WSP | PARSONS BRINCKERHOFF

300 Trade Center
Suite 4690
Woburn, MA 01801
Main: 781-933-7340
wsp-pb.com/usa

VIA ELECTRONIC MAIL

September 20, 2016

Ms. Tara L. Rutland
Project Manager, Bureau of Eastern Remedial Action
Division of Environmental Remediation, 11th Floor
New York State Department of Environmental Conservation
625 Broadway
Albany, NY 12233-7015

Re: Sub-Slab Soil Investigation Work Plan
Former TransTechnology Corporation Facility, Glen Head, New York #1-30-101

Tara,

WSP USA Corp., on behalf of our client, Breeze-Eastern LLC, has prepared this work plan for evaluating potentially impacted soil at the former TransTechnology Corporation (TTC) facility in Glen Head, New York. The soil was identified during the sub-slab inspection and follow-up activities conducted after the demolition of the onsite buildings. This work, which was performed in accordance with the procedures outlined in the New York State Department of Environmental Conservation-approved (NYSDEC-approved) *Interim Site Management Plan* (SMP), included a visual, olfactory, and instrument-based screening of the soil and buried structures (including subsurface piping) uncovered during the removal of the concrete floor, footers, and other subsurface components of the structures. Several areas of concern were identified that, based on the definition of *Discovered Contamination*[1] in the SMP, warrant further evaluation. The scope of work determining whether these soils contain constituents of concern above the site-specific soil cleanup objectives (SCOs) is presented below.

All work detailed in this plan is being conducted under the June 2006 Record of Decision (ROD)[2] for the site. The proposed investigation will be conducted in accordance with WSP's Standard Operating Procedures (SOPs), the *Excavation Work Plan* (Appendix D in the approved SMP), and the NYSDEC's *Technical Guidance for Site Investigation and Remediation* (DER-10). Copies of the appropriate SOPs are included in Enclosure A.

Background

Investigations beginning in 1992 identified constituents of concern, volatile organic compounds (VOCs), including some chlorinated constituents; metals; and, to a lesser degree, semivolatile organic compounds (SVOCs) and metals (primarily chromium), in the soil at the site. Remediation of the

[1] Discovered Contamination refers to the management of soil that may be discovered during the course of site activities that exhibits evidence of suspected contamination, or is confirmed by testing to exceed one or more of the site-specific SCOs.
[2] Record of Decision, TransTechnology, Operable Unit No. 1, Glen Head, Nassau County, New York, Site Number 1-30-101, dated June 2006.

affected soil from accessible areas of the site, designated as Operable Unit No. 1 (OU-1), began in the mid-2000s and was completed in 2012. The only areas not fully evaluated were those that lay directly beneath the 96,000-square-foot main building and several smaller outbuildings (Figure 1). The above grade portions of the site buildings were removed beginning in October 2015 and, with the submission and subsequent approval of *OU-1 Remedial Activities Construction Completion Report* and the attendant SMP (required before intrusive demolition work could be completed), the concrete floor and footer deconstruction activities were initiated in April 2016. The inspection of the sub-slab soil was conducted by WSP personnel[3] on May 19, 2016, shortly after the final portions of the concrete floor were removed. Subsequent work[4], including the uncovering of pipes and other suspect areas identified during the inspection was overseen by environmental professionals with Laurel Environmental of Huntington Station, New York. The NYSDEC was notified of the presence of potential *Discovered Contamination* via telephone and a subsequent electronic mail message, dated May 20, 2016, as specified in Sections D-1 and D-11 in the *Excavation Work Plan*.

Inspection Findings

The sub-slab inspection and subsequent follow-up work identified seven potential areas of concern (AOCs), designated as AOC-1 through AOC-7 (Figure 1), that are designated as *Discovered Contamination*. These areas of concern are generally located in the southern portion of the main building footprint near the former production areas of the facility. Three of the AOCs, AOC-1 through AOC-3, are associated with a series of interconnected cast iron and concrete pipes uncovered during demolition. The cast iron pipes, which, based on their layout, were likely tied to facility floor drains, appear to empty into either to cesspool C-6 (for the northern end of the pipe network) or, via a concrete distribution box and additional concrete pipe, cesspool C-1 to the south. Potentially affected soil, as evidenced by staining, elevated photoionization detector (PID) readings, or both, were identified near pipe junctions (AOCs 1 and 2), near a concrete distribution box and concrete piping run (AOC-3). The potentially impacted areas were generally detected parallel to the trace of the pipes at depths between 3 and 5 feet below ground surface (bgs). Additional stained soil was also observed beneath the footings and former floor surfaces near the north end and southwest portion of AOC-3.

The two AOCs near the southwest corner of the main building, AOC-4 and AOC-5, are associated with the former facility's shipping and receiving areas (Figure 1). Soil that appears to be stained a dark color was uncovered directly beneath the floor slab of the elevated truck dock in the loading area. The interval of potentially-impacted soil is relatively small (less than 20 feet square) and appears, based on the exposed soil face beneath the floor of the dock, to be limited (less than 1 foot thick) in vertical extent. The overlying portion of concrete floor, which also appears to be stained yellow, was left in place and the area was cordoned off to prevent disturbance during the remaining floor removal activities. Similarly stained soil was identified in AOC-5, which is approximately 120 feet to the southwest along the flank of the elevated drive leading to the truck dock. The area of potentially-impacted soil is somewhat larger, approximately 40 feet long and 20 feet wide, and was found to contain lumber and other debris buried during a previous phase of development.

[3] The inspection was performed by Mr. David Bouchard of WSP, a qualified environmental professional, as defined in 6 New York Codes, Rules and Regulations (NYCRR) Part 375-1.2(ak).

[4] Environmental professionals with Laurel Environmental also provided oversight during the deconstruction activities that were performed prior to WSP's inspection on May 19, 2016.

The two remaining AOCs, AOC-6 and AOC-7, are located in the eastern and northern portions of the facility (Figure 1). Discolored soil with elevated PID readings were noted beneath what was formerly the building foundation in AOC-6. The potentially-impacted soil is present over a 125-foot-long linear trace parallel to what was the eastern wall of the facility. Soil near the former building foundation north of the facility in AOC-7 contained small pieces of a tar-like material just beyond the northern edge of the former building. The soil also exhibited moderate PID readings (approximately 20 ppm).

All seven AOCs exhibit evidence of *Discovered Contamination* as defined in the SMP and, thus, warrant further evaluation.

