/ Ambient Air Blank (b)	Trip Blanks (e)	Container	Sample Preservation	Holding Time
SOIL VAPOR SAMPLES										
Soil Gas Samples										
VOCs	Vapor	12	EPA TO-15	1	(c)	0	0	6-liter SUMMA canister	None	30 days
Sub-Slab Soil Vapor Samples										
VOCs	Vapor	15	EPA TO-15	1	(c)	0	0	6-liter SUMMA canister	None	30 days
Indoor Air Samples										
VOCs	Air	4	EPA TO-15	1	(c)	1	0	6-liter SUMMA canister	None	30 days
GROUNDWATER SAMPLES										
Direct Push Samples										
VOCs	Groundwater	43	EPA 8260B	3	1	3	1	3 - 40ml clear glass vial with Teflon septum	HCl to pH <2; Cool to 4^{o}C	14 days
Monitoring Well Samples										
VOCs	Groundwater	9	EPA 8260B	1	1	1	1	3 - 40ml clear glass vial with Teflon septum	HCl to pH <2; Cool to 4^{o}C	14 days
Alkalinity	Groundwater	9	EPA 310.2	1	1	1	0	500-mL plastic bottle	Cool to 4˚C	14 days
Nitrate/Nitrite	Groundwater	9	EPA 300	1	1	1	0	500-mL plastic bottle	Cool to 4˚C	48 hours
Ferrous iron	Groundwater	9	Field colorimetric HACH Method 8146	1	1	1	0	Provided by the laboratory	No preservation required	As soon as possible
Sulfate	Groundwater	9	EPA 300	1	1	1	0	500-mL plastic bottle	Cool to 4˚C	28 days
Sulfide	Groundwater	9	EPA 376.1/376.2	1	1	1	0	500-mL plastic bottle	Cool to 4 °C	As soon as possible
Methane/ethane/ethene	Groundwater	9	RSK SOP 147 (f) or RSK SOP 175	1	1	1	0	3 - 40ml clear glass vial with Teflon septum	Cool to 4˚C, no headspace, avoid air and light	14 days
Total Organic Carbon	Groundwater	9	EPA 415.1	1	1	1	0	125-mL amber glass bottle	H_2SO_4 to pH <2, Cool to 4˚C	28 days
Chloride	Groundwater	9	EPA 300	1	1	1	0	500-mL plastic bottle	Cool to 4˚C	28 days
SOIL SAMPLES										
Volatile Organic Compounds	Soil	50	EPA 8260B	10	1	1	0	3 - 40 ml glass VOC with plastic cap with Teflon septum with 25 ml methanol (prepared by lab)	Cool to 4^{o}C	14 days
Semi-Volatile Organic Compounds	Soil	50	EPA 8270C	10	1	1	0	250-mL (8 oz) amber glass	Cool to 4^{o}C	7 days
Metals	Soil	50	EPA 6010	10	1	1	0	250-mL (8 oz) amber glass	Cool to 4^{o}C	180 days

Notes:
(a) A minimum of 5% of all groundwater and vapor samples and 20% of all soil samples should be collected in duplicate.
Duplicate for indoor air are collected at a frequency of 1 per site.
(b) Groundwater field blanks are collected at a frequency of 1 per day. A minimum of 2% of all soil samples should be collected as field blank.
(c) SUMMA canisters containing samples are not spiked in the field.
(d) Cannister should be used within 15 days of being shipped to the field for sample collection.
(e) Trip blanks are collected at a frequency of 1 per sampling event or 1 per every five days.
(f) Robert S. Kerr Environmental Research Laboratory Standard Operating Procedures, No. 147, Revision No. 0, January 1993.



LEGEND

- DESTROYED MONITORING WELLS
- INTERIOR MONITORING WELL (INSIDE THE BUILDING)
- DEEP/SHALLOW MONITORING WELL CLUSTER
- SHALLOW MONITORING WELL
- INTERIOR SUMP
- FENCE LINE
- APPROXIMATE LOCATION OF DRAIN SPOUT
- APPROXIMATE VICINITY OF PREVIOUS EXCAVATED & STOCKPILED SOILS
- ROW — RIGHT OF WAY
- SEWER MANHOLE (APPROX 12' DEEP)
- UNDERGROUND STORM SEWER
- PROPOSED SUB-SLAB (SB) SAMPLE
- PROPOSED SOIL GAS (SG) SAMPLE
- PROPOSED INDOOR AIR (IA) SAMPLE
- PROPOSED PERMANENT SOIL VAPOR PROBE/ DIRECT PUSH GROUNDWATER SAMPLE
- PROPOSED SHALLOW MONITORING WELL
- PROPOSED DEEP/SHALLOW MONITORING WELL CLUSTER
- PROPOSED GROUNDWATER PROFILE

DRAFTED BY: CJ	PROPOSED SAMPLE LOCATIONS
CHECKED BY: MW	PROJECT PLAN ADDENDUM C REMEDIAL INVESTIGATION/FEASIBILITY STUDY STANDARD MOTOR PRODUCTS, INC. LONG ISLAND CITY, NEW YORK
REVIEWED BY:	CDM

NORTH	SCALE IN FEET	DATE	FIGURE
	0 50	4-6-07	1

Appendix A

Sampling and Analysis Plan Addendum

Sampling and Analysis Plan Addendum C

for

Remedial Investigation/Feasibility Study
Standard Motor Products Site
Site code 2-41-016

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April 6, 2007

Contents

List of Tables

Section 1
Introduction

The sampling and analysis plan (SAP) has been developed specifically for the Phase IV Investigation. This SAP is being provided as an addendum to the Sampling and Analysis Plan (SAP) for the project.

1.1 Purpose

The principal purpose of this document is to specify quality assurance/quality control (QA/QC) procedures for the collection, analysis, and evaluation of data that will be legally and scientifically defensible.

1.2 Objectives

The SAP provides specific investigation information and procedures applicable to the activities and analytical program detailed in Project Plan Addendum C. This information includes definitions and generic goals for data quality and required types and quantities of QA/QC samples. The procedures address field documentation; sample handling, custody, and shipping; instrument calibration and maintenance; auditing; data reduction, validation, and reporting; corrective action requirements; and QA reporting specific to the analyses performed by the laboratories subcontracted by CDM.

Section 2
Field Procedures

CDM's points of contact for the field investigation are the Site Manager. Any minor changes in sampling activities that are within the proposed scope of this project will be documented each day in the field logbook and signed by the Site Manager. Any modifications that are inconsistent with the approved work plan are to be approved by NYSDEC prior to implementation.

2.1 Documentation (Field Log Book)

Information recorded in field log books include observations, data, calculations, time, weather, description of the data collection activity, methods, instruments, and results. Additionally, the logbook may contain descriptions of wastes, biota, geologic material, and site features including sketches maps, or drawings as appropriate.

2.1.1 Preparation

In addition to this SAP, site personnel responsible for maintaining logbooks must be familiar with other site specific standard operating procedure (SOPs). These should be consulted as necessary to obtain specific information about equipment and supplies, health and safety, sample collection, packaging, decontamination, and documentation.

Prior to use in the field, each logbook should be marked with a specific control number. The field notebook will then be assigned to an individual responsible for its care and maintenance.

Field logbooks will be bound with lined, consecutively numbered pages. All pages must be numbered prior to initial use of the logbook. The following information will be recorded inside the front cover of the logbook:

- Field logbook document number
- Activity (if the log book is to be activity-specific)
- Person and organization to whom the book is assigned, and phone number(s)
- Start date

2.1.2 Operation

The following is a list of requirements that must be followed when using a logbook:

- Record work, observations, quantities of materials, calculations, drawings, and related information directly in the log book. If data collection forms are specified by an activity-specific plan, this information need not be duplicated in the logbook. However, any forms used to record site information must be referenced in the logbook.

- Do not start a new page until the previous one is full or has been marked with a single diagonal line so that additional entries cannot be made. Use both sides of each page.

- Do not erase or blot out any entry at any time. Before an entry has been signed and dated, any changes may be made but care must be taken not to obliterate what was written originally. Indicate any deletion by a single line through the material to be deleted.

- Do not remove any pages from the book.

- Record as much information as possible.

- Specific requirements for field logbook entries include:

  - Initial and date each page.
  - Initial and date all changes.
  - Multiple authors must sign out the logbook by inserting the following:

    Above notes authored by:

    (Sign name)
    (Print name)
    (Date)

- A new author must sign and print his/her name before additional entries are made.

- Draw a diagonal line through the remainder of the final page at the end of the day.

- Record the following information on a daily basis:

  - Date and time
  - Description of activity being conducted including station (i.e., well, boring, sampling location number) if appropriate
  - Weather conditions (i.e., temperature, cloud cover, precipitation, wind direction, and speed) and other pertinent data
  - Level of personnel protection to be used

Entries into the field logbook will be preceded with the time (written in military units) of the observation. The time should be recorded at the point of events or measurements that are critical to the activity being logged. All measurements made and samples collected must be recorded unless they are documented by automatic methods (e.g., data logger) or on a separate form. In these cases, the logbook must reference the automatic data record or form.

