COVERSHEET
STANDARD OPERATING PROCEDURE

Operation Title: Compendium of Field Testing of Soil Samples for Gasoline and Fuel Oil

Originator Name(s): Fred Lavallee, Rob Peale and Troy Smith, Division of Technical Services, Bureau of Remediation & Waste Management

APPROVALS:

Bureau Director:

Ronald E. Dyer
Print Name

Signature

Date: 10-22-12

Quality Assurance Manager:

George M MacDonald
Print Name

Signature

Date: 10-24-12

Commissioner:

Patricia W. Aho
Print Name

Patricia W. Aho
Signature

Date: 10/25/2012

DISTRIBUTION

( ) Bureau of Air Quality.....By:____ Date:_____
( ) Bureau of Land and Water Quality.....By:____ Date: _____
( ) Bureau of Remediation & Waste Management.....By:____ Date:_____
( ) Office of the Commissioner.....By:____ Date: _____
( ) Quality Management Steering Committee.....By: ____ Date: _____

COVERSHEET
STANDARD OPERATING PROCEDURE

Operation Title: COMPENDIUM OF FIELD TESTING of SOIL SAMPLES for GASOLINE and FUEL OIL

Originators: Fred Lavallee, Rob Peale, Troy Smith and Deb Stahler
Division of Technical Services
Bureau of Remediation and Waste Management
Department of Environmental Protection

Revision Editors: Fred Lavallee, Rob Peale, and Troy Smith
Division of Technical Services
Bureau of Remediation and Waste Management
Department of Environmental Protection

Standard Operating Procedure: TS004
REVISION: 2.1
DATE: October 15, 2012

George Seel — Signature — 10/22/12 — Date
Oil Program Manager

Definition of Acronyms

Acronym	Definition
AOC	Area of Concern
AST	Aboveground Storage Tank
BRWM	Bureau of Remediation and Waste Management
CSM	Conceptual Site Model
CSS	Confirmation Screening Sample
DQO	Data Quality Objective
DR	Division of Remediation
EDD	Electronic Data Deliverable
EGAD	Environmental and Geographic Analysis Database
EPS	Expanded Polystyrene
ESA	Environmental Site Assessment
ESS	Excavation Screening Sample
FGS	Feet below Ground Surface
GW	Groundwater
LS	Laboratory Sample
LUST	Leaking Underground Storage Tank
^{o}F	Degrees Fahrenheit
PID	Photo Ionization Detector
PPM	Parts Per Million
PPMV	Parts Per Million by Volume
QAP	Quality Assurance Plan
RAG	Remedial Action Guideline
REC	Recognized Environmental Condition
RS	Response Services
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
TS	Technical Services
UST	Underground Storage Tank

1.0 PURPOSE

The purpose of this document is to describe the Maine Department of Environmental Protection, Bureau of Remediation and Waste Management (BRWM) procedure for petroleum field testing of soils.

2.0 APPLICABILITY

BRWM is responsible for the investigation and remediation of petroleum sites throughout Maine. The procedures described herein are field tests for (1) determining relative levels of gasoline present in soil with a PID instrument and (2) screening soils contaminated with kerosene and fuel oil using an oleophilic dye test. Under certain conditions where soil contact scenarios focus on the excavation-construction worker exposure scenario below two feet, a third screening technique identified as the Water Shake Test can be used as an acceptable substitute for the PID and Oleophilic Dye Test as explained below.

The **PID Bag Headspace Test** is applicable only for soils contaminated with gasoline. It is not applicable for heavier petroleum products such as kerosene or fuel oil.

The **Oleophilic Dye Test** is applicable for fuel oils. It is not applicable for use with heavy crude oils (Bunker C) or bituminous materials like asphalt or waxes. Mineral oil and motor oils may be detected; however, the detergents in some synthetic motor oils may interfere with color development.

Both tests are needed to screen soils for gasoline and fuel oils at sites contaminated with mixed or unknown petroleum products.

When these procedures are strictly followed results may be used to make key field decisions and provide information for site assessments.

The **Water Shake Test** is applicable only when leaching to groundwater is NOT a risk pathway of concern, the direct contact risk is limited to the excavation construction worker, and the soils are deeper than two-feet below the land surface. Under these conditions the Water Shake Test can replace the PID Bag Headspace Test and the Oleophilic Dye Test methods.

3.0 RESPONSIBILITES

All staff must be appropriately trained prior to performing these tests for the investigation of petroleum sites and that training must be documented in accordance with the LUST QAP (http://www.maine.gov/dep/rwm/ust/lustqaplan.htm). Generally, it is the field personnel of BRWM/Technical Services (BRWM/TS), BRWM/Response Services (BRWM/RS) and BRWM/Remediation (BRWM/DR) who will be responsible for performing these tests.

The directors of the Divisions of Response Services, Technical Services and Remediation as well as all supervisors in those divisions are responsible for ensuring that staff understand and adhere to these procedures when used for key field decisions or site assessments.