Approach

WSP plans to conduct a limited soil investigation within the identified AOCs to characterize the soil and determine if additional remedial action is necessary. The soil sampling procedures for each AOC will be similar to those used during previous investigations at the site. Soil samples will be collected from within the stained interval (or, if no staining is present, from areas with the highest PID readings) with additional samples collected outside and beneath the impacted soil (if accessible) for horizontal and vertical delineation. These additional samples will be placed on hold with the analytical laboratory and released only if the characterization samples from within the impacted area indicate compounds are present above the site-specific SCOs. The specific number of samples and their position within the AOC, however, will be adjusted on an *ad hoc* basis by the field crew. This approach was adopted to accommodate the irregular shapes, sizes, and differing levels of access in each AOC. The potentially-affected soil in AOC-4, for example, because it is relatively small and elevated above the surrounding ground surface, offers better access for sampling, particularly for horizontal delineation, then the soil in AOC-3, some of which is in the base of a 180-foot long trench and may be only partially exposed (Figure 1). WSP anticipates that no less than two soil samples for characterization purposes will be collected from AOCs 1, 2, 4, 5, and 7 with an additional concrete sample collected from AOC-4. A minimum of 4 characterization samples will be collected from the former piping run and the area beneath the former floor and building footer in AOCs 3 and 6. In addition, a sample of the tar-like material will be collected.

It is important to note that, although this sampling strategy will afford the field crew flexibility to adjust to the conditions encountered in the field and may, in some cases, provide complete delineation, it is possible that additional investigation will be required. Additional investigation or remediation warranted based on the results of this investigation will be submitted to the NYSDEC under a separate cover.

Data collected during this investigation will be compared to the site-specific SCOs for *Restricted Residential*[5] end use developed for the site during implementation of the remedy. These criteria are a modification of the cleanup objectives outlined in the 2006 ROD, which were largely based on the NYSDEC *Technical and Administrative Guidance Memorandum* (TAGM) 4046. Those standards were superseded in 2010 by the regulations promulgated in Title 6 New York Code of Rules and Regulations (NYCRR) Part 375-6. To harmonize the criteria, WSP elected (with the concurrence of the NYSDEC) to modify the SCOs outlined in the ROD by selecting the lower of the two values between the original TAGM 4046 criteria and those listed in Part 375, Table 6.8(b) for *Restricted Residential* end use. This

[5] All of the areas identified during the inspection and subsequent work at the site are within Parcel B (RMF-16), as defined in the SMP. This portion of the site has been designated for Restricted Residential use only. See the SMP for additional information.

approach was adopted to provide a set of criteria that is supported by current regulation, achieves the ROD-specified future site use, and represents the most conservative values for the site. The site-specific SCOs are presented in Tables 1(surface soil) and 2 (subsurface soil) in the approved SMP.

Scope of Work

The proposed soil sampling will be performed using a hand augers, stainless steel trowels, or other appropriate hand equipment suitable for near-surface soil sampling (none of the proposed sampling areas, all of which were exposed by the excavation equipment, will require a drill rig for the sample collection) in accordance with WSP's SOP 9 (Enclosure A). Recovered soil will be placed on plastic sheeting for screening using a PID, lithologic description (grain size, color, moisture content, density, and visible staining, if present), and analytical sample collection. All soil descriptions will be recorded in the field notebook in accordance with WSP's SOP 1. Soil samples for the discrete VOC analysis will be selected based on the PID results or, if present, staining or odors. The balance of the soil from each sample will be placed in a dedicated stainless steel bowl and composited using dedicated stainless steel implements. Additional soil may be recovered from the sample location for those areas where multiple parameters are being collected to ensure sufficient material for the analysis.

A chip sample of the yellow stained concrete identified in AOC-4 will also be collected for characterization. The sample will be obtained using a decontaminated hammer and chisel to physically break off fragments of the potentially-impacted concrete, which will then be placed into laboratory-supplied containers in accordance with WSP's SOP 16 (Enclosure A). The sample will be sufficiently disaggregated to fit into the supplied glassware; however, final disaggregation will be conducted at the analytical laboratory in advance of the analysis.

The soil samples will be shipped to a New York-certified laboratory for analysis of Target Contaminant List (TCL) VOCs by U.S. Environmental Protection Agency (EPA) Method 8260, TCL SVOCs by EPA Method 8270, TCL pesticides by EPA Method 8081, PCBs by EPA Method 8082, and Target Analyte List metals by EPA Method 6010/7000 series, as specified in the *Excavation Work Plan*. The concrete samples will be analyzed for total and hexavalent chromium only by EPA Method 6010/7000 series. All of the samples will be handled and shipped in accordance with WSP's SOP 3 (Enclosure A).

All of the sample locations will be marked in the field with spray paint, wooden stakes, or other means for later location by a New York-licensed land surveyor.

Quality Assurance/Quality Control

Field QA/QC procedures for the planned sampling activities will include the collection and analysis of blind duplicate samples, matrix spike and matrix spike duplicates (MS/MSDs), equipment rinsate blanks (for non-dedicated sample equipment), and trip blanks. The blind duplicate samples will be analyzed with the other samples to evaluate the reproducibility of the sample collection and analytical procedures, and the MS/MSD samples will be collected to evaluate the effect of the matrix on the analytical protocol. The equipment rinsate blanks will be collected by pouring analyte-free water over the decontaminated sampling equipment used (if any) to collect the soil samples. The rinsate blank is used to determine if contaminants are being inadvertently introduced from the sampling equipment or by the sampling procedures. Finally, a trip blank will accompany the sample containers from the laboratory to the field and the samples from the field to the laboratory. The trip blank is used to assess cross-contamination during transit. Quality assurance and quality control samples will be collected during the proposed activities in accordance with WSP's SOP 4 (Enclosure A).

Decontamination Procedures

All non-dedicated equipment used for the investigation will be decontaminated before work begins, between each sample location, and at the end of site activities using non-phosphate soap and laboratory-supplied deionized water, as appropriate, in accordance with WSP's SOP 6 (Enclosure A). The decontamination rinsate will be placed in Department of Transportation-approved (DOT-approved) 55-gallon drums and moved to a designated onsite storage area.

Investigation-Derived Wastes

Investigation-derived waste (IDW) generated (if any) during sampling activities, including decontamination rinsate, residual soil cuttings, and other solid waste (e.g., poly sheeting, personal protective equipment, etc.) will be placed in DOT-approved 55-gallon steel drums and staged onsite for later offsite disposal in accordance with state and federal regulations.

Project Schedule and Reporting

The investigation activities will be conducted in accordance the *Excavation Work Plan* in the approved SMP and, thus, does not require advance Department approval; however, the plan is being submitted as a courtesy to provide the NYSDEC an opportunity to comment. WSP will proceed with the onsite work as detailed above if comments are not received within 7 days of the plan submittal. The soil investigations are anticipated to require up to 1.5 days to complete. The preliminary analytical results are expected within 2 weeks of sample collection.

The results of the soil investigation will be summarized in a letter report submitted to NYSDEC within 4 weeks of receiving the validated sample results. The document will include, at a minimum, summary tables of the results, figures, and WSPs recommendations for additional investigation or remediation, if warranted.