Other events and observations that should be recorded include:

- Changes in weather that impact field activities.
- Deviations from procedures outlined in any governing documents. Also record the reason for any noted deviation.
- Problems, downtime, or delays.
- Upgrade or downgrade of personnel protection equipment.

2.1.3 Post-Operation

To guard against loss of data due to damage or disappearance of logbooks, copies of completed pages will be made periodically (weekly, at a minimum) and submitted to the project manager. Documents that are separate from the logbook will be copied and submitted regularly and as promptly as possible to the project manager. This includes all automatic data recording media (printouts, logs, disks or tapes) and activity-specific data collection forms required by other SOPs.

At the conclusion of each activity or phase of site work, the individual responsible for the log book will ensure all entries have been appropriately signed and dated, and that corrections were made properly (single lines drawn through incorrect information, then initialed and dated). The completed logbook will be submitted to the records file.

2.2 Sample Documentation and Identification

The following procedures describe proper documentation to be included in field notebooks. Documentation includes describing data collection activities, logging sample locations, sample IDs, container labeling and chain-of-custody forms. Procedures for sample classification to insure proper labeling of samples are also included.

2.2.1 Responsibilities

The field manager and/or field technician is required to oversee drilling of the boreholes, collection of vapor, groundwater, and air samples, fill out field book logs, submit samples for analysis, chain-of-custody (COC) forms, and labeling of any waste-containing drums, if required. Also, the field manager and/or field engineer is required to adhere to the site-specific HASP. Field book entries should state starting time of monitoring, equipment used and results.

2.2.2 Field Notebooks

Complete thorough notes of all field events are essential to a timely and accurate completion of this project. The field manager and/or field engineer is responsible for accounting for particular actions and times for these actions of the subcontractor while in the field. Also, identification (numbers and description) of field samples duplicates samples, and blank samples should also be noted in the field book. For a particular workday, the field book should contain the following:

- Field personnel name, contractors name, number of persons in crew, equipment used, weather, date, time, and location at start of day (boring number)
- Sample identification number, depth, amount of sample recovery, photoionization detector (PID) readings and soil descriptions
- Description of any unusual surface or subsurface soil conditions
- Record of Health and Safety monitoring: time, equipment, and results
- Record of site accidents or incidents
- Record of any visitors
- Potential of delays
- Materials and equipment used during borehole installation
- Final daily summary of work completed including list of samples obtained
- Completion of daily QA/QC log sheet
- Contractor downtime, decontamination time, equipment breakdowns, movement tracking throughout the day, etc.
- Any other data that may be construed as relevant information at a later date

The field logs should confirm the subcontractor's data. Field notes should be photocopied weekly and returned to the project manager.

If a borehole is completed as a monitoring well, simply note this on the form, and complete the monitoring well log. Examples of completed boring logs should be reviewed and adequate blank log forms obtained.

Monitoring well logs are required in addition to the boring log form if the borehole is completed as a monitoring well. These are to be completed in the field after a monitoring well is installed. They should include data such as screen length, riser length, materials used, etc. Examples of monitoring well logs should be reviewed and adequate blank log forms obtained.

2.2.3 Drum Labeling

Labeling of drums is essential for tracking hazardous materials. The responsibility of the contractor is to collect, handle, and store the drums, but the responsibility of field personnel is to label these drums appropriately. There is a significant cost implication if drums are not property labeled. Unknown material must be disposed of as hazardous waste if any hazardous waste is found on-site.

The following drum labeling procedures are to be adhered to:

- Field staff shall secure packing list envelopes to the side of the drum(s) at the completion of a boring.

- Field staff shall print with an indelible marker on information cards all information pertaining to the contents of the drum(s). If more than one drum is collected from the same borehole, each information card shall be numbered sequentially in parenthesis starting with the number one after the boring number. The information shall include:

- Program Area
- Boring No.(s)
- Date collected
- Description of contents (i.e., soil cuttings, well water, etc.)
- Amount of water (specify in inches)
- Fullness of drum (not including free liquid, specify in fractional form)

■ Field staff shall insert information card into packing list envelope. The packing list envelope shall be sealed at this time.

■ Field staff shall record in field book all information pertaining to the contents of the drum that was printed on the information card.

■ Program manager, upon receipt of the analytical data for the drums, shall prepare a summary table of the analytical results on a weekly basis, and provide the designated coordinator.

■ Based on the tabulated information the designated coordinator will determine and prepare the appropriate storage labels required:

- Hazardous Waste label
- Non-hazardous label

■ The designated coordinator will fill out these labels.

■ Field staff shall attach these labels to the appropriate drums. If the information cards inside the packing list envelopes are damaged, they shall be reprinted at this time.

It is noted that waste material is expected to be transported off-site during excavation. No investigation derived wastes are expected to be drummed.

2.2.4 Sample Identification

Each sample collected will be designated by an alphanumeric code that will identify the type of sampling location, matrix sampled, and the specific sample designation (identifier). Site-specific procedures are described below.

Sample identification will contain a sequential code consisting of two segments. The first segment will designate the location type and specific sample location. Location types will be identified by a two-letter code, for example: MW (monitoring well), SG (soil gas), SB (Sub-slab vapor), etc. The specific sampling location will be identified using a two-digit number. For groundwater monitoring wells, a "D" or "S" will follow the sampling location to indicate a deep or shallow monitoring well. The second segment will identify the matrix type and a sample depth designation. The matrix type will be designated by a two-letter code, for example: GW (groundwater), VP (vapor), etc. The sample identifier will be represented by a two-digit code identifying the depth below ground surface of the sample, for example 08 for eight feet below ground surface. For sequential depth intervals of soil samples, the sample identifier will correspond to depth increments.

The following is a general guideline for sample designation:

FIRST SEGMENT		SECOND SEGMENT	
AA	NNA	AA	NN
Location type	Specific Location	Matrix Type	Bottom Depth
MW	11D	GW	12

SYMBOL DEFINITIONS:
A = Alphabetic
N = Numeric

LOCATION TYPE
SG = Soil Gas (external to building)
SB = Sub-slab
IA = Indoor Air
AA = Ambient Air
MW = Monitoring Well
TB = Trip Blank
FB = Field Blank

MATRIX TYPE:
VP = Vapor
GW = Groundwater
SS = Soil
AQ=Aqueous

For a soil gas sample obtained at a depth of 2 feet at location 01, the sample identification will be SG01-VP02 (Figure 1). The deep groundwater sampled from a depth of 35 feet from monitoring well 11 would have a designation of MW11D-GW35. For soil sample obtained at a depth of 4 feet at the soil gas sample location 05 would have a designation of SG05-SS04. For blank samples, the field blank taken from the groundwater sampling apparatus would be identified as FB01-GW00, and the second field blank taken from the second day of groundwater sampling apparatus would be identified as FB02-GW00. The first trip blank would be identified as TB01-AQ00.

2.3 Chain-of-Custody Procedures

This section describes the procedures used to ensure that sample integrity and COC are maintained throughout the sampling and analysis program. COC procedures provide documentation of sample handling from the time of collection until its disposal by a licensed waste hauler. This documentation is essential in assuring that each sample collected is of known and ascertainable quality.

The COC begins at the time of sample collection. Sample collection is documented in the field notebooks in accordance with the specified SOP. At the same time, the sampler fills out the label on the sample container with the following information:

- Sample ID code
- Required analyses
- Sampler initials
- Date and time of sample collection

2.3.1 Chain-of-Custody Forms

The COC forms are a paper trail system that follows the samples collected and indicates which laboratory analyses are to be performed on which samples. Each sample should be clearly labeled and listed on the COC. The laboratory will only perform analyses on samples indicated and all other samples should be indicated with a "HOLD" designation. By labeling a sample "HOLD", the laboratory will store the sample until further instruction is given. Do not check the request for analysis blocks on the COC for samples designated with "HOLD" Status. Never indicate duplicate or blank samples on a COC.

It is the responsibility of the field manager to coordinate COC forms and supply copies of all COC to the project manager for data management use.

A COC form is filled out for each sample type at each sampling location. Each time the samples are transferred to another custodian or to the laboratory, the signatures of the people relinquishing the sample and receiving the sample, as well as the time and date, are documented. Labels will be filled out with an indelible, waterproof, marking pen.

2.3.2 Chain-of-Custody Records

The COC record is a three-part form. The laboratory retains the original form and the person relinquishing the samples keeps a copy of the form at the time of sample submittal. This form is then returned to the project manager or person in charge of data coordination.