4.0 INTRODUCTION

This SOP includes three field tests for petroleum along with guidance for their application for site work.

For the **PID Bag Headspace Test**, a soil sample is placed in an approved container and the volatile constituents are allowed to come to equilibrium. The headspace is then measured with an isobutylene calibrated PID, with a result expressed in parts per million by volume (PPMV).

For the **Oleophilic Dye Test**, soil is added to the sample bottle, to which oil-free water is also added and the contents shaken vigorously with a rapidly dissolving red or blue oleophilic dye.

The oleophilic dye stains petroleum products red (or blue). When petroleum is released from the soil it attaches to an expandable polystyrene (EPS) bead and/or attaches to the walls of the container. Where no visible oil layer is present the bead will turn pink or blue down to the limit of detection which is about 500 ppm.

For the **Water Shake Test** soil and water are added to a clear glass container, shaken, and the presence of free petroleum blebs or a petroleum layer can be seen.

5.0 PLANNING

As with any sampling event, a sampling and analysis plan (SAP) and a health and safety plan (HASP) should be developed. Guidance for the development of a Sampling and Analysis Plan can be found in DR SOP #014 – Development of a Sampling and Analysis Plan (http://www.maine.gov/dep/rwm/sops/index.htm).

Processing one headspace sample will take up to 30 minutes from initial sample collection through recording results. It is important to plan for someone to complete the sampling and analysis in a careful and timely fashion for results to be useful. For some projects more than one field person may be needed.

6.0 EQUIPMENT

6.1 The following equipment is required for conducting the PID Bag Headspace Test for gasoline:

- Soil sampling equipment such as shovel, bucket auger, soil borer, scoops; 200g container (6 ounce can), 20g and 5g soil coring devices.
- Approved containers: Bags are made from a double layer of strong metalized polyester and low-density polyethylene (3 mil) with dimensions: 8-1/2" x 12" stand-up zipper pouch with 3-1/2" bottom gusset.

  *Note: Associated Bag Company Item Number 183-52 meets these requirements. Other products may be acceptable. Standard re-sealable plastic bags such as sandwich or freezer bags are **not** acceptable because they do not adequately prevent the loss of gasoline vapors.*
- An approved PID with a lamp energy of 10.2 to 10.6 eV; and
- Calibration equipment, including users' manual, for particular PID to be used.

6.2. The following equipment is required for conducting the Oleophilic Dye Test for fuel oils:

- Soil sampling equipment such as shovel, bucket auger, soil borer, scoops;
- 50 ml plastic sample bottles containing appropriate dyes and EPS bead. Kits from two commercial test kit companies, Oil-In-Soil and OilScreenSoil have been successfully tested

by MEDEP for use according to this SOP. Red dyes are preferred, but Indigo Blue kits are available for use when soil color interferes with interpretation of red dye test kits; and

- Oil-free water

6.3. The following equipment is required for conducting the Water Shake Test:

- Clear container with cover; and
- Oil free water.

7.0 PROCEDURE for PID BAG HEADSPACE

7.1. Instructions for use of a PID can be found in Division of Remediation SOP DR#019 – Protocol for Use of a PID/FID (http://www.maine.gov/dep/rwm/sops/index.htm). It is recommended that the operator that will be conducting this procedure take the time before the sampling event to familiarize themselves with the particular instrument that will be used, if they are not already familiar with that instrument. This includes reviewing the specific user manual, and calibration and practice with the instrument prior to the sampling event.

7.2. The PID must be bump tested prior to each use, at least every two hours during use, and at the end of the day. If the bump test falls outside 100±10 PPM, the lamp should be cleaned and the filter changed. If repeat bump testing remains outside 100±10 PPM the instrument should be re-calibrated. Record all bump test results. The PID must be calibrated to isobutylene according to manufacturer instructions. Check the calibration ("bump test") against the 100 PPM isobutylene standard and record the results.

Note: No calibration adjustment or correction of instrument readings is made for set points; the response factor should be 1.0 for all instruments.

7.3. Evaluate PID high concentration performance before arriving at the site each day of use. This can be accomplished by measuring the headspace over pure acetone or other suitable substance that normally produces values higher than the Outdoor Commercial Worker/ Excavation-Construction Worker screening number from Table 1. The PID must not be used for site work if performance does not meet the expectation.

7.4. Collect the soil sample with appropriate soil sampling equipment, as outlined in the site specific Sampling and Analysis Plan (SAP)(See SOP DR#014 - Development of a Sampling and Analysis Plan) or the applicable Appendix to this SOP.