If you have questions concerning this work plan or any other aspect of this project, please feel free to contact me at (774) 413-5109.

Sincerely yours,

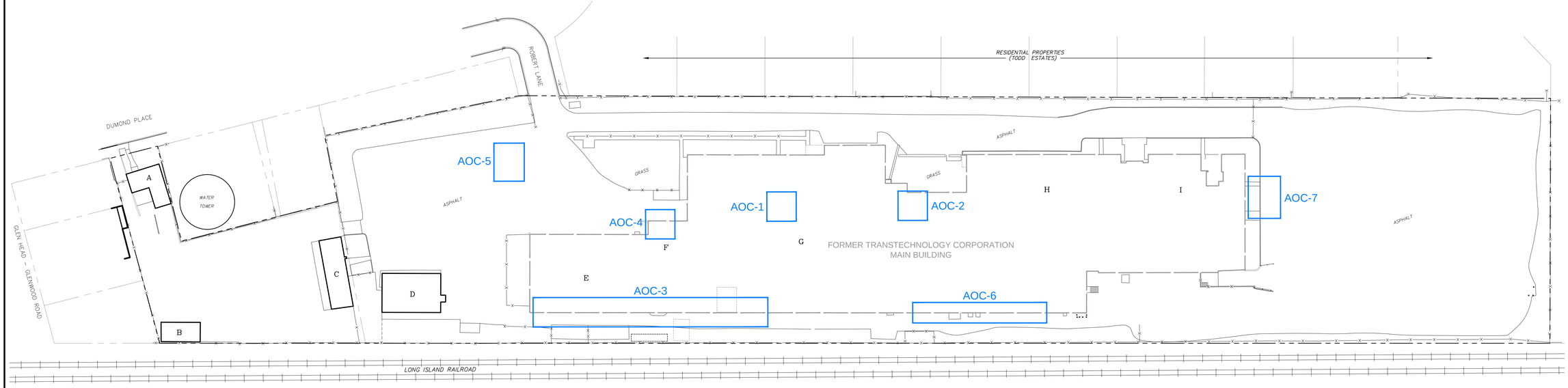
David P. Bouchard
Senior Project Director

DPB:paw

\\USCAZ1SER01\es\Clients\Breeze-Eastern\TransTechnology\Investigation & Remediation\OU-1 Investigation & Remediation\Sub-slab Inspection Plan\Sub-slab Work Plan 092016.docx

cc: Mr. John A. Simon, Gnarus Advisors, LLC

Figure



LEGEND

PROPERTY BOUNDARY

AOC-# AREA OF CONCERN (APPROXIMATE LOCATION)

THE ORIGINAL VERSION OF THIS DRAWING IS IN COLOR. BLACK & WHITE REPRODUCTION MAY NOT ACCURATELY DEPICT CERTAIN INFORMATION.

50 0 50 100
SCALE, FEET

D

R:\CAD\Acad\CAD\00028873-Glenhead_NY\CAD\00028873-D64.dwg 8/25/2016 11:03 AM USER2016

REV	DESCRIPTION		
1	Revised:	Chkd:	Appr.:
2	Revised:	Chkd:	Appr.:
3	Revised:	Chkd:	Appr.:

SEAL

DATE

DRAWN BY

CHECKED

APPROVED

PROPERTY OF WSP USA CORP.
IMPORTANT: THIS DRAWING PRINT IS LOANED FOR MUTUAL ASSISTANCE AND MAY BE RECALLED AT ANY TIME. NEITHER IT NOR ANY INFORMATION CONTAINED HEREON IS NOT TO BE REPRODUCED, COPIED OR USED FOR ANY PURPOSE OTHER THAN THE BENEFIT OF PARTIES OTHER THAN NECESSARY TO THE PROJECT FOR WHICH IT WAS PREPARED WITHOUT THE SPECIFIC WRITTEN CONSENT OF WSP USA CORP.

NOTICE: THIS DRAWING HAS BEEN PREPARED UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER/LAND SURVEYOR. ALTERATIONS TO THIS DRAWING BY ANY PARTY UNDER THE DIRECTION OF A LICENSED PROFESSIONAL ENGINEER/LAND SURVEYOR, UNLESS SUCH PARTY IS ACTING AS AN AGENT OF SAID LICENSED PROFESSIONAL ENGINEER/LAND SURVEYOR, IS A VIOLATION OF LAW.

SUB-SLAB AREAS OF CONCERN

FORMER TRANSTECHNOLOGY CORPORATION FACILITY
GLEN HEAD, NEW YORK

PREPARED FOR
BREEZE-EASTERN LLC
WHIPPANY, NEW JERSEY

WSP | PARSONS BRINCKERHOFF
WSP USA Corp.
300 Trade Center, Suite 4690
Woburn, Massachusetts 01801
(781) 933-7340
www.wspgroup.com/usa

FIGURE 1

Drawing Number
00028873-D64

Enclosure A

FIELD STANDARD OPERATING PROCEDURE #1

NOTE TAKING AND FIELD BOOK ENTRIES PROCEDURE

The field book is a record of the day's activities that serves as a reference for future reporting and analyses. The field book is also a legal record for projects and may be included during litigation proceedings. It is of the utmost importance that all notes are complete and comprehensive. The user is advised to read the entire standard operating procedure (SOP) and review the site health and safety plan (HASP) before beginning any onsite activities.

1.1 ACRONYMS AND ABBREVIATIONS

HASP	health and safety plan
IDW	investigation-derived waste
SOP	standard operating procedure

1.2 MATERIALS

- Permanently-bound waterproof field book (e.g., Rite-in-the-Rain® #550, or equivalent)
- Black or blue ballpoint pen (waterproof ink recommended; do not use felt-tip pens)

1.3 PRECONDITIONS AND BACKGROUND

This SOP has been prepared as part of the company's Environmental Quality Management Plan and is designed to provide detailed procedures for common field practices. Compliance with the methods presented in this document is mandatory for all field personnel and will ensure that the tasks are performed in a safe and consistent manner, are in accordance with federal and state guidance, and are technically defensible.

This SOP is written for the sole use of company employees and will be revised periodically to reflect updates to company policies, work practices, and the applicable state and/or federal guidance. Employees must verify that this document is the most recent version of the company SOPs. Employees are also strongly advised to review relevant state and/or federal guidance, which may stipulate program-specific procedures, in advance of task implementation.

The purpose of the field book is to provide a written log of all of field events and conditions. The notes must include sufficient detail (i.e., who, what, when, where, why, and how) to enable others to reconstruct the day's activities for analysis, reporting, or litigation. It is important to be objective, factual, and thorough. Language must be free of personal comments or terminology that might prove inappropriate. Additional data logs or worksheets, such as low flow groundwater sampling sheets, may be used as a supplement; however, under no circumstances should the data sheets be used as a substitute for the daily record of events to be recorded in the field book.