The COC Record will be placed in a Ziplock bag and placed inside of all shipping and transport containers. All samples will be hand delivered or shipped by Federal Express to the laboratory specified by the field manager. Samples should be packed so that no breakage will occur. Custody seals will be placed on all coolers/packages containing laboratory samples during shipment.

2.4 Field Quality Control Samples

In order to maintain quality assurance and quality control in both the field and the laboratory, additional samples such as trip blanks, duplicates, field blanks, performance evaluation samples and background samples will be collected. Each type of QA/QC sample is described below.

2.4.1 Quality Control for Soil Sampling

Approximately twenty percent of all soil samples analyzed should be QA/QC samples. These samples act as a verification of appropriate field and laboratory procedures. These samples should be recorded in the field book but should not be identified on the COC form other than with an MD (Miscellaneous Discrete). All QA/QC samples should be numbered sequentially with other field samples on the soil log form. The following is a breakdown of types of QA/QC samples to be taken.

2.4.1.1 Duplicate Samples

Approximately twenty percent of all soil samples analyzed should be duplicate samples. Soil duplicates shall be field-homogenized samples. To ensure laboratory "blind" analyses, duplicate samples will be identified with the next sequential sample number on sample containers and the COC forms. The actual identification of the duplicate samples shall be recorded in the field book. Duplicate samples are collected from the same split spoon sampler, homogenized in the field and analyzed for the same compounds.

2.4.1.2 Field Blanks

Approximately two percent of all soil samples analyzed should be field blanks. Rinsate blanks are collected after a sample is taken and the equipment used (i.e., split spoon sampler) has been decontaminated. Distilled water is then poured over the decontaminated sampling equipment and collected in sample jars for analysis. It should be documented in the field book which soil sample preceded the field blank and which soil sample followed the field blank for the equipment used.

2.4.2 Quality Control for Soil Vapor and Air Sampling

Approximately five percent of all vapor) samples analyzed should be duplicate samples (one duplicate per 20 samples collected). Soil vapor duplicates will be collected in a manner so that the sample and duplicate are being collected simultaneously from the same sample location. One duplicate indoor air sample will be collected per site where indoor air sampling is being conducted. Duplicate outdoor air samples will be collected only at the sites where indoor air sampling is also being conducted. Duplicate samples are analyzed for the same compounds. All summa canisters must be certified to be free of contaminants in accordance with QA/QC protocol.

2.4.3 Quality Control for Groundwater Sampling

Approximately five percent of all groundwater samples analyzed should be QA/QC samples (one duplicate per 20 samples collected). These samples act as a verification of appropriate field and laboratory procedures. These samples should be recorded in the field book but should not be identified on the COC form as a QA/QC sample. All QA/QC samples should be numbered sequentially with other field samples. The following is a breakdown of types of QA/QC samples to be taken.

2.4.3.1 Duplicate Samples

Approximately five percent of all groundwater samples analyzed should be duplicate samples. To ensure laboratory "blind" analysis, duplicate samples will be recorded with the well I.D. number and the next sequential sample number on sample containers and the COC forms. Duplicate samples are collected from the same bailer and analyzed for the same compounds.

2.4.3.2 Trip Blanks

Each cooler packed and shipped for aqueous VOC analysis should also contain a trip blank. Trip blanks are VOA vials filled with distilled water. These pre-filled vials are to be carried with the sample bottles and samples and should remain sealed the entire time. It should be documented in the field book which aqueous samples were collected and transported with the trip blank.

2.4.3.3 Field Blanks

One field blank sample will be collected per day of sampling. Field blanks are collected after a sample is taken and the equipment used (i.e., bailer) has been decontaminated. Distilled water is then poured over the decontaminated sampling equipment and collected in sample jars for analysis. It should be documented in the field book which groundwater sample preceded the field blank and which sample followed the field blank for the equipment used

2.5 Premobilization

Prior to initiating fieldwork, the following preparatory activities will be completed:

- Project mobilization.
- Utility clearance and permitting; The drilling subcontractor is responsible for contacting the appropriate local utility or “one-call” service to locate subsurface and aboveground utilities in the vicinity of the soil gas survey area.
- Site specific issues will be resolved.
- Sample analysis will be scheduled with the laboratory

- Appropriate sample containers and preservatives for the various sample parameters will be obtained. Extra containers will be obtained to account for possible breakage.

- Field blank water will be obtained from the laboratory performing the analysis.

- Necessary field sampling and monitoring equipment will be obtained. Prior to use, the equipment will be checked to confirm that it is in good working condition, properly calibrated, and decontaminated.

- Materials necessary for personal protection and decontamination will be obtained.

- Coordinate with subcontractors.

2.6 Direct Push Soil Sampling

2.6.1 Equipment

The following is a list of equipment that is required:

- Field logbook
- Personal protective equipment as specified in HASP
- Sample containers
- Stainless steel sample bowls and trowels
- Ice and cooler
- Field blanks
- COC forms and COC seals
- Indelible marker
- Sample labels
- Distilled and deionized water
- Alconox
- Paper towels
- Garbage bags
- Water jugs
- Permanent markers with Ultra Fine tip
- Compass
- 200-foot Tape measure
- Spray paint
- Calculator
- Clean sand
- Drill rig/Geoprobe rig -if necessary (operated by CDM subcontractor)

2.6.2 Soil Sampling Procedure

The following procedure will be followed during the soil sample collection:

1. A licensed driller will operate the drill rig.

2. Place the thread protector over the threads of the liner grabber and then connect the drive head to the outer split spoon sampler.
3. Raise the probe shell to the highest position. Next, raise the foot up off the surface to allow room to place the sampler below the hammer. Be sure to keep the derrick straight.
4. Insert an anvil into the hammer and place the sampler and probe rod in the driving position. Raise the hammer latch into the up position while initially driving the sampler to avoid contact with the drive head.
5. Use the FOOT control to apply down pressure and activate the hammer as necessary to begin sampling. When the foot reaches the ground surface, begin using the PROBE control to apply down pressure as in normal operation.
6. Add a probe rod and drive the sampler until the drive head reaches the ground surface. Do not over-drive the sampler.
7. The boring will be continued until approximately one foot above water level.
8. Continuous samples will be collected using either a standard 24-inch split spoon sampler or a 48-inch sampler with a teflon liner. Soil samples will be collected continuously during drilling.
9. The driller will collect the soil sample from each interval and provide the sampler to the CDM geologist for evaluation.
10. Open the sampler and immediately scan the sample with the OVM and record readings. Also characterize the sample according to physical properties as specified herein.
11. Collect the soil sample for VOC analysis directly from the sampler using the *Methanol Preservation Method*:
    a. Sample containers will be supplied by the laboratory containing demonstrated analyte free purge and trap grade methanol. The containers will be labeled with a unique numeric designation.
    b. Calibrate the electronic balance scale before use.
    c. Weigh each labeled sample container of methanol to the nearest one tenth (0.1g) of a gram. Record the weight in the logbook and on the chain of custody record with its corresponding numerical designation.
    d. The laboratory will supply a disposable syringe for sample collection. Tare weigh the small diameter core sampler.
    e. Expose a fresh soil surface on the sample collected with the hand auger using a stainless steel trowel.

f. Immediately after the fresh surface is exposed use the laboratory supplied syringe to collect an 8-12 gram sample (wet weight) by inserting the open syringe into the soil.

g. Quickly weigh the sample while contained in the small diameter core sampler. Excess soil sample can be removed from the coring device by extruding a small portion of the core and cleaning away with a decontaminated trowel or spatula. If soil weight is below the weight limit, obtain additional sample. Reweigh after each addition or removal of sample to the subcore until the target weight is attained (8-12g).

h. Immediately open the sample container and slowly extrude the soil core into the pre-weighed and pre-numbered sample container supplied by the laboratory performing the analysis. Avoid splashing methanol out of the sample container. Do not immerse the small diameter soil coring device into the methanol.

i. Ensure the threads on the sample container and cap are free of soil particles. Use a clean brush or paper towel to remove the particles off the threads. The presence of soil particles compromises the seal of the container resulting in loss of methanol, which may invalidate the sample.

j. Secure the lid of the sample container. Gently swirl the sample to mix and break up the soil aggregate until soil is covered with methanol. Do not shake.

k. Do not attach any additional adhesive backed labels or tape to the sample containers. Record sample numbers on container avoiding covering laboratory identification number. Record laboratory and field identification numbers on chain of custody and field notes.

l. Weight the sample container with the soil in it and record it on the chain-of-custody. The actual weight of soil will be determined by the laboratory performing the analysis.

m. Do not use or submit samples for analysis if any methanol has spilled from a sample container during shipment to the site or during sampling.

n. After sample collection, immediately place the containers in an upright position in a cooler with bagged ice sufficient to cool the samples to 4°C.