- Do test in triplicate (at a minimum), taking co-located samples. True replicates are difficult to collect. It is important to collect at least three samples when using the results to make key field decisions.
- Label and open the bags. Unfold the bottom gusset in each bag to facilitate a uniform headspace volume when the bags are closed. This is particularly important for smaller sample sizes.
- Place appropriate mass of soil in aluminized bag.
    - For Leaching to Groundwater cleanup scenarios use 200 g soil (6 oz can)
    - For Resident or Park User cleanup without regard to groundwater use 20 g soil (20 ml syringe or plug sampler)
    - For Outdoor Commercial Worker/ Excavation-Construction Worker cleanup scenarios use 5 g soil (5 ml syringe or plug sampler)

- Close bag leaving uniform headspace.
- Knead samples (in closed bag) if needed to break up clumps, then shake bags for 30 seconds.
- Thaw sample if frozen.
- Let stand for 10 minutes to develop headspace.
- Knead/shake bags for additional 30 seconds.
- Let stand for 2 minutes. Do not let samples stand for more than a total of 30 minutes before PID measurement. Gasoline vapors can migrate through bags. Testing indicates up to 20% loss after sitting for 60 minutes at 70^{o}F in the metalized bags.
- Open bag carefully and insert probe of calibrated PID one third to half way into bag (approximately 4 inches). Keep bag seal closed as much as possible around probe.
- Allow instrument to read until concentrations start to fall.
- Record highest sustained reading.
- Repeat for additional bags.

7.5. Result Interpretation

- Table 1 presents field cleanup guidelines for the various exposure scenarios. Values in Table 1 are dependent on sample size and PID model. Only approved PID models may be used. Remediation is indicated if the average sample result is at or above the Table 1 value for the site's cleanup scenario.
- Excavation Screening Samples (ESS) and other samples where only one bag per sample is tested: compare results to Table 1 values.
- Confirmation Screening Samples (CSS) and other samples where more than one bag per sample is tested: Average the three (or more) sample results and compare to Table 1 values.
- Alternatively, a PID can be calibrated to a gasoline contaminated site if sufficient laboratory MA VPH sample data are available for comparison. Any alternative calibration must follow a Department approved plan.

8.0 PROCEDURE FOR FUEL OIL OLEOPHILIC DYE TEST

8.1 Collect the soil sample with appropriate soil sampling equipment, as outlined in the site specific Sampling and Analysis Plan (SAP)(See SOP DR#014 - Development of a Sampling and Analysis Plan) or the applicable Appendix to this SOP.

8.2 Perform test as follows:

- Add soil to sample bottle (50 ml plastic sample bottles containing appropriate dyes and EPS bead) according to manufacturer's instructions;
- Label bottle;
- Add oil free water to sample bottle according to manufacturer's instructions;
- Shake vigorously until dye cube dissolves (about 30 seconds);
- Allow sample to sit for 10 minutes for color development on bead;
- Use indigo blue dye when results are inconclusive with red dye.

8.3 Results are reported as saturated, positive, slightly positive and undetected as described below:

- **Saturated** when obvious red (or blue) dye is observed in the soil matrix, or in/on the water (may stain the side of the jar);
- **Positive** when only the EPS bead is dyed dark pink/ red or blue and there is no coloration in the soil or water;
- **Slightly Positive** when only the EPS bead is dyed light pink or blue and there is no coloration in the soil or water; or
- **Undetected** when there is no coloration in the soil or water and the EPS bead remains white.

8.4 Results are interpreted as described below:

- **Undetected** result indicates no cleanup is required unless laboratory results indicate an exceedance of a leaching to groundwater exposure criteria.
- **Positive/ Slightly Positive** result indicates cleanup is needed for leaching to groundwater, excavations less than 200 cubic yards, and resident/park user scenarios.
- **Saturated** results indicate cleanup is needed for leaching to groundwater, resident/park user and outdoor commercial/ excavation-construction worker scenarios.

Note: Testing performed to date indicates that an Undetected result will be protective of leaching to groundwater in most cases. Laboratory analyses may be needed to ensure all guidelines are met. The Department will continue to collect and review results to evaluate whether or not this test may be used to determine when cleanup is needed for leaching to groundwater scenarios.

9.0 PROCEDURE FOR WATER SHAKE TEST

9.1 Collect the soil sample with appropriate soil sampling equipment, as outlined in the site specific Sampling and Analysis Plan (SAP)(See SOP DR#014 - Development of a Sampling and Analysis Plan) or the applicable Appendix to this SOP.

9.2 Perform test as follows:

- Add soil to clear glass container, approximately 1/3 container volume;
- Label bottle;
- Add oil free water to container, to fill approximately 1/2 container volume;
- Shake vigorously for approximately 30 seconds;
- Allow sample to sit for 10 minutes;
- Make observation of any NAPL.

9.3 Results are reported as Observed NAPL (ON) or No Observed NAPL (NON)

- **Observed NAPL** when a NAPL layer or blebs is observed on or below the water surface;
- **No Observed NAPL** when no NAPL is present or only a sheen is observed.