The field book forms the foundation upon which most of the project work (reports, subsequent work plans, etc.) is based. It is critical that the field book's chain of custody be maintained at all times.

1.4 SET-UP PROCEDURES

The first step in setting up a new field book is to add the information necessary for you to identify the field book in the future and for others to return the book to the project manager, should it be lost. On the first page of the field book (or, for some field books, the inside cover), place a "Return for Reward" notice. Include the following information:

- An "If Found – Return for Reward" notice in bold letters
- Our company name

- Our company address (usually the office where the project is being managed)
- Our company phone number

Reserve the second page of the field book for project-specific information, such as:

- The project name and number
- The project manager's name
- The site telephone number, address, and onsite contact (if appropriate)
- The names and telephone numbers for all key (onsite) personnel
- The emergency telephone numbers including the police, fire, and ambulance (found in the HASP)

Business cards from individuals who visit the site, (including the person in charge of the field book) can be affixed to the inside back cover.

1.5 FIELD BOOK ENTRIES

Start each day on a new page. Include the following information in the header of the first page (and all subsequent pages):

- The date
- The project name
- The page number (often pre-printed in Rite-in-the-Rain® style field books)

Precede field book entries by the time entered along the left margin of the page using a 24-hour or military clock (e.g., 1330 for 1:30 PM). The first entry of the day must include your and your subcontractor's arrival time at the site, a description of the planned activities, key onsite personnel (including subcontractors), and the weather forecast. The first entry must also detail the tailgate review of the site-specific HASP with the onsite personnel. Be sure that field book entries are LEGIBLE and contain factual, accurate, and inclusive documentation of project field activities. Do not leave blank lines between field book entries. If a mistake is made in an entry, cross out the mistake with a single line and place your initials at the end of the line. Any acronyms written in the field book (including your initials) must be spelled out prior to the first use. If the field book is not pre-numbered, record your initials, date, and page number at the bottom of each page.

Subsequent log entries must document the day's activities in sequence and must be completed throughout the day as events occur (i.e., do not wait until the end of the work day to complete the notes); should notes need to be entered out of sequence, please identify using a footnote or by clearly indicating "Late Entry." Notes must be descriptive and provide location information or diagrams (if appropriate) of the work area or sample locations. Note any changes in the weather and document all deviations from the work plan. Arrival and departure times of all personnel, and operational periods of standby, decontamination, and specific activities must be recorded.

Include the following information in entries describing field activities:

- The equipment, materials and methods used by subcontractors, if appropriate (e.g., drill rig type, boring diameters, well casing materials, etc.)
- The equipment, materials and methods used to obtain samples (e.g., split-spoon sampler, polyethylene bailer, pump types, geochemical, water or air monitoring equipment, low-flow purging procedures, etc.)
- The sample identification, which should include the location and depth, as appropriate
- The sample location, including a description of the approximate location as measured from a known point (e.g., 50 feet north of the building entrance; for points not yet surveyed)

- Any air or water monitoring equipment used, associated calibration activities, and measurements
- The sample collection time
- The sample identification of associated quality assurance/quality control samples (e.g., blind duplicate)
- The sample media and analyses to be performed; sizes, numbers, and types of containers; preservation (if any), and any resulting reactions (e.g., effervescence)
- If supplemental data recording logs (digital or hard copy) are used, such as groundwater sampling logs, chains-of-custody, and shipping records, the above information must be entered in the field book and the supplemental records cross-referenced
- The decontamination and disposal procedures for all equipment, samples, and personal protective equipment
- An inventory of the investigation-derived waste (IDW) materials generated during the site activities
- A description of the IDW labeling procedures and the onsite staging information; other sampling-specific information to be included in the IDW log is provided in SOP 5

Maintain a sequential log if the sample locations and areas of interest are photographed (strongly recommended). The photographic log must include:

- The date and time of the photograph
- The sequential number of the photograph (e.g., photograph-1, photograph-2, etc.)
- The general direction faced when the photograph was made
- A description of the subject in the image

1.6 CLOSING NOTES

The last entry of the day must include a brief wrap up of the work accomplished, a description of how the site is being secured, and a description of any near hits, accidents, and incidents that occurred during the day's work. Draw a line through the remainder of the page from the row of text diagonally through any blank lines and initial at the end of the diagonal line.

FIELD STANDARD OPERATING PROCEDURE #3

SAMPLE PACKAGING AND SHIPMENT PROCEDURE

Shipping samples is a basic but important component of field work. Nearly all of the field activities include the collection of environmental samples. Proper packing and preservation of those samples is critical to ensuring the integrity of the company's work product. The user is advised to read the entire standard operating procedure (SOP) and review the site health and safety plan (HASP) before beginning any onsite activities. In accordance with the HASP, proper personal protective equipment (PPE) must be selected and used appropriately.

3.1 ACRONYMS AND ABBREVIATIONS

CFR	Code of Federal Regulations
DOT	U.S. Department of Transportation
IATA	International Air Transport Association
HASP	health and safety plan
PPE	personal protective equipment
SOP	standard operating procedure

3.2 MATERIALS

- Suitable shipping container (e.g., plastic cooler or lab-supplied styrofoam-insulated cooler)
- Chain-of-custody forms
- Custody seals
- Mailing labels
- Tape (strapping, clear packing, or duct tape)
- Heavy-duty zipper-style plastic bags
- Knife or scissors
- Permanent marker
- PPE
- Large plastic garbage bag
- Wet ice (as necessary)
- Bubble wrap or other packing material
- Universal sorbent materials
- Sample container custody seals (if required)
- Shipping form (with account number)

3.3 PRECONDITIONS AND BACKGROUND

This SOP has been prepared as part of the company's Environmental Quality Management Plan and is designed to provide detailed procedures for common field practices. Compliance with the methods presented in this document is mandatory for all field personnel and will ensure that the tasks are performed in a safe and consistent manner, are in accordance with federal and state guidance, and are technically defensible.

This SOP is written for the sole use of company employees and will be revised periodically to reflect updates to company policies, work practices, and the applicable state and/or federal guidance. Employees must verify that this document is the most recent version of the company SOPs. Employees are also strongly advised to review

relevant state and/or federal guidance, which may stipulate program-specific procedures, in advance of task implementation.

This SOP is designed to provide the user with a general outline for shipping samples and assumes the user is familiar with basic field procedures, such as recording field notes (SOP 1), sample collection and quality assurance procedures (SOP 4), and investigation derived waste management procedures (SOP 5), and has a current certificate for U.S. Department of Transportation (DOT) Hazardous Materials training.