12. For the SVOC and metal sample analysis, either collect the sample directly from the sampler or transfer the sample with minimum disturbance to a decontaminated stainless steel bowl with a decontaminated stainless steel trowel.

    a. Remove the cap from the container

   b. Fill the sample container as completely as possible by transferring the sample to the container immediately after collected the sample with a stainless steel trowel, and screening the sample with the OVM.

   c. Close the sample container tightly.

   d. Label the container and place it into in a cooler with bagged ice sufficient to cool the samples to 4°C.

13. Maintain COC forms for samples.
14. Log the description and depth of the soil sample sent for analysis in the field book.
15. Soil descriptions will be consistent with the Unified Soil Classification System (USCS) and observations that could further clarify the characteristic of the site geology will be noted as specified herein.
16. Record field information and sample location, including measurements from fixed points in logbook.
17. Backfill the boring location with clean sand within the soil horizon, and gravel, if necessary, above.
18. Patch blacktop with asphalt patch in accordance with NYCDOT requirements

2.7 Soil Boring Logs/Geoprobe

Geological logging, as previously defined, includes keeping a detailed record of drilling (or excavating) and a geological description of materials on a prepared form. Geological logs are used for all types of drilling and exploratory excavations and include descriptions of both soil and rock. Accurate and consistent descriptions are imperative.

2.7.1 Log Form

When drilling in soils or unconsolidated deposits, the log should be kept on a standard Soil Boring Log Form. The following basic information should be entered on the heading of each log sheet:

- Project name and number
- Boring or well number
- Locations (approximate in relation to an identifiable landmark; will be surveyed)
- Elevations (approximate at the time; will be surveyed)
- Name of drilling contractor
- Drilling method and equipment
- Water level
- Start and finish (times and date)

The following technical information is recorded on the logs:

- Depth of sample below surface
- Sample interval

- Sample type and number
- Length of sample recovered
- Standard penetration test (ASTM-D1586) results if applicable
- Soil description and classification
- Graphic soil symbols
- HNu/OVA/OVM readings

In addition to the items listed above, all pertinent observations about drilling rate, equipment operation, or unusual conditions should be noted. Such information might include the following:

- Size of casing used and method of installation
- Rig reactions such as chatter, rod drops, and bouncing
- Drilling rate changes
- Material changes
- Zones of caving or heaving

2.7.2 Soil Classification

The soil description should be concise and should stress major constituents and characteristics. Soil descriptions should be given in a consistent order and format. The following order is as given in ASTM D2488:

- Soil name. The basic name of the predominant constituent and a single-word modifier indicating the major subordinate constituent.

- Gradation or plasticity. For granular soil (sand or gravel) that should be described as well graded, poorly graded, uniform, or gap-graded, depending on the gradation of the minus 3-inch fraction. Cohesive soil (silts or clays) should be described as non-plastic, slightly plastic, moderately plastic, or highly plastic, depending on the results of the manual evaluation for plasticity as described in ASTM D2488.

- Particle size distribution. An estimate of the percentage and grain-size range of each of the soil's subordinate constituents with emphasis on clay-particle constituents. This description may also include a description of angularity. This parameter is critical for assessing hydrogeology of the site and should be carefully and fully documented.

- Color. The color of the soil using Munsell notation.

- Moisture content. The amount of soil moisture, described as dry, moist, or wet.

- Relative density or consistency. An estimate of density of a granular soil or consistency of a cohesive soil, usually based on standard penetration test results (see Table 2-1 and 2-2).

- Local geologic name. Any specific local name or a generic name (i.e., alluvium, loess). Also use of Unified Soil Classification System of symbols.

The soil logs should also include a complete description of any tests run in the borehole; placement and construction details of piezometers, wells, and other monitoring equipment; abandonment records; geophysical logging techniques used; and notes on readings obtained by air monitoring instruments.

Additional data in sedimentary rocks includes:

- Sorting
- Cementation
- Density or compaction
- Rounding

The core should be logged as quickly as possible after removal from the hole. Some materials may degrade rapidly upon exposure, resulting in apparently poor rock, which was not actually present in the subsurface.

Check carefully each core end and try to determine if the fracture is natural or mechanical in origin. Mechanical fractures often can be identified by their orientation, the absence of secondary coatings or filling and slickensides, and it's fit with the adjacent core piece. If doubt exists, consider it a natural fracture. If it is determined that the fracture is mechanical, ignore it and consider the two pieces of core as a single piece.

Table 2-1
Relative Density of Noncohesive Soil

Blows/Ft	**Relative Density**	**Field Test**
0-4	Very Loose	Easily penetrated w/ ½-inch steel rod pushed by hand
5-10	Loose	Easily penetrated w/ ½-inch steel rod pushed by hand
11-30	Medium	Easily penetrated w/ ½-inch steel driven with a 5-lb hammer
31-50	Dense	Penetrated one foot with a ½-inch steel road driven with 5-lb hammer
>50	Very Dense	Penetrated only a few inches with a ½-inch steel rod driven with a 5-lb hammer

Table 2-2
Relative Consistency of Cohesive Soil

Blows/Ft	Consistency	Pocket Penetrometer (TSF)	Torvance (TSF)	Field Test
<2	Very Soft	<0.25	<0.12	Easily penetrated several inches by fist
2-4	Soft	0.25-0.8	0.12-0.25	Easily penetrated several inches by thumb
5-8	Firm	0.50-1.0	0.25-0.5	Can be penetrated several inches by thumb with moderate effort
9-15	Stiff	1.0-2.0	0.5-1.0	Readily indented by thumb but penetrated only with great effort
16-30	Very Stiff	2.0-4.0	1.0-2.0	Readily indented by thumbnail
>30	Hard	>4.0	>2.0	Indented with difficulty by thumbnail

TSF= Tons per square foot

2.8 Direct Push Groundwater Sampling

2.8.1 Purge and Sampling

Standard purge techniques will be utilized to purge and sample groundwater. Standard purge and sampling techniques consist of using a check valve and tubing to purge the well at a low flow rate. The check valve intake is set approximately in the middle of the screen. The well is purged at the low rate until the water flows clear or the turbidity is reduced to 50 NTUs or less. The sample is then collected directly from tubing.

2.8.2 Equipment

The following equipment is required:

- polyethylene sheeting
- PID or equivalent
- water level indicator
- logbook(s)
- decontamination supplies
- sample bottles and preservatives
- labels and shipping products
- personal protective equipment specified in HASP

2.8.3 Groundwater Sampling Procedure

Personal protective equipment will be donned in accordance with the requirements of the HASP.

1. Assemble the screen point groundwater sampler.

2. Attach the Mill-slotted screen point groundwater sampler, onto the leading probe rod.

3. Thread the drive cap onto the top of the probe rod and advance the sampler using either the hydraulic hammer or hydraulic probe mechanism. Replace the 30-centimeter (cm) rod with the 90-cm rod as soon as the top of the sampler is driven to within 15 cm of the ground surface.

4. Advance the sampler to the interval to be sampled using the hydraulic hammer. Add additional probe rods as necessary to reach the specified sampling depth.

5. Move the probe unit back from the top of the probe rods and remove the drive cap.

6. Attach the pull cap to the top probe rod, retract the probe rods, push the screen into the formation, remove extension rods from the probe rods, and measure and record the water level, allowing time for the water level to reach equilibrium.

7. Purge the groundwater until the water flows clear or the turbidity has been reduced to 50 NTUs or less. If the well is purged dry, the sample may be collected after the well recharges.

8. Collect the samples using a check valve and flexible tubing system or a dedicated bailer. Volatile compounds that degrade by aeration must be collected first. All sample bottles should be filled by allowing the water to flow gently down the inside of the bottle with minimal turbulence. Cap each bottle as it is filled.

9. Samples will be preserved, labeled, and placed immediately into a cooler and maintained at 4°C throughout the sampling and transportation period. Samples should be labeled, recorded on the chain-of-custody and shipped according to the proper procedures. Custody seals will be placed on all coolers/packages containing laboratory samples during shipment

2.9 Soil Vapor Sampling

Soil vapor sampling will be conducted in accordance with the NYSDOH "*Final Guidance for Evaluating Soil Vapor Intrusion in the State of New York, dated October 2006*" and the NYSDEC "*Draft Division of Environmental Remediation (DER)-10 Technical Guidance for Site Investigation and Remediation, dated December 2002*".

2.9.1 Equipment

The following equipment is required:

- PID or equivalent
- ¼-inch Teflon tubing
- electrical conduit putty or modeling clay
- lab-grade helium and regulator

- helium detector
- 1-gallon buckets with foam along the rim
- low-flow pump
- 60 cc syringe
- three-way valve
- bricks
- 6 Liter summa canisters with pre-set 2-hour regulators
- labels and shipping products
- personal protective equipment specified in HASP

2.9.2 Soil Vapor Probe Installation

Soil vapor probe installation at all locations will be performed according to the following procedures:

1. At each location, a Geoprobe will be used to drive stainless steel rods equipped with detachable stainless steel drive points to the desired depth (approximately 8 feet bgs).