9.4 Results are interpreted as described below:

- **Observed NAPL:** oil or gasoline saturated soil is present;
- **No Observed NAPL:** oil or gasoline saturated soil is not present.

Note: The Water Shake Test is only applicable for sites where leaching to groundwater is not a risk pathway of concern, soils are below two-foot depth, and when resident, park user, or commercial worker scenarios are NOT applicable.

10.0 QUALITY ASSURANCE/QUALITY CONTROL

All field tests must be completed and documented according to these written procedures.

Samples will be collected in accordance with a site specific sampling plan or as outlined in the applicable appendix to this SOP.

PID calibration must be checked at the beginning and end of each day and every two hours while testing is performed. Results must be 100±10 PPM for initial calibration check. If the initial check falls outside 100±10 PPM, the lamp should be cleaned and the filter changed. If repeat bump testing remains outside 100±10 PPM the PID should be recalibrated. All recalibration and calibration checks (bump tests) must be documented on the field sheet or in the field notebook.

PID high concentration performance must be evaluated and documented before each day of use, as described in Section 7.3.

All PID Bag Headspace samples used for key field decisions or assessments performed for compliance to Chapter 691 rules must be taken in triplicate (at a minimum).

Quality control samples will be taken in accordance with the LUST QAP.

Additional quality assurance/quality control tasks may be needed based on the DQO requirements of the project.

11.0 DOCUMENTATION

Field notes should be collected following the standard procedures as outlined in 6.0 of the LUST QAP. When documenting such a sampling event, one should include enough information so that a person at a later date can easily duplicate the sampling and be able to compare the results. Any deviations from these procedures must be documented.

Record results for the PID bag headspace test on the form provided in Attachment 1. Results may alternatively be recorded in the field notebook as long as all information from Attachment 1 is recorded. Additionally, some PIDs have software which can record data. Any special method of recording and documenting results must be outlined in the SAP.

Record results for the oleophilic dye test and/or water shake test on the form provided in Attachment 2. Results may alternatively be recorded in the field notebook as long as all information from Attachment 2 is recorded.

Results for CSS with corresponding laboratory analysis should be submitted to the Department in the Maine DEP electronic data deliverable [EDD] format. Excel spreadsheets (http://www.maine.gov/dep/rwm/ust/sop/EDD_Oil_Field_Sheets_blank.xls) for use specifically with these field tests as well as laboratory EDD spreadsheets (http://www.maine.gov/dep/rwm/egad/ME_DEP_EGAD_EDDv5.1_FINAL_rhd.xls) are available from Maine DEP. The Excel spreadsheets for these field tests follow the format of Attachment 1 and Attachment 2. Note: Submission of EDD should not include ESS field screening results.

Only CSS with the corresponding laboratory results should be submitted for uploading to the Environmental and Geographic Analysis Database [EGAD].

Table 1: Approved PID Field Cleanup and Notification Guidelines

Cleanup Scenario	Soil size [grams]	Ion	Thermo	Passport	Foxboro	MiniRAE	Photon
Leaching to GW/ Notification	200	80	60	60	50	40	40
Resident/ Park User	20	700	275	500	250	350	300
Outdoor Commercial Worker/ Excavation-Construction Worker	5	1200	500	850	375	1500	400

Note: No adjustment is made for set points; the response factor should be 1.0 for all instruments.

Instrument Descriptions

Ion: Ion Science PhoCheck Series

Thermo: Thermo Environmental OVM 580 Series

Passport: MSA Passport PID II OVM

Foxboro PID: Foxboro TVA-1000 PID mode

MiniRAE: RAE Systems MiniRAE 2000 and MiniRAE 3000

Photon: MSA Photon Gas Detector

TS004 Bag Headspace Field EDD Sheet									
Site Name:							Spill #		
Town:							Sampler:		
Air Temperature:		Date:					Sample Method		
Calibration Gas Concentration:							Soil Heating Method:		
Confirm high end measurement:							PID Instrument:		
Calibration Documentation				**Bump Test Documentation**				Weather:	
Time 1:		Reading 1:		Time 1:		Reading 1			
Time 2:		Reading 2:		Time 2:		Reading 2			
Time 3:		Reading 3:		Time 3:		Reading 3			

Calibration Documentation readings above should be post-calibration readings

Sample ID	Depth [FGS]	Sample Size	Collection Time	Analysis Time	Bag-1	Bag-2	Bag-3	Average	Soil Type	CSS Location	Comments

TS004 Oil Shake Test Field/Water Shake Test Field EDD Sheet					
Site Name:				Town:	
Date:			Sample Method:		
Spill #				Sampler:	
Ambient Temperature:				Weather:	
Sample ID	Depth [FGS]	Result	Soil Type	CSS Location	Comments