> **NOTE: Employees shipping samples regulated as hazardous materials or exempt hazardous materials by air must have International Air Transport Association (IATA) training. IATA training is a separate training required in addition to DOT hazardous materials training for such shipments. Most employees do not have IATA training and therefore, anyone who needs to ship by air MUST consult with a company IATA-trained compliance professional. The remainder of Section 3.3 covers shipments regulated by DOT only.**

Environmental samples can meet the definition of DOT hazardous materials when shipped by air, ground, or rail from a project site to the laboratory. As such, field staff must work with their assigned company compliance professional to determine whether the sample shipment is subject to any specific requirements (e.g., packaging, marking, labeling, and documentation) under the DOT hazardous materials regulations.

Title 49 Code of Federal Regulations (CFR) Section 171.8 defines a "hazardous material" as a substance which has been determined by the Secretary of Transportation to be capable of posing an unreasonable risk to health, safety, and property when transported in commerce, and which has been so designated. DOT hazardous materials are listed in the hazardous materials table at 49 CFR 172.101.

In most cases, the company is collecting environmental samples in order to determine whether any hazardous chemicals are present in the sampled media. Therefore, we would not have the appropriate information to make a hazardous materials classification for the samples prior to shipment. 49 CFR 172.101(c)(11) allows the use of a tentative classification where the shipper is uncertain of the material's hazard class. When the physical characteristics of the samples are unknown, a non-hazardous material classification may be made. Non-hazardous materials are not subject to the DOT hazardous materials regulations.

There are certain cases where the characteristics and hazard class of the samples are known (e.g., samples of free product, samples preserved with a hazardous material [TerraCore® samplers]). Contact your assigned company compliance professional or an internal DOT contact for guidance on shipment of these materials.

3.4 SAMPLE SHIPMENT PROCEDURES

The two major concerns in shipping samples are incidental breakage during shipment and complying with applicable DOT and courier requirements for hazardous materials shipments.

> **NOTE: Many couriers, including Federal Express and UPS, have requirements that the company register with them before shipping hazard materials. In most cases, it is the sampling location, not the company office address, which needs to be registered. Therefore, each project will likely have unique requirements. Please contact your assigned company compliance professional to determine whether or not you will be required to register for your shipment.**

Protecting the samples from incidental breakage can be achieved using "common sense." Pack all samples in a manner that will prevent them from moving freely about in the cooler or shipping container. Do not allow glass surfaces to contact each other. When possible, repack the sample containers in the same materials that they were originally received in from the laboratory. Cushion each sample container with plastic bubble wrap, styrofoam, or other nonreactive cushioning material. A more detailed procedure for packing environmental samples is presented below.

3.4.1 NON-HAZARDOUS MATERIAL ENVIRONMENTAL SAMPLES

The first step in preparing your samples for shipment is securing an appropriate shipping container. In most cases, the analytical laboratory will supply the appropriate container for bottle shipment, which can be used to return samples once they have been collected. Be sure that the container is large enough to contain the samples plus a sufficient amount of packing materials, and if applicable, enough wet ice to maintain the samples at the preservation temperature (usually 4° Celsius). Use additional shipping containers as needed so that sample containers are protected from breakage due to overcrowding. Do not use lunch-box sized coolers or soft-sided coolers, which do not offer sufficient insulation or protection from damage.

3.4.1.1 TEMPERATURE-PRESERVED SAMPLES CONTAINER PREPARATION

Temperature-preserved samples should be shipped to the laboratory in an insulated container (e.g., cooler). If using a plastic cooler with a drain, securely tape the inside of the drain plug with duct tape or other material to ensure that no water leaks from the cooler during shipment. Place universal sorbent materials (e.g., sorbent pads, Pig-brand absorbent blankets) in the bottom of the shipping container. The amount of sorbent material must be sufficient to absorb any condensation from the wet ice and a reasonable volume of water from melted wet ice (if a bag were to rupture) or a damaged (aqueous) sample container.

The next step is to line the shipping container with a large, heavy-duty plastic garbage bag. Place 2 to 4 inches of bubble wrap or other appropriate packing material inside the heavy-duty plastic bag in the bottom of the shipping container to form a cushion for the sample containers. Place the samples on the packing materials with sufficient space to allow for the addition of more bubble wrap or other packing material between the sample containers. Place large or heavy sample containers on the bottom of the cooler with lighter samples placed on top to minimize the potential for breakage. Place all sample containers in the shipping container right-side up. Do not overfill the cooler with samples; leave sufficient room for the wet ice if the samples are to be preserved during transit. Place wet ice to be used for sample preservation inside two sealed heavy-duty zipper-style plastic bags (1 gallon-sized, or less). Place the bags of ice on top of or between the samples. Place as much ice as possible into the cooler to ensure the samples arrive at the lab at the required preservation temperature, even if the shipment is delayed. Fill any remaining space in the container with bubble wrap or other packing material to limit the airspace and minimize the in-transit melting of ice. Securely close the top of the heavy-duty plastic bag and seal with tape.

3.4.1.2 NON-TEMPERATURE-PRESERVED SAMPLES CONTAINER PREPARATION

Non-temperature-preserved samples should be shipped to the laboratory in a durable package (e.g., hard plastic container or cardboard box). If shipping breakable sample containers (e.g., glass), place bubble wrap or other packing materials on the bottom of the container. Place the samples on the packing materials with sufficient space to allow for the addition of more bubble wrap or other packing material between and on top of the sample containers. Place large or heavy sample containers on the bottom of the container with lighter samples placed on top to minimize the potential for breakage. Place all sample containers within the shipping container right-side up.

3.4.1.3 CONTAINER SHIPMENT

Place the original, white top copy chain-of-custody form into a heavy-duty zipper-style plastic bag, affix the bag to the shipping container's inside lid, and then close the shipping container. Only one chain-of-custody form is required to accompany one of the shipping containers per sample shipment; the other coolers in the shipment do not need to include chain-of-custody forms. At this point, sample shipment preparations are complete if using a laboratory courier.

If sending the sample shipment through a commercial shipping vendor, place two signed and dated chain-of-custody seals on alternate sides of the shipping container lid so that it cannot be opened without breaking the seals. Securely fasten the top of the shipping container shut with clear packing tape; carefully tape over the custody seals to prevent damage during shipping. Once the shipping container is sealed, shake test the shipping

container to make sure that there are no loose sample containers. If loose sample containers are detected, open the shipping container, repack the sample containers, and reseal the shipping container.

Using clear tape, affix a mailing label with the company's return address to the top of the shipping container. Be sure to ship environmental samples to the contracted analytical laboratory using an appropriate delivery schedule. If applicable, check the appropriate box on the shipping airbill for Saturday delivery (you need to verify with the laboratory that someone will be at the lab on a Saturday to receive the sample shipment). Declare the value of samples on the shipping form for insurance purposes, if applicable, and be sure to include the project billable number on the shipping form's internal billing reference section. When shipping samples to a lab, identify a declared value equal to the carrier's default value ($100); additional fees will be charged based on a higher value declared. Our preferred carrier, FedEx, will only reimburse for the actual value of the cooler and its contents if a sample shipment is lost; they will not reimburse for the cost of having to re-collect the samples. [Please note: if you are shipping something other than samples, such as field equipment, declare the replacement value of the contents.]