2. Once the probe is in place, retract the drive rod slightly to expose a 6-inch sampling screen and sampling port. Insert Teflon-lined tubing through the rods and attach it to the soil gas probe just above the tip.

3. Seal the probe at the surface using electrical conduit putty.

4. The borehole will then be backfilled with sand to a minimum depth of 6 inches above the screen interval.

5. Bentonite chips or pellets will then be placed from approximately 6 inches above the screen to the ground surface and immediately hydrated. The bentonite will be allowed to set-up for a minimum of 24 hours.

2.9.3 Tracer Testing

Tracer tests will be conducted at all soil vapor locations to verify the integrity of the soil vapor probe seal. Tracer tests will be conducted according to the following procedures:

1. Set up the tracer test apparatus by first sealing the open area around the tubing with wax or bentonite.

2. A bucket is then placed upside down over the borehole with the tubing coming out through a hole at the top.

3. Helium will then be injected through a hole near the bottom of the bucket to enrich the atmosphere to at least 80% helium. The concentration of helium inside the bucket will be monitored by a helium detector located at a second hole near the bottom of the bucket.

4. Once the atmosphere is enriched to the appropriate concentration, the helium detector will then be used to check the concentration coming out of the tubing from the borehole located at the top of the bucket. If the reading is below 20 percent tracer gas, the probe seal is sufficient; proceed with sampling, as described in the following sections. If the reading is above 20 percent tracer gas, the probe seal is not sufficient; reseal the probe surface with bentonite and repeat the tracer test until the reading is below 20 percent tracer gas.

2.9.4 Soil Vapor Sampling Procedures for Offsite Analysis

Once the soil gas probe is installed and a tracer test is conducted, soil gas samples for off site analysis will be collected according to the following procedures:

1. The soil vapor samples will be collected using a laboratory-certified clean summa canister with a two-hour regulator ensuring that the sample flow rate less than 200 milliliters per minute (ml/min) to minimize outdoor air infiltration during sampling. The summa canisters will have a vacuum of 28 inches mercury (in Hg) ± 2 inches prior to the collection of the soil vapor sample.

2. Calculate the dead air volume of the tubing including the screen interval as part of the dead air volume. The poly tubing has an inside diameter of ¼ inch and a volume of 9.65 ml/foot.

3. Attach the vacuum pump and purge at least 3 dead air volumes from the tubing. Syringes will be utilized to purge the tubing if obtaining a flow rate of 200 ml/min is difficult with vacuum pump.

4. The purge volume will be screened using the PID meter. The PID readings will be observed and recorded on the appropriate field form.

5. After purging is complete, the tubing will be connected to the Summa® canister.

6. Record the initial pressure in the stainless steel Summa® canister to be used for the sample prior to connecting the tubing. The samples will be collected using laboratory-certified clean summa canisters with flow regulators and a vacuum of 28 inches Hg ± 2 inches. Vacuum readings in the canister should be approximately 28-30 in Hg. If no vacuum reading is obtained, use a different canister as this indicates the canister was not properly evacuated.

7. Connect the end of the tubing directly to the summa canister intake valve.

8. Collect the sample into the Summa® canister, which will be provided by CDM's laboratory. An additional canister and regulator will be ordered as backup. Sample flow rate will not exceed 200 ml/min.

9. When the vacuum gauge reads 5 in Hg, close the valve. Sampling is complete. A vacuum of 5 in Hg ± 1 inch must be present when sample collection is terminated

to prevent contamination during transit. Record the final pressure reading in the Summa® canister.

10. CDM personnel will label, pack and ship the samples to an ELAP-approved laboratory. The serial numbers for the summa canisters and the regulators will be recorded on the chain of custody. Custody seals will be placed on all coolers/packages containing laboratory samples during shipment.

11. The field sampling team will maintain a sample log sheet summarizing the following:

    a. sample identification.
    b. date and time of sample collection
    c. sampling height
    d. serial numbers for summa canisters and regulators
    e. sampling methods and devices
    f. purge volumes
    g. volume of soil vapor extracted
    h. vacuum of summa canisters before and after sample collection
    i. apparent moisture content (dry, moist, saturated, etc.) of the sampling zone
    j. chain of custody protocols and records used to track samples from sampling point to analysis.

It is critical to ensure that moisture does not enter the summa canister which can compromise the analytical results.

2.10 Permanent Port Sub-Slab Soil Vapor Sampling Procedures for Offsite Analysis

2.10.1 Equipment

The following equipment is required:

- PID or equivalent
- hammer drill
- 3/8-inch drill bit
- 1-inch drill bit
- ¾-inch open end wrench or medium adjustable wrench
- 2 small adjustable wrenches
- tubing cutter
- trowel or putty knife
- ¼-inch Swagelock™ female connector
- ¼-inch Swagelock™ male connector
- ¼-inch flush mount hex socket plug, Teflon coated

- ¼-inch OD stainless steel tubing
- ¼-inch OD Teflon tubing
- Teflon thread tape
- bucket
- anchoring cement
- modeling clay
- 60 cc syringe
- Sample bag
- three-way valve
- 6 Liter summa canisters with pre-set 24-hour regulators
- labels and shipping products
- personal protective equipment specified in HASP

2.10.1 Permanent Sub-Slab Soil Vapor Port Installation and Sampling Procedures

Sub-slab soil gas samples for off site analysis will be collected from permanent sub-slab ports according to the following procedures:

1. Prior to installation of the sub-slab vapor probe, the building floor should be inspected and any penetrations (cracks, floor drains, utility perforations, sumps, etc.) should be noted and recorded. Probes should be installed at locations where the potential for ambient air infiltration via floor penetrations is minimal.

2. After the slab has been inspected and the location of any subsurface utilities determined, the ambient air surrounding the proposed sampling location will be screened with a PID

3. A hammer drill with a 3/8-inch diameter drill bit will be used to drill an inner pilot hole into the concrete slab to a depth of approximately two inches.

4. Using the pilot hole as the center, drill an outer hole to an approximate depth of 1 3/8 inch using the one-inch diameter drill bit.

5. Clean any cuttings out of the hole

6. Using the 3/8” drill bit, continue to drill the pilot hole through the slab and several inches into the sub-slab material.

7. Assemble the stainless steel probe:

    a. Determine the length of stainless steel tubing required to reach from the bottom of the outer hole, through the slab, and into the open cavity below the slab. To avoid obstruction of the probe tube, insure that it does not contact the sub-slab material.

b. Attach the measured length of ¼-inch OD stainless tubing to the female connector with the swagelock™ nut and tighten the nut.

c. Insert the ¼-inch hex socket plug into the female connector. Tighten the plug. Do not over tighten.

d. Place the completed probe into the outer hole. The probe tubing should not contact the sub-slab material and top of the female connector should be flush with the surface of the slab and centered in the outer hole.

e. Fill the space between the probe and the inside of the outer hole with anchoring cement and allow to cure.

8. Wrap one layer of Teflon thread tape onto the NPT end of the male connector

9. Remove the ¼-inch hex socket plug from the female connector

10. Screw and tighten the male connector into the female connector.

11. A length of Teflon tubing is attached to the probe assembly and connected to the sample system using for purging and sample collection.

12. A three-way valve will be used to allow purging of all the lines. Flow rates for both purging and collection must not exceed 100 milliliters per minute to minimize the ambient air infiltration during sampling.

13. Purge at least 3 dead air volumes from the subsurface probe and captured in a sample bag using a 60cc syringe. PID readings will be observed from this sample and the highest reading shall be recorded on the appropriate field form.

14. Record the initial pressure in the stainless steel Summa® canister to be used for the sample prior to connecting the tubing. The samples will be collected using laboratory-certified clean summa canisters with flow regulators and a vacuum of 28 inches Hg ± 2 inches. Vacuum readings in the canister should be approximately 28-30 in Hg. If no vacuum reading is obtained, use a different canister as this indicates the canister was not properly evacuated.

15. The end of the tubing will be connected directly to the summa canister's regulator intake valve via the three-way valve. Flexible silicone tubing will be used at a minimum and as a tubing adapter only. The sample shall be collected with a 6 Liter laboratory-certified summa canister with dedicated regulator set for a 24-hour sample collection.

16. Collect the sample into the Summa® canister, which will be provided by the subcontracted laboratory.

17. When the vacuum gauge reads 5 in Hg, close the valve. Sampling is complete. A vacuum of 5 in Hg ± 1 inch must be present when sample collection is terminated to prevent contamination during transit. Record the final pressure reading in the Summa® canister.

18. CDM personnel will label, pack and ship the samples to an ELAP-approved laboratory. The serial numbers for the summa canisters and the regulators will be recorded on the chain of custody. Custody seals will be placed on all coolers/packages containing laboratory samples during shipment.