SA = Saturated- obvious red (or blue) dye is observed in the soil matrix, or in/on the water (may stain the side of the jar)
PO = Positive- the EPS bead is dyed dark pink/ red or blue and there is no coloration in the soil or water
SP = Slightly Positive- the EPS bead is dyed light pink or blue and there is no coloration in the soil or water
U = Undetected - No observations of dye coloration on EPS bead, soil, or water
NON = No Observed NAPL for Water Shake Test
ON = Observed NAPL for Water Shake Test

Field Sampling Procedure for Excavations

Appendix A is to be used at soil removals and excavations where the data quality objective is to meet the Soil Exposure Guidelines in Section 5 of the Remediation Guidelines for Petroleum Contaminated Sites in Maine. Appendix A is not intended for remediating releases under Section 3 of the Remediation Guidelines for Petroleum Contaminated Sites in Maine. The basis of this procedure is that field samples will be used to direct soil excavation and confirm that field screening objectives are met prior to terminating the excavation and collecting laboratory samples. The following procedure should be followed when the objective is to determine excavation limits based on field screening. The following procedure is not intended to override the Conceptual Site Model (CSM) or other site specific objectives for the removal action. If termination of the excavation is not based on field screening procedures, then the reasons should be clearly presented in post removal documentation. A site specific sampling plan that differs from this procedure may be applied if approved in advance by the Department.

This procedure uses three types of samples as defined below. The sample type definitions are provided to help clarify what is meant by terms used in this document.

Excavation Screening Samples (ESS). Use ESS to define soils to be removed. These are field screened samples generally collected to help direct the soil excavation (see Appendices B and C for other uses). These samples may represent soils that are removed during an excavation because they exceed the field screening guidelines, or they may represent soils that remain in place. Triplicate sampling is not required for PID Bag Headspace test of ESS for this application. Documentation of the ESS is at the discretion of the Environmental Professional completing the sampling.

Confirmation Screening Samples (CSS). CSS should identify areas of the excavation where cleanup objectives have been reached or where site limitations prevent further excavation. These field screened samples should represent worst case contaminated soils, if still present, that remain in place. Triplicate samples are required for Bag Headspace test of CSS. CSS must be documented and include all information presented in Attachment B.

Laboratory Samples (LS). These are lab samples that are collected at the termination of the excavation and represent worst case contaminated soils, if still present, that remain in place. They are collected at a rate of 1 - LS per 10 - CSS. Please remember, you can collect as many excavation screening samples as you need to help direct the excavation without collecting any LS. However, once you have reached the limits of the excavation and CSS are collected, then a minimum of one LS will be collected for each ten CSS collected. The LS should be co-located with the corresponding CSS location or locations, and should be collected where the most contaminated soil was present during the excavation process.

CONCEPTUAL SITE MODEL [CSM]

The Appendix A procedure is intended to fit within the context of the CSM when the objective for the site is to complete an excavation based on field screening methods described in this SOP. In cases where the CSM justifies variation from the procedure outlined in Appendix A, the CSM must be presented in written form and included in the post removal document that is available for future investigators. The CSM should also be included in the site specific sampling plan submitted for Department approval when variation from the Appendix A procedure is appropriate. The CSM must include a concise explanation of the sources present at the site and on adjoining properties (surface spill, AST, UST, product piping, loading rack, and fuel dispensers); receptors (on-site and off-site); and the risk scenario (Leaching to Groundwater,

Resident/Park User, Outdoor Commercial Worker/Excavation-Construction Worker). Keep in mind that the risk scenario may change if contamination extends onto an adjoining property.

SAMPLING STRATEGIES

During the soil removal various sampling strategies can be utilized to expedite decision making. For example, a large sample (full bag) can be collected from the excavation and brought to a work table for processing. For gasoline contaminated sites, an initial PID screening of the soil (quick bag headspace with a 1-minute headspace equilibration) can be done to determine the relative concentration of gasoline contamination that is present. If the initial screening shows that results are above the termination criteria then no further processing may be necessary and the soil in the bag can be placed in a truck for disposal. If the initial screening determines that the concentrations may be near the termination criteria, then triplicate samples can be prepared. This sampling strategy requires quick processing and handling. Triplicate samples should be prepared within a few minutes of collecting the large sample volume from the excavation.

SAMPLE FREQUENCY

Excavation Screening Sampling (ESS)

The sampling frequency and documentation of ESS is up to the discretion of the environmental professional responsible for directing the excavation. Once the environmental professional determines that sufficient soils have been removed, CSS should be collected to document the decision to terminate excavation.

Confirmation Screening Samples (CSS)

The collection of CSS is separated into specified depth intervals to account for direct contact risks and risks associated with contaminant migration (oil saturated soils, free-product, or leachable to groundwater). The specified depth intervals are based on the definitions of *Accessible, Potentially Accessible,* and *Isolated Soil* included in The Maine Remedial Action Guidelines (RAGs) for Soil Contaminated with Hazardous Substances. The top two feet is defined as *accessible soil* and represents that greatest potential for direct contact and ingestion risk. Therefore, samples are required for determining the risks in the upper two feet. Below two feet the soils are considered *potentially accessible* to a depth of 15-feet unless the soils are covered by a building or other permanent structure that does not have earthen floors. Below 15-feet the soils are considered *isolated* for contact risk, but may represent a groundwater leaching pathway.