Record the tracking numbers from the shipping company forms (i.e., the shipping airbill number) in the field book and on the chain-of-custody form and retain a copy of the shipping airbill. On the expected delivery date, confirm sample receipt by contacting the laboratory or tracking the package using the tracking number; provide this confirmation information to the project manager.

> **NOTE: Most shipping carriers adhere to transit schedules with final pickup times each day; these schedules are subject to change and vary by service location. If shipping containers are dropped off at a service location after the final pickup time, transit to the laboratory will not be initiated until the following day, and samples may not be properly preserved. Therefore, confirm transit schedules in advance of each sampling event, and ensure samples are dropped off before the final pickup time of the day.**

3.4.2 HAZARDOUS MATERIALS SAMPLES

Employees rarely ship hazardous materials due to DOT shipping requirements. If you find that your samples could be considered a DOT hazardous material, first coordinate with the assigned company compliance professional and project manager to make a hazardous material classification and, if necessary, establish the necessary protocols and to receive the appropriate training/certification. **Do not ship hazardous materials samples without first consulting a company compliance professional.**

FIELD STANDARD OPERATING PROCEDURE #4

SAMPLE COLLECTION AND QUALITY ASSURANCE PROCEDURE

The purpose of this procedure is to assure that sample volumes and preservatives are sufficient for analytical services required under U.S. Environmental Protection Agency (EPA) or other agency approved protocols. This operating procedure describes sample identification procedures, sampling order for select analytes, quality control and quality assurance (QA/QC) sampling procedures, and custody documentation for environmental sampling. The user is advised to read the entire standard operating procedure (SOP) and review the site health and safety plan (HASP) before beginning any onsite activities. In accordance with the HASP, proper personal protective equipment (PPE) must be selected and used appropriately.

4.1 ACRONYMS AND ABBREVIATIONS

ºC	degrees Celsius
COC	chain-of–custody [form]
DI	deionized water
DOT	U.S. Department of Transportation
EDD	electronic data deliverable
EPA	U.S. Environmental Protection Agency
HASP	health and safety plan
ID	Identification [number]
MS/MSD	matrix spike and matrix spike duplicate
MSA	Master Services Agreement
PPE	personal protective equipment
QA	quality assurance
QA/QC	quality assurance/quality control
QAPP	quality assurance project plan
SOP	standard operating procedure
VOCs	volatile organic compounds

4.2 MATERIALS

- Field book
- Indelible (waterproof) markers or pens
- PPE
- Sample containers
- Sample labels
- Clear tape
- Deionized (DI) water
- Cleaned or dedicated sampling equipment

4.3 PRECONDITIONS AND BACKGROUND

This SOP has been prepared as part of the company's Environmental Quality Management Plan and is designed to provide detailed procedures for common field practices. Compliance with the methods presented in this document is mandatory for all field personnel and will ensure that the tasks are performed in a safe and consistent manner, are in accordance with federal and state guidance, and are technically defensible.

This SOP is written for the sole use of company employees and will be revised periodically to reflect updates to company policies, work practices, and the applicable state and/or federal guidance. Employees must verify that

this document is the most recent version of the company SOPs. Employees are also strongly advised to review relevant state and/or federal guidance, which may stipulate program-specific procedures, in advance of task implementation.

This SOP is designed to provide the user with a general outline for collecting environmental and quality assurance samples and assumes the user is familiar with basic field procedures, such as recording field notes (SOP 1), sample shipment procedures (SOP 3), investigation derived waste management procedures (SOP 5), and equipment decontamination (SOP 6). This SOP does not cover investigation planning, nor does it cover the analysis of the analytical results. These topics are more appropriately addressed in a site-specific work plan or a dedicated quality assurance project plan (QAPP).

4.4 SAMPLE IDENTIFICATION PROCEDURES

Information on the sample container labels must include the site/project name, project/task number, unique alpha-numeric sample identification (ID) number, sample collection date, time of collection using the military or 24-hour clock system (i.e., 0000 to 2400 hours), analytical parameters, preservative, and the initials of the sampling personnel. Employees are advised to use pre-printed waterproof mailing labels (e.g., Avery® 5xxx-series Waterproof Address Labels) for all sample identification; templates for the labels are available.

The sample identification (ID) number must, unless otherwise approved by your project manager or specified in your site-specific work plan, comply with the following naming protocol. This protocol was developed to aid in determining the type of sample collected (e.g., soil, groundwater, vapor, etc.), the sample location, and, where appropriate, the sample depth. The protocol was also designed to ensure consistency across the company.

Construct sample IDs in the following format:

SB-10A (4-6)

Where, in this example:

SB = the first two or three characters will define the sample type (see list of approved prefixes below); in this case, a soil boring

10A = the next two or three alpha-numeric digits (separated by a dash from the sample type identifier) indicate the location of the boring on the site; in this case, boring number 10A

(4-6) = the depth the sample was collected, with the first number (including decimals, if necessary) indicating the top of the sample interval (in feet) and the second number indicating the bottom of the sample interval (in feet); not all sample types will include depth information.

Additional label information may be added after the last character of the sample ID number (e.g., sample date, underground storage tank number, area of concern number, “Area” number, client identifier, etc.). Separate any additional information from the required portion of the sample name by dash(es).

Sample Prefix	**Permitted Use**
AA -	Ambient outdoor air sample
CC -	Concrete core/chip sample
CS -	Confirmation/verification soil sample collected from an excavation
HA -	Soil sample collected with a hand auger
IAB -	Indoor air sample – basement
IAC -	Indoor air sample – crawl space
IAF -	Indoor air sample – first floor
MW -	Soil sample collected from a monitoring well borehole or a groundwater sample collected from a monitoring well
PZ -	Groundwater sample collected from a piezometer
SB -	Soil sample collected from boreholes that will not be converted to monitoring wells
SED -	Sediment sample

Sample Prefix	Permitted Use
SG -	Soil gas sample other than a sub-slab sample (e.g., sample collected from a temporary or permanent polyvinyl chloride sample point or stainless steel screen implant)
SL -	Sludge sample
SS -	Surface soil sample collected using hand tools (e.g., trowel, spoon, etc.) and typically at depths less than 2 feet below ground surface
SSV -	Sub-slab vapor sample
SW -	Surface water sample
TC -	Tree core sample
TP -	Soil sample collected from a test pit
WC -	Waste characterization sample
WP -	Wipe sample

4.5 SAMPLE CONTAINERS, PRESERVATIVES, AND HOLDING TIMES

The first step in sample collection is to verify that the analytical laboratory has provided the correct number and type of sample containers and each contains the appropriate preservatives for the proposed project (i.e., check against the sampling plan requirements outlined in the site-specific QAPP or, for those projects without a site-specific QAPP, the laboratory Task Order). Inspect all containers and lids for flaws (cracks, chips, etc.) before use. Do not use any container with visible defects or discoloration. Report any discrepancies, or non-receipt, of specific types of sample containers to the team leader or project manager immediately. Make arrangements with the laboratory to immediately ship missing or additional sampling containers.