When sub-slab vapor samples are collected, the following actions should be taken to document conditions during sampling and ultimately to aid in the interpretation of the sampling results:

a. historic and current storage and uses of volatile chemicals should be identified, especially if sampling within a commercial or industrial building (e.g., use of volatile chemicals in commercial or industrial processes and/or during building maintenance);

b. the use of heating or air conditioning systems during sampling should be noted;

c. floor plan sketches should be drawn that include the floor layout with sampling locations, chemical storage areas, garages, doorways, stairways, location of basement sumps or subsurface drains and utility perforations through building foundations, HVAC system air supply and return registers, compass orientation (north), footings that create separate foundation sections, and any other pertinent information should be completed;

d. outdoor plot sketches should be drawn that include the building site, area streets, outdoor air sampling locations (if applicable), compass orientation (north), and paved areas;

e. weather conditions (e.g., precipitation and indoor and outdoor temperature) and ventilation conditions (e.g., heating system active and windows closed) should be reported; and

f. any pertinent observations, such as spills, floor stains, smoke tube results, odors and readings from field instrumentation (e.g., vapors via PID, ppbRAE, Jerome Mercury Vapor Analyzer, etc.), should be recorded.

Additional documentation that could be gathered to assist in the interpretation of the results includes information about air flow patterns and pressure relationships obtained by using smoke tubes or other devices (especially between floor levels and between suspected contaminant sources and other areas), the barometric pressure and photographs to accompany floor plan sketches.

The field sampling team should maintain a sample log sheet summarizing the following:

a. sample identification,
b. date and time of sample collection,
c. sampling depth,
d. identity of samplers,
e. sampling methods and devices,
f. soil vapor purge volumes,
g. volume of soil vapor extracted,
h. if canisters used, vacuum of canisters before and after samples collected,
i. apparent moisture content (dry, moist, saturated, etc.) of the sampling zone, and
j. chain of custody protocols and records used to track samples from sampling point to analysis.

2.11 Indoor (Ambient) Air Sampling Procedures for Offsite Analysis

2.11.1 Equipment

The following equipment is required:

- Surveyor's stand (or equivalent to place canister on)
- 6 Liter summa canisters with pre-set 24-hour regulators
- Labels and shipping products
- Personal protective equipment specified in HASP

2.11.2 Indoor Air Sampling

All indoor air samples will be collected with a 6 Liter laboratory-certified summa canister regulated for a 24-hour sample collection. Sample collection will be similar to outdoor ambient air sample collection. The summa canister will be placed in such a location as to collect a representative sample from the breathing zone at four or six feet above the floor. Personnel should avoid lingering in the immediate area of the sampling device while samples are being collected.

The New York State Department of Health *Indoor Air Quality Questionnaire and Building Inventory* shall be completed for each structure where indoor air testing is being conducted. The following actions should be taken to document conditions during indoor air sampling and ultimately to aid in the interpretation of the sampling results

a. historic and current uses and storage of volatile chemicals should be identified, especially if sampling within a commercial or industrial building (e.g., use of volatile chemicals in commercial or industrial processes and/or during building maintenance);

b. a product inventory survey documenting sources of volatile chemicals present in the building during the indoor air sampling that could potentially influence the sample results should be completed;

c. the use of heating or air conditioning systems during sampling should be noted;

d. floor plan sketches should be drawn that include the floor layout with sampling locations, chemical storage areas, garages, doorways, stairways, location of basement sumps or subsurface drains and utility perforations through building foundations, HVAC system supply and return registers, compass orientation (north), footings that create separate foundation sections, and any other pertinent information should be completed;

e. outdoor plot sketches should be drawn that include the building site, area streets, outdoor air sampling locations (if applicable), compass orientation (north), and paved areas;

f. weather conditions (e.g., precipitation and indoor and outdoor temperature) and ventilation conditions (e.g., heating system active and windows closed) should be reported; and

g. any pertinent observations, such as spills, floor stains, smoke tube results, odors and readings from field instrumentation (e.g., vapors via PID, ppbRAE, etc.), should be recorded.

Additional documentation that could be gathered to assist in the interpretation of the results includes information about air flow patterns and pressure relationships obtained by using smoke tubes or other devices (especially between floor levels and between suspected contaminant sources and other areas), the barometric pressure and photographs to accompany floor plan sketches.

The field sampling team should maintain a sample log sheet summarizing the following:

a. sample identification,

b. date and time of sample collection,

c. sampling height,

d. identity of samplers,

e. sampling methods and devices,

f. volume of air sampled,

g. vacuum of canisters before and after samples collected, and

h. chain of custody protocols and records used to track samples from sampling point to analysis.

2.12 Outdoor (Ambient) Air Sampling Procedures for Offsite Analysis

2.12.1 Equipment

The following equipment is required:

- 6 Liter summa canisters with pre-set 24-hour regulators
- Labels and shipping products
- Personal protective equipment specified in HASP

2.12.2 Ambient Air Sampling

All outdoor air samples will be collected with a laboratory-certified summa canister regulated for a 24-hour sample collection using a 6 Liter summa canister. The summa canister will be placed in such a location as to collect a representative sample from the breathing zone at four or six feet above the ground.

Personnel will avoid lingering in the immediate area of the sampling device while samples are being collected. Ambient air samples will be collected in a location of as far away as possible from any boring or dust generating activities.

The following actions will be taken to document conditions during ambient air sampling:

a. Outdoor plot sketches will be drawn that include the building site, area streets, ambient air sample locations, the location of potential interferences, compass orientation, and paved areas.

b. Weather conditions (e.g. precipitation, temperature, wind direction and barometric pressure)

c. Any pertinent observations, such as odors, reading from field instruments, and significant activities in the vicinity (e.g. operation of heavy equipment) will be recorded.

The field sampling team will maintain a sample log sheet summarizing the following:

a. sample identification,

b. date and time of sample collection,

c. sampling height,

d. identity of samplers,

e. sampling methods and devices,

f. volume of air sampled,

g. vacuum of canisters before and after samples collected, and

h. chain of custody protocols and records used to track samples from sampling point to analysis.

2.13 Decontamination

All non-dedicated, non-disposal sampling equipment and tools used to collect samples for chemical analysis will be decontaminated prior to and between each sample interval using an Alconox rinse and potable water rinse prior to reuse. Unless disposable sampling equipment is used, the equipment will be decontaminated by the following procedure:

1. Wash with the non-phosphate detergent
2. Tap water rinse
3. Methanol or acetone, rinse
4. DI water rinse
5. Air dry and wrap in aluminum foil, shiny side out

Additional cleaning of the drilling equipment with steam may be needed under some circumstances if elevated levels of contamination appear to be present using field monitoring equipment or visible stained soils. Decontamination fluids will be discharge to the ground surface unless visible sheen or odor is detected either on the equipment or the fluids, at which point the decontamination water will be contained in a 55-gal drum, staged and properly disposed.

2.14 Investigative Derived Waste

Soil cuttings and purge water will be placed and dispersed on the ground unless visible contamination or elevated PID readings are observed. If contamination is present, investigative derived waste (IDW) will be contained and analyzed to determine the appropriate disposal methods.

2.14.1Waste Sampling

Waste classification sampling will occur before the completion of site investigation activities. Representative soil samples from waste containers will be collected with a decontaminated stainless steel trowel. The aliquots will be homogenized in a stainless steel bowl and transferred to the sample container(s) for subsequent analysis. Grab samples will be collected from each container containing aqueous wastes.

The requirements for waste characterization will be determined by the disposal facility. The containers of waste will be stored in an area designated by SMP until the analytical results are received and the waste can be characterized for disposal.

2.14.2 Equipment

The following equipments are required:

- Sample containers
- Sample shipping containers with ice packs
- Paper work and packaging
- Field notebook and forms
- OVM PID
- Pre-cleaned stainless steel trowels, spoons and bowls
- COLIWASA or sample thief for liquid sampling in a container
- Health and Safety equipment as required by HASP
- Coolers

2.14.2 Waste Sampling Procedure

2.14.2.1 Soil Waste

1. Scan the sample with the OVM and record readings.
2. Collect a sample of the soil from the container using a decontaminated stainless steel trowel and place the sample in a stainless steel bowl. Homogenize the soil using the trowel. Several samples will be collected and homogenized in the steel bowl to represent each drum.
3. Remove the cap from the container
4. Fill the sample container as completely as possible by transferring the sample to the container immediately after collected the sample with a stainless steel trowel, and screening the sample with the OVM.
5. Close the sample container tightly.
6. Label the container and place it into in a cooler with bagged ice sufficient to cool the samples to 4°C.
7. Maintain Chain-of-Custody forms for samples.
8. Log the description and depth of the sample sent for analysis in the field book.
9. Record field information and sample location, including measurements from fixed points in logbook.