Lab Samples (LS)

LS frequency is set at 10% of total CSS analyzed for the excavation. LS should be co-located with a CSS and documentation of the co-located samples should be clear for future investigators.

MINIMUM SAMPLE LOCATIONS

Excavation Wall Sampling

Top Two Feet of Excavation

A minimum of one CSS is required in the top two feet for each twenty-foot section of excavation exposure. The excavation exposure is the total perimeter distance of the excavation.

Two to Fifteen Feet of Excavation Depth

A minimum of one CSS is required for each twenty linear feet of excavation perimeter.

Greater than Fifteen Feet of Excavation Depth

A minimum of one CSS is required for each additional ten feet of depth by 20 linear feet of excavation perimeter.

Floor Sampling

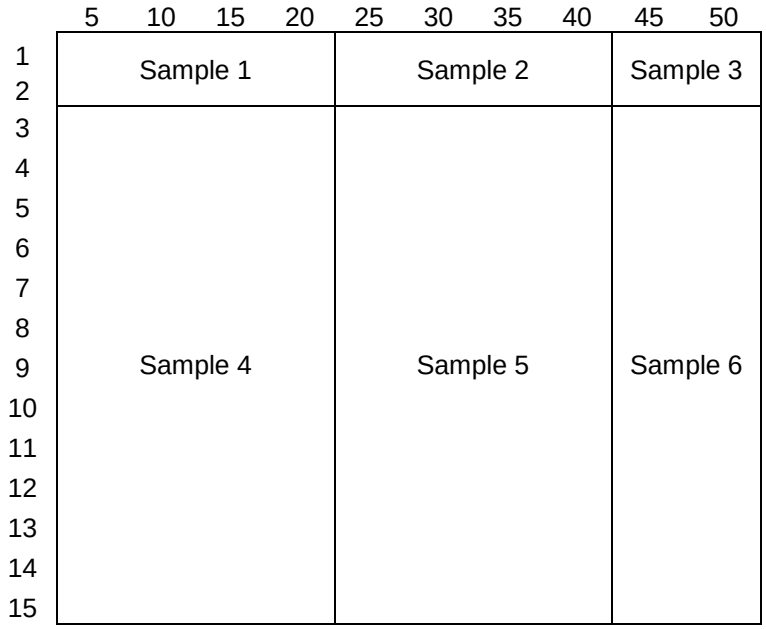
On the floor, a minimum of one CSS sample shall be collected for each 100-square feet of floor exposure (10 x 10). Keep in mind that due to side wall sloping, the floor exposure is likely to be smaller than the foot print of the excavation.

EXAMPLE

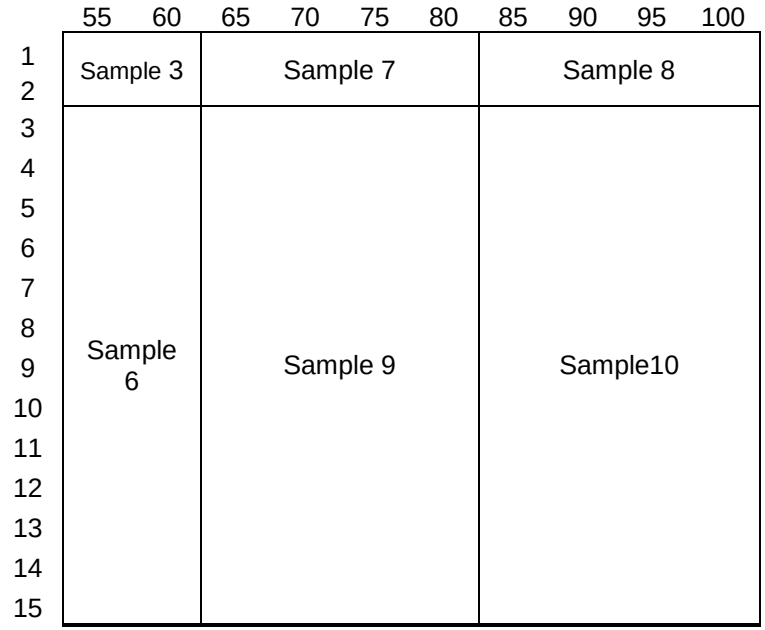
An excavation oriented north-south that is 50-feet long, 50-feet wide, and 15-feet deep represents a removal of approximately 1,400 cubic yards (Figure 1). The perimeter measures 200-feet and the walls are vertical to keep things simple. This excavation would require a minimum of 45 CSS locations as shown below. The 45 CSS included: ten CSSs from 0-2 feet, ten samples from 2-15 feet, and 25 samples from the floor. This example would require a minimum of 5 LS.