Precautions must be taken to prevent cross-contamination and contamination of the environment when collecting samples. Wear a clean pair of new, disposable gloves each time a different sample is collected and don the gloves immediately prior to sampling. The gloves must not come in contact with the medium being sampled and must be changed any time during sample collection when their cleanliness is compromised. Sample collection must follow all appropriate SOPs, state and federal regulations, or guidance, for the collection of environmental samples; the recommended order of sample collection is:

- Geochemical measurements (e.g., temperature, pH, specific conductance)
- Volatile organic compounds (VOCs)
- Extractable organics, petroleum hydrocarbons, aggregate organics, and oil and grease
- Total metals
- Dissolved metals
- Inorganic non-metallic and physical and aggregate properties
- Microbiological samples
- Radionuclides

Collected samples that require thermal preservation must be immediately (within 15 minutes) placed in a cooler with wet ice and maintained at a preservation temperature of 4° Celsius (ºC).

4.6 FIELD QUALITY ASSURANCE/QUALITY CONTROL SAMPLES

Field quality assurance/quality control (QA/QC) samples include equipment blanks, trip blanks, duplicates, and split samples. The project manager or QAPP must specify the type and frequency of QA/QC sample collection. The QA/QC sample identification number must, unless otherwise approved by your project manager or specified in your site-specific work plan, follow the naming protocol as discussed in the sections below. QA/QC samples must be clearly identified on the COC form and in the field book. Failure to properly collect and submit required

QA/QC samples can result in invalidation of an entire sampling event. Collect, preserve, transport and document split samples using the same protocols as the related samples.

4.6.1 EQUIPMENT BLANKS

Equipment blanks are used to document contamination attributable to using non-dedicated equipment (i.e., equipment that must be decontaminated after each use). Collect equipment blanks in the field at a rate of one per type of sampling equipment per day, unless otherwise specified. If the site-specific work plan or QAPP indicates that an equipment blank is to be collected from dedicated sampling equipment, collect the equipment blank in the field before sampling begins. If field decontamination of sampling equipment is required, prepare the equipment blanks after the equipment has been used and field-decontaminated at least once. Prepare equipment blanks by filling or rinsing the pre-cleaned equipment with laboratory-provided analyte-free water and collecting the rinsate in the appropriate sample containers. The samples must be labeled, preserved, and filtered (if required) in the same manner as the environmental samples. Record the type of sampling equipment used to prepare the blank. Have the equipment blanks analyzed for all the analytes for which the environmental samples are being analyzed, unless otherwise specified. Decontamination of the equipment following equipment blank procurement is not required. If laboratory-grade DI water is unavailable, store-grade distilled water can be used to prepare these blanks. If store-grade distilled water is used, be sure to record the source and lot number in the field book. Designate equipment blanks using “EB”, followed by the date, and in the order of equipment blanks collected that day. For example, the first equipment blank collected on July 4, 2015, would be designated EB070415-1.

4.6.2 TRIP BLANKS

Trip blanks are used to document VOC contamination attributable to shipping and field handling procedures. Trip blanks are only required when analyzing samples for VOCs. Trip blank(s) are prepared by the laboratory and sent to the facility along with sample containers. Never open trip blank sample bottles; label them in the field and return them to the laboratory in the same shipping container in which the trip blank sample bottles arrived at the site. Keep the trip blank sample bottles in the same shipping container used to ship and store VOC sample bottles during the sampling event. Unless more stringent project requirements are in place, submit one trip blank in each shipping container of VOC samples. To minimize the number of trip blanks needed per shipment, if possible, ship all of the VOC samples in the same shipping container with the trip blank. If laboratory-provided trip blanks are not available, DI water, or store-grade distilled water and clean, empty VOC sample bottles can be used to prepare additional trip blanks. If store-grade distilled water is used, be sure to record the source and lot number in the field book. Identify trip blanks using “TB”, followed by the date. For example, the trip blank shipped with a cooler of samples on July 4, 2015, would be designated TB070415-1. If a second trip blank is needed on that same day, the designation would be TB070415-2.

4.6.3 TEMPERATURE BLANK

Temperature blanks are used to determine if proper sample thermal preservation has been maintained by measuring the temperature of the sample container upon arrival at the laboratory. A temperature blank should be included in each sample cooler used to ship and store the sample bottles during the sampling event. If laboratory-provided temperature blanks are not available, fill a clean, unpreserved sample bottle with potable, DI, or store-grade distilled water and identify the bottle as a temperature blank.

4.6.4 DUPLICATES

Duplicates are useful for measuring the variability and documenting the precision of the sampling process. Unless more stringent project requirements are in place, collect duplicate samples at a rate of at least 1 per 20 samples collected. Under no circumstances can equipment or trip blanks be used as duplicates. Sample locations where sufficient sample volume is available and where expected contamination is present should be selected for sample duplication.

Collect each duplicate sample at the same time, from the same sample aliquot and in the same order as the corresponding field environmental sample. When collecting aqueous duplicate samples, alternately fill sample bottle sets (i.e., the actual sample bottle and the bottle to be used for the duplicate) with aqueous samples from the same sampling device. If the sampling device does not hold enough volume to fill the sample containers, fill the first container with equal portions of the sample, and pour the remaining sample into the next sample containers. Obtain additional sample volume and pour the first portion into the last sample container, and pour the remaining portions into the first containers. Continue with these steps until all containers have been filled.

Duplicate samples will be assigned arbitrary sample ID and a false collection time so that they are not identified as duplicates by the laboratory (i.e., submit the samples blind to the lab). The blind duplicate sample "location designation" will be left up to the project manager; however, in no case will "Dup" be allowed to appear in the sample name. Have the duplicate samples analyzed for the same analytes as the original sample. Be sure to record the duplicate sample ID, the false time, and the actual time of collection in the field notebook. The duplicate should also be indicated on the company's carbon copy of the chain-of-custody.

4.6.5 MATRIX SPIKE AND MATRIX SPIKE DUPLICATES

Matrix spike and matrix spike duplicate samples, known as MS/MSD samples, are used to determine the bias (accuracy) and precision of a method for a specific sample matrix. Many of the company's projects require the collection of MS/MSD samples; however, laboratory generated MS/MSD samples are sufficient for some projects. As required by your QAPP or site-specific work plan, collect MS/MSD samples at the required ratio; if the sampling ratio is not specified by your QAPP or site-specific work plan, collect MS/MSD samples at a rate of 1 for every 20 samples. Clearly convey the MS/MSD identity to the laboratory by adding "MS" or "MSD" after the sample name (e.g., MW 01MS) or in the comments section of the chain-of-custody. Under no circumstances can equipment or trip blanks be used as MS/MSD samples.