2.14.2.2 Aqueous Waste

1. Remove the cap from the drum containing the aqueous waste.
2. Fill a sample container(s) as completely as possible by transferring liquid sample from the waste container to the sample container with the COLIWASA (or similar), and screening the sample with an OVM.
3. Close the sample container(s) tightly.
4. Place sample container(s) in cooler with bagged ice sufficient to cool the samples to 4°C.
5. Maintain Chain-of-Custody forms.

2.15 Direct Push Well Installation

2.15.1 Equipment

The following is a list of equipment required:

- Drive rods
- Expendable drive points
- Organic Vapor Monitor (OVM)
- 1-inch ID PVC Pipe
- Schedule 40 PVC slotted wellscreen. 1-inch diameter, 0.01-inch slots, flush joint threaded
- Water Level indicator
- Drill rig/geoprobe (operated by a CDM subcontractor)
- U.S. Silica sand bankrun or "00" well gravel 6 grout seal
- Filter pack
- Cement grout
- Top and bottom cap. Top cap should be slip fit and vented
- 50-foot tape measure
- Field logbook
- Personal Protective Equipment as specified in HASP

2.15.2 Direct Push Well Installation Procedures

A subcontracted driller will perform the well installation. CDM will oversee the fieldwork.

1. Wells will be constructed of 1-inch ID PVC casings and 10-slot well screens. This will be assembled prior to installation.

2. Assemble the protective outer drive rod to the expandable drive points.

3. Thread the drive cap onto the top of the probe rod and advance the protective drive rod using either the hydraulic hammer or hydraulic probe mechanism. Replace the 30-centimeter (cm) rod with the 90-cm rod as soon as the top of the sampler is driven to within 15 cm of the ground surface.

4. Advance the drive rod to the target depth using the hydraulic hammer. Add additional probe rods as necessary to reach the specified sampling depth.

5. Lower the well assembly into the probe rod string with threaded PVC riser pipe to the bottom of the probe rod string.

6. Retract the probe rods to a point above the screen.

7. Measure and record the water level, allowing time for the water level to reach equilibrium.

8. Install a sand filter around the well screen to directly above the screen. Grain size of the sand will be appropriate for the slot size of the screen (normally 0.01-inch)

9. Install 2-foot grout penetration seal using "00" gravel or bankrun sand.

10. Insert a tremie pipe and backfill the remainder of the hole with bentonite-cement grout until it flows at the surface.

11. Square cut the well pipe below grade.

12. Install protective flushmount casing around new well.

2.16 Direct Push Well Development

All completed wells, whether the production or monitoring type, must be developed in order to facilitate unobstructed and continuous groundwater flow into the well. Well development is the process of cleaning the fines from the face of the borehole and the formation near the well screen. During any drilling process the side of the borehole becomes smeared with drilling mud, clays or other fines. This plugging action substantially reduces the permeability and retards the movement of water into the well screen. If these fines are not removed, especially in formations having low permeability, it then becomes difficult and time consuming to remove sufficient water from the well before obtaining a fresh groundwater sample because the water cannot flow easily into the well.

The development process is best accomplished for monitoring wells by causing the natural formation water inside the well screen to move vigorously in and out through the screen in order to agitate the clay and silt, and move these fines into the screen. The use of water other than the natural formation water is not recommended.

2.16.1 Development Methods

The following well development methods may be used including:

- Surge Block - A surge block is a round plunger with pliable edges such as belting that will not catch on the well screen. Moving the surge block forcefully up and down inside the well screen causes the water to surge in and out through the screen accomplishing the desired cleaning action. Surge blocks are commonly used with cable-tool drilling rigs, but are not easily used by other types of drilling rigs.

- Bailer - A bailer sufficiently heavy that it will sink rapidly through the water can be raised and lowered through the well screen. The resulting agitating action of the water is similar to that caused by a surge block. The bailer, however, has the added advantage of removing the fines each time it is brought to the surface and dumped. Bailers can be custom-made for small diameter wells, and can be hand-operated in shallow wells.

- Surging and pumping - Starting and stopping a pump so that the water is alternately pulled into the well through the screen and backflushed through the screen is an effective development method. Periodically pumping to the surface will remove the fines from the well and permit checking the progress to assure that development is complete.

Well development should continue until the water becomes free of sediment or contains sediment in a lesser amount than was initially present. Conductivity, pH, temperature and turbidity (as measured by a turbidity meter) of the development water must all have stabilized prior to ceasing development. Disposal of development water is site specific and should be discussed in the Sampling and Analysis Plan or Work Plan.

2.17 Monitoring Well Sampling

Low-flow purge and sampling is appropriate at locations where disturbance of the media around the well screen needs to be minimized. A common concern is turbidity in the monitoring wells and the consequent undesirable effects on metals sampling results.

2.17.1 Low-flow Purge and Sampling

The low-flow purge and sample method creates less disturbance and agitation in the well, and therefore excess turbidity is not generated during the purging and sampling process. The result is a more rapid stabilization of turbidity and other parameters (pH, temperature, specific conductivity, and dissolved oxygen), and a sample more representative of conditions in the formation is collected.

The low flow purge and sample method consists of using a submersible pump to purge the well at a very low flow rate (0.5 to 1.5 liter/minute). The pump intake is set approximately in the middle of the well screen, with a stagnant water column over the top of the pump. The well is purged at the low rate until the field parameters (temperature, pH, specific conductivity, turbidity, dissolved oxygen, and Eh) have stabilized. The sample is then collected directly from the pump discharge at a low flow rate.

2.17.2 Equipment

The following equipment is required:

- Filtration apparatus with 0.45 um filter
- Polyethylene sheeting
- Monitoring instrument for measuring pH, turbidity, dissolved oxygen, conductivity, temperature (Horiba U-10 or equivalent)
- Large, wide-mouth breakers for measuring field parameters
- PID or equivalent
- Electronic water level indicator or equivalent (marked in 0.01-foot increments)
- Logbook(s)

- Decontamination supplies:
- Sample bottles and preservatives
- Labels and shipping products
- Personal protective equipment specified in HASP

2.17.3 Low-Flow Sampling

The following describes the sampling procedures for the bailer sampling method. Personal protective equipment will be donned in accordance with the requirements of the HASP. Wells shall be sampled in the order of least contaminated to most contaminated.

1. Check and record the condition of the well for any damage or evidence of tampering.

2. Remove the well cap.

3. Measure well headspace with a PID and record the reading in the field logbook. For wells installed on a landfill, also measure the headspace with a combustible gas indicator.

4. Measure and record the depth to water with an electronic water level device and record the measurement in the field logbook. Do not measure the depth to the bottom of the well at this time (to avoid disturbing any sediment that may have accumulated). Obtain depth to bottom information from installation information in the field logbook or drilling logs. Calculate volume of the water column by depth of water column times the cross-sectional area of the well.

5. During purging, monitor the field parameters (temperature, pH, turbidity, specific conductance and dissolved oxygen) approximately every 3 to 5 minutes until the parameters have stabilized to within 10 percent (plus or minus 5 percent) over a minimum of three readings. Turbidity and dissolved oxygen are typically the last parameters to stabilize. Note: once turbidity readings get below 10 NTUs, then the stabilization range can be amended to 20 percent (plus or minus 10 percent) over a minimum of three readings.

6. Readings should be taken in a clean container (preferably a less beaker) and the monitoring instrument allowed to stabilize before collection of the next sample. The Horiba instrument takes the readings consecutively and therefore the process to record all the measurements may take longer than five minutes. If so, measurements should be taken as often as practicable.

7. Once the field parameters have stabilized, collect the samples from the bailer. Volatile and analytes that degrade by aeration must be collected first. All sample bottles should be filled by allowing the water to flow gently down the inside of the bottle with minimal turbulence. Cap each bottle as it is filled.

8. Samples shall be preserved, labeled, and placed immediately into a cooler and maintained at 4°C throughout the sampling and transportation period. Samples should be labeled, recorded on the chain-of-custody and shipped according to the proper procedures.

2.17.4 Decontamination

Unless disposable bailers are used, the bailer will be decontaminated by the following procedure:

1. Wash with the non-phosphate detergent
2. Tap water rinse
3. Methanol, rinse
4. DI water rinse
5. Air dry and wrap in aluminum foil, shiny side out

2.18 Well Abandonment

The well will be abandoned by a New York State certified well driller as follows:

1. The well will be sounded (its depth measured with a weighted line or appropriate method) immediately before it is destroyed to make sure that it contains no obstructions that could interfere with filling and sealing.

2. Where possible, remove all material within the original borehole – including the well casing, filter pack and annular seal. If the casing, filter pack and annular seal materials cannot be removed, they may be left in place

3. The casing left in place may require perforation or puncturing to allow proper placement of sealing materials. Where the casing is left in the hole, the casing may be cut at the surface.