Sampling Plan for 50’L x 50’W x 15’D Excavation

North Wall: 50-feet long, 15 feet deep



East Wall 50 feet long, 15 feet deep



South Wall: 50-feet long, 15 feet deep

	105	110	115	120	125	130	135	140	145	150
1	Sample 11				Sample12				Sample13	
2										
3	Sample 14				Sample 15				Sample16	
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										

West Wall 50 feet long, 15 feet deep

	155	160	165	170	175	180	185	190	195	200
1	Sample 13		Sample 17				Sample 18			
2										
3	Sample 16		Sample 19				Sample 20			
4										
5										
6										
7										
8										
9										
10										
11										
12										
13										
14										
15										

Floor Of Excavation is 50-feet long and 50-feet wide

	5	10	15	20	25	30	35	40	45	50
5	Sample 21		Sample 22		Sample 23		Sample 24		Sample 25	
10										
15	Sample 26		Sample 27		Sample 28		Sample 29		Sample 30	
20										
25	Sample 31		Sample 32		Sample 33		Sample 34		Sample 35	
30										
35	Sample 36		Sample 37		Sample 38		Sample 39		Sample 40	
40										
45	Sample 41		Sample 42		Sample 43		Sample 44		Sample 45	
50										

Field Sampling Procedures for Environmental Site Assessment [ESA] Investigations

1. Introduction

The purpose of this appendix is to provide for application of the field procedures to ESAs, which include Phase II assessments, property transactions, or similar environmental investigations. This procedure focuses on analyzing surface and subsurface soil samples. Sample collection methods may include backhoe/excavator, split spoon, direct push, bucket auger, or hand tools.

Results of the field methods can be used for selecting samples for laboratory analyses, determining if DEP notification levels have been exceeded, and for making risk-based decisions for the site.

In situations where the field methods will be used to make risk-based decisions, a site specific sampling plan must be developed prior to completing the field investigation to assure that the appropriate risk-based criteria and field methods are applied to the site.

This procedure specifies methodologies for field screening to make risk-based decisions and DEP notification determinations. This procedure also specifies methodologies for using field screening to select laboratory samples where decisions are based on the laboratory results and not the field results.

This procedure establishes certain documentation requirements for recording the soil sampling method used to obtain samples.

The method or methods selected for field screening will depend on the scope of the investigation and the contaminants of concern. In general the oleophilic dye test is for determining the presence of petroleum saturated soil or for determining the relative concentration of diesel, fuel oil, or kerosene contamination present. The PID bag headspace test is appropriate to determine the relative concentration of gasoline contamination, and may be useful in detecting the presence of fuel oil or kerosene contamination but it cannot be used to determine the absence of fuel oil or kerosene.

2. Sampling Purpose

DEP staff and other environmental professionals using the field methods must understand the purpose for collecting the samples prior to completing the Environmental Site Assessment (ESA). The purpose for sample collection will determine how to apply the procedures at a specific site. It is strongly recommended that historical research be performed and a sampling plan be developed for all ESAs by a qualified environmental professional.

2.1 Field Screening for Laboratory Analyses

The field procedures may be used to select samples for appropriate laboratory analyses (VOC, SVOC, VPH, EPH, lead, etc.). Under this approach, the procedures will be used to determine the relative presence of VOCs detectable with the selected PID and/or the relative presence of middle distillate SVOCs detectable with the oleophilic dye test. However, risk-based decisions will not be based on the field screening methods. Instead risk-based decisions will be based on the laboratory results. PID bag headspace samples collected for this purpose are not required to be completed in triplicate.

Note: the sample volume used for screening should be based on the linear range of the PID selected. Based on the Department's experience the approximate limit of linearity is 10% higher than the Table 1 Outdoor Commercial Worker/ Excavation-Construction Worker Scenario field cleanup guidelines regardless of sample size.

2.2 Field Screening for DEP Notification

The field procedures may be used to determine if the DEP notification level at petroleum sites has been exceeded. Appendix C discusses the application of the field procedures to the UST Site Assessment process. Section 2.2 applies where the screening is not related to an UST site assessment but the ESA is being completed to determine if DEP notification is warranted. For this purpose, PID bag headspace samples will be collected in metalized bags in triplicate with all three samples targeting the same depth (see sample methodology Section 3 for additional discussion). Sample size will be 200 grams as specified on Table 1, page 8 of the SOP.

2.3 Field Screening for Risk-Based Decisions

The field screening procedures may be used as a basis for making risk-based decisions at petroleum sites. DEP staff and other environmental professionals should determine the appropriate exposure scenario (leaching, resident, park user, commercial, excavation) for the project based on the CSM, the appropriate sample depth criteria (accessible, potentially accessible, and isolated), and the applicability of institutional controls to limit future exposure. Select the appropriate PID bag headspace soil sample size(s) for the project given the above criteria. ESSs (as defined in Appendix A) can be used to determine the distribution of contamination within each separate source area (may also be referred to as an area of concern or recognized environmental condition). PID bag headspace CSSs, collected in triplicate, targeting the appropriate depth (based on the CSM, ESS results and exposure scenario) can be used to make risk-based decisions about gasoline contamination within potentially contaminated areas at the site. LS will be based on the number of CSS (1 LS for every 10 CSS).

3. Sampling Methodology

Documentation of the sampling method used must be included with the data in the ESA report. Excavators, backhoes, and hand tools all have the ability to expose relatively large volumes of soil for direct examination and sample collection. However, subsurface soil borings rely on small sample volumes to represent subsurface conditions. Therefore, different sample methodologies are warranted as presented below.

3.1 Hand Tools, Excavator, Backhoe

Triplicate and co-located samples can be selected with more reliability using direct excavation techniques such as test pits than from soil borings. Therefore, the sampling methodology is the same as presented in Appendix A.

3.2 Subsurface Soil Borings

Due to the limitations in sample recovery and direct observation of the subsurface conditions several soil borings may be required to reliably use the field screening procedures to characterize subsurface conditions. The number of soil borings is site specific and depends on the soils present, the size of the area being investigated and the ability of the equipment to recover representative samples. Sample recoveries less than 60% will require alternative methods to use the field screening techniques for making risk-based decisions. Alternative sampling methods may include shortening the sample length to increase soil recovery in a target interval. For example where a 4 foot core barrel is in use, it could be driven and recovered twice to collect 2 two-foot samples over a four-foot interval. Depending on the soil type, this may result in better sample retrieval than attempting to sample all four feet in one run. Another alternative method may include completing multiple borings at a specific location to adequately sample the subsurface when soil recoveries are below 60%. When risk-based decisions or notification level determinations are being based on field methods and soil borings, a minimum of one ESS should be collected for every two feet of boring depth. If significant

changes in contaminant concentrations or geologic characteristics are observed over a sampled interval then they should be sampled (field screened) separately. In addition a minimum of one CSS should be collected for each risk-based depth criteria (accessible, potentially accessible, and isolated) in accordance with Appendix A. Lastly at least one boring must be sampled as a CSS per each 500 square feet of potentially contaminated area (AOC, REC, or source area).

4. Documentation

The method of soil sample collection must be documented. Where subsurface soil samples are described on a log (test pit log or boring log) the information must be recorded in a way that documents the stratigraphy and the specific characteristics of the soil sample. For boring logs, the depth interval sampled must be recorded. Additionally, the sample recovery details must be documented, including either the percentage of the target interval actually recovered, or the length of recovery compared to the target length. Collapsed soils recovered in the sample interval must not be included in the percent recovered or in the length of sample recovered. This is often referred to as “wash” from wash and drive drilling methods. Direct push tools that do not utilize dual tube samplers may also experience collapse from coarse grained units.

Field Sampling Procedures for UST Site Assessments at Facility Closure or Tank Abandonment

1.0 Introduction

This section applies to Appendix P of Chapter 691, the Department's Rules for Underground Oil Storage Facilities. Notification levels for the PID Bag Headspace test are given in Table 1 of the SOP. Notification for the Oleophillic Dye Test is any coloration on the ESP bead or if dye is observed in the soil matrix, in/on the water, or staining the side of the jar.

2.0 Underground Piping and Dispenser Island areas

For the purpose of this Appendix, a piping run and associated dispenser(s) island is treated as one area. One ESS is required for each 5-foot section of underground piping, including the associated piping dispenser island. One CSS is required at all ESS locations that exceed the DEP Notification Level specified in this SOP. If no ESS exceeds the notification level, then the three highest ESS readings shall be selected for CSS collection. One LS shall be required for each 10 CSS collected within each underground piping and dispenser area.

3.0 Underground Storage Tank Area

More than one UST may be removed during a tank removal event. If the tanks are located adjacent to one another and the resulting excavation is one continuous excavation, then it can be considered one tank area. If the USTs are not adjacent to one another and the resulting tank excavations have separate excavation side walls, then they shall be treated as separate tank areas.

3.1 Excavation Screening Sampling (ESS)

The ESS are to be collected in accordance with Appendix A in a metalized bag and follow the procedures outlined in this SOP.

3.2 Confirmation Screening Samples (CSS)

CSS are to be collected in accordance with Appendix A. For the tank facility where the tank is to be replaced in the same location, and the surface will be paved, CSS in the top two feet of the tank excavation is not required.

NOTE: The basis for this exclusion is that soil in the upper two feet of a tank excavation is seldom contaminated. CSS are to be taken from the piping runs (including any piping run above the tank footprint) and dispenser island in accordance with Section 2.0 of this Appendix, even when the tank will be replaced and the surface paved.

3.3 Lab Samples (LS)

LS are to be collected in accordance with Appendix A.