4. The monitoring well should be filled to the surface with cement grout, or within 20 feet of the surface with bentonite grout. After the placement of the bentonite grout (if used), the remaining portion of the well then should be sealed with a Portland Type I, II or Type I/II cement with 2 percent to 5 percent bentonite.

2.19 Water Level Measurement Procedure

The following procedure will be used for measuring the water level from monitoring wells:

1. Clean all water-level measuring equipment using decontamination procedures.

2. Remove well cover, locking well cap, note weather, time of day, and date, etc. in field notebook, or on an appropriate form.

3. Remove well casing cap.

4. Monitor headspace of well with vapor detector (PID or OVA) to determine presence of volatile organic compounds, and record in field notebook.

5. Lower water level measuring device into well until the water surface is encountered.

6. Measure distance from water surface to reference measuring point on well casing, and record in field notebook.

7. Measure total depth of well and record in field notebook or on log form.

8. Remove all downhole equipment, replace well casing cap and locking steel caps.

9. Calculate elevation of water:

$$Ew = E - D$$

where, Ew = Elevation of Water

E = Elevation at point of measurement

D = Depth to Water

Appendix B

NYSDOH Questionnaire

NEW YORK STATE DEPARTMENT OF HEALTH
INDOOR AIR QUALITY QUESTIONNAIRE AND BUILDING INVENTORY
CENTER FOR ENVIRONMENTAL HEALTH

This form must be completed for each residence involved in indoor air testing.

Preparer's Name ______________________________________ Date/Time Prepared ______________

Preparer's Affiliation __________________________________ Phone No.______________________

Purpose of Investigation____

1. OCCUPANT:

Interviewed: Y / N

Last Name: __________________________ First Name: __________________________

Address: ____

County: __________________

Home Phone: ____________________ Office Phone: ____________________

Number of Occupants/persons at this location _______ Age of Occupants ______________________

2. OWNER OR LANDLORD: (Check if same as occupant ___)

Interviewed: Y / N

Last Name: __________________________First Name: ____________________________

Address: ____

County: __________________

Home Phone: ____________________ Office Phone: ____________________

3. BUILDING CHARACTERISTICS

Type of Building: (Circle appropriate response)

Residential	School	Commercial/Multi-use
Industrial	Church	Other: __________________

If the property is residential, type? (Circle appropriate response)

Ranch	2-Family	3-Family
Raised Ranch	Split Level	Colonial
Cape Cod	Contemporary	Mobile Home
Duplex	Apartment House	Townhouses/Condos
Modular	Log Home	Other:_______________

If multiple units, how many? ________

If the property is commercial, type?

Business Type(s) ______________________________________

Does it include residences (i.e., multi-use)? Y / N If yes, how many? ______

Other characteristics:

Number of floors______ Building age______

Is the building insulated? Y / N How air tight? Tight / Average / Not Tight

4. AIRFLOW

Use air current tubes or tracer smoke to evaluate airflow patterns and qualitatively describe:

Airflow between floors

____

____

____

Airflow near source

____

____

____

Outdoor air infiltration

____

____

____

Infiltration into air ducts

____

____

____

5. BASEMENT AND CONSTRUCTION CHARACTERISTICS (Circle all that apply)

a. Above grade construction:	wood frame	concrete	stone	brick
b. Basement type:	full	crawlspace	slab	other ________
c. Basement floor:	concrete	dirt	stone	other ________
d. Basement floor:	uncovered	covered	covered with _______________	
e. Concrete floor:	unsealed	sealed	sealed with _________________	
f. Foundation walls:	poured	block	stone	other ________
g. Foundation walls:	unsealed	sealed	sealed with _________________	
h. The basement is:	wet	damp	dry	moldy
i. The basement is:	finished	unfinished	partially finished	
j. Sump present?	Y / N			
k. Water in sump?	Y / N / not applicable			

Basement/Lowest level depth below grade: ________(feet)

Identify potential soil vapor entry points and approximate size (e.g., cracks, utility ports, drains)

____

____

6. HEATING, VENTING and AIR CONDITIONING (Circle all that apply)

Type of heating system(s) used in this building: (circle all that apply – note primary)

Hot air circulation	Heat pump	Hot water baseboard	
Space Heaters	Stream radiation	Radiant floor	
Electric baseboard	Wood stove	Outdoor wood boiler	Other ___________

The primary type of fuel used is:

Natural Gas	Fuel Oil	Kerosene
Electric	Propane	Solar
Wood	Coal	

Domestic hot water tank fueled by: ____________________________

Boiler/furnace located in:	Basement	Outdoors	Main Floor	Other___________
Air conditioning:	Central Air	Window units	Open Windows	None

Are there air distribution ducts present? Y / N

Describe the supply and cold air return ductwork, and its condition where visible, including whether there is a cold air return and the tightness of duct joints. Indicate the locations on the floor plan diagram.

____

____

____

____

7. OCCUPANCY

Is basement/lowest level occupied? Full-time Occasionally Seldom Almost Never

Level	**General Use of Each Floor (e.g., familyroom, bedroom, laundry, workshop, storage)**
Basement	____
1^{st} Floor	____
2^{nd} Floor	____
3^{rd} Floor	____
4^{th} Floor	____

8. FACTORS THAT MAY INFLUENCE INDOOR AIR QUALITY

a. Is there an attached garage? Y / N

b. Does the garage have a separate heating unit? Y / N / NA

c. Are petroleum-powered machines or vehicles stored in the garage (e.g., lawnmower, atv, car) Y / N / NA Please specify___________________

d. Has the building ever had a fire? Y / N When?__________________

e. Is a kerosene or unvented gas space heater present? Y / N Where? _________________

f. Is there a workshop or hobby/craft area? Y / N Where & Type? _________________

g. Is there smoking in the building? Y / N How frequently? ________________

h. Have cleaning products been used recently? Y / N When & Type? _________________

i. Have cosmetic products been used recently? Y / N When & Type? _________________

j. Has painting/staining been done in the last 6 months? Y / N Where & When? ________________

k. Is there new carpet, drapes or other textiles? Y / N Where & When? ________________

l. Have air fresheners been used recently? Y / N When & Type? _________________

m. Is there a kitchen exhaust fan? Y / N If yes, where vented?_____________

n. Is there a bathroom exhaust fan? Y / N If yes, where vented?_____________

o. Is there a clothes dryer? Y / N If yes, is it vented outside? Y / N

p. Has there been a pesticide application? Y / N When & Type?__________________

Are there odors in the building? Y / N
If yes, please describe: ____

Do any of the building occupants use solvents at work? Y / N
(e.g., chemical manufacturing or laboratory, auto mechanic or auto body shop, painting, fuel oil delivery, boiler mechanic, pesticide application, cosmetologist

If yes, what types of solvents are used? ____

If yes, are their clothes washed at work? Y / N

Do any of the building occupants regularly use or work at a dry-cleaning service? (Circle appropriate response)

Yes, use dry-cleaning regularly (weekly) No
Yes, use dry-cleaning infrequently (monthly or less) Unknown
Yes, work at a dry-cleaning service

Is there a radon mitigation system for the building/structure? Y / N Date of Installation: _____________
Is the system active or passive? Active/Passive

9. WATER AND SEWAGE

Water Supply: Public Water Drilled Well Driven Well Dug Well Other: ________

Sewage Disposal: Public Sewer Septic Tank Leach Field Dry Well Other: ________

10. RELOCATION INFORMATION (for oil spill residential emergency)

a. Provide reasons why relocation is recommended: ____

b. Residents choose to: remain in home relocate to friends/family relocate to hotel/motel

c. Responsibility for costs associated with reimbursement explained? Y / N

d. Relocation package provided and explained to residents? Y / N

11. FLOOR PLANS

Draw a plan view sketch of the basement and first floor of the building. Indicate air sampling locations, possible indoor air pollution sources and PID meter readings. If the building does not have a basement, please note.

Basement:

First Floor:

12. OUTDOOR PLOT

Draw a sketch of the area surrounding the building being sampled. If applicable, provide information on spill locations, potential air contamination sources (industries, gas stations, repair shops, landfills, etc.), outdoor air sampling location(s) and PID meter readings.

Also indicate compass direction, wind direction and speed during sampling, the locations of the well and septic system, if applicable, and a qualifying statement to help locate the site on a topographic map.

13. PRODUCT INVENTORY FORM

Make & Model of field instrument used: ____

List specific products found in the residence that have the potential to affect indoor air quality.

Location	Product Description	Size (units)	Condition*	Chemical Ingredients	Field Instrument Reading (units)	Photo ** Y / N

* Describe the condition of the product containers as **Unopened (UO), Used (U),** or **Deteriorated (D)**
** Photographs of the **front and back** of product containers can replace the handwritten list of chemical ingredients. However, the photographs must be of good quality and ingredient labels must be legible.