4.6.6 SPLIT SAMPLES

Split samples may be collected as a means of determining compliance or as an added measure of quality control. Unlike duplicate samples that measure the variability of both the sample collection and laboratory procedures, split samples measure only the variability between laboratories. Therefore, the laboratory samples must be subsamples of the same parent sample and every attempt must be made to ensure sample homogeneity. Collect aqueous split samples in the same manner as a duplicate sample.

Collecting split samples of soil, sediment, waste, and sludge is not recommended because the homogenization necessary for a true split sample in these matrices is not possible and the resulting laboratory results would not be comparable.

Spilt samples should have the same sample location designation (e.g., MW-01, SB-03 (4-6), but are differentiated from each other by inserting the laboratory analyzing or the agency/consultant collecting the sample after the sample location (e.g., MW-01-WSP and MW-01-EPA).

4.7 CUSTODY DOCUMENTATION

Sample custody protocols are used to demonstrate that the samples and sample containers were handled and transferred in such a manner as to prevent tampering. Legal chain of custody (COC) begins when the pre-cleaned sample containers are dispatched to the field from the laboratory and continues through sample analysis and eventual disposal of the sample and sample containers. Maintaining custody requires that samples must be in the actual possession or view of a person who is authorized to handle the samples (e.g., sample collector, laboratory technician), secured by the same person to prevent tampering, or stored in a designated secure area.

It is a good idea to limit, to the extent possible, the number of individuals who physically handle the samples. Samples must be placed in locked storage (e.g., locked vehicle, locked storeroom, etc.) at all times when not in the possession or view of authorized personnel. Do not leave samples in unoccupied motel or hotel rooms or

other areas where access cannot be controlled by the person(s) responsible for custody without first securing samples and shipping or storage containers with tamper-indicating evidence tape or custody seals

The COC form is used to trace sample possession from the time of collection to receipt at the laboratory. Although laboratories commonly supply their own COC form, it is recommended that the company's COC be used to ensure that all necessary data are recorded. Unless more stringent project requirements are in place, submit one COC form per sample shipment. At a minimum, the COC needs to have a unique COC number, accompany all the samples, and include the following information:

- Project number, name, and location
- Sampler's printed name(s) and signature(s)
- Sample identification number
- Date and time (military time) of collection
- Sample matrix
- Total number of containers per sample
- Parameters requested for analysis including number of containers per analyte
- Remarks (e.g., irreducible headspace, field filtered sample, expected concentration range, specific turn-around time requested, etc.)
- Signatures of all persons involved in the chain of possession in chronological order
- Requested turn-around-time
- Name and location of analytical laboratory
- Custody seal numbers
- Shipping courier name and tracking information
- Internal temperature of shipping container upon shipment to laboratory, as needed
- Internal temperature of shipping container upon delivery to laboratory
- Company contact information

Affix tamper-indicating evidence tape or seals to all storage and shipping container closures when transferring or shipping sample container kits or samples to an off-property party. Place the seal so that the closure cannot be opened without breaking the seal. Record the time, calendar date and signatures of responsible personnel affixing and breaking all seals for each sample container and shipping container. Affix new seals every time a seal is broken until continuation of evidentiary custody is no longer required.

FIELD STANDARD OPERATING PROCEDURE #6

DECONTAMINATION

The decontamination procedures outlined in this standard operating procedure (SOP) are designed to ensure that all sampling equipment is free from the analytes that could potentially interfere with the sample results. The user is advised to read the entire SOP and review the site health and safety plan (HASP) before beginning any onsite activities. In accordance with the HASP, proper personal protective equipment (PPE) must be selected and used appropriately.

6.1 ACRONYMS AND ABBREVIATIONS

DI	deionized water
DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency
HASP	health and safety plan
PPE	personal protective equipment
QAPP	quality assurance project plan
SOP	standard operating procedure

6.2 MATERIALS

- Field book
- PPE
- Polyethylene sheeting and/or garbage bags
- Laboratory-grade non-phosphate detergent[1] (e.g., Luminox® or Liquinox®)
- Cleaning reagents, as needed (e.g., isopropyl alcohol, methanol, hexane, etc.)
- Potable water
- Deionized (DI) water
- Containers (e.g., plastic buckets)
- Nylon brushes
- Aluminum foil
- Spray bottles
- Paper towels
- Pressurized steam cleaner (e.g., steam jenny), as needed
- Decontamination pad, as needed

6.3 PRECONDITIONS AND BACKGROUND

This SOP has been prepared as part of the WSP USA Corp. Environmental Quality Management Plan and is designed to provide detailed procedures for common field practices. Compliance with the methods presented in this document is mandatory for all field personnel and will ensure that the tasks are performed in a safe and consistent manner, are in accordance with federal and state guidance, and are technically defensible.

[1] Not all laboratory-grade detergents are phosphate free. Be sure to verify the detergent's phosphate content before use.

This SOP is written for the sole use of WSP employees and will be revised periodically to reflect updates to WSP policies, work practices, and the applicable state and/or federal guidance. WSP employees must verify that this document is the most recent version of the WSP SOPs. WSP employees are also strongly advised to review relevant state and/or federal guidance, which may stipulate program-specific procedures, in advance of task implementation.

This SOP is designed to provide the user with a general outline for decontamination and assumes the user is familiar with basic field procedures, such as recording field notes (SOP 1), sample shipment procedures (SOP 3), sample collection and quality assurance procedures (SOP 4), and investigation-derived waste management procedures (SOP 5). All decontamination references must be available for consultation in the field, including:

- WSP's SOPs
- Applicable state and federal guidelines or procedures
- Manufacturer's manuals
- Project-specific work plan and HASP
- QAPP

6.4 GENERAL PROCEDURES

The cleaning and decontamination procedures described below are designed to ensure that the equipment used for sample collection is free of analytes that could potentially alter the analytical results. These procedures are primarily targeted at reducing the incidence of cross-contamination (i.e., compounds of interest being transferred on the sampling equipment from one sample location or depth to another) and, when properly implemented, provide a methodology for obtaining high quality, representative results. As with all analytical sampling, the effectiveness of the cleaning procedures must be demonstrated with the collection of equipment blanks. The sampling procedures and equipment blank collection frequency are discussed in SOP 4.

6.4.1 EQUIPMENT AND REAGENT SELECTION

It is important for WSP personnel to evaluate the expected types of contamination before mobilization to a site. State programs (or the U.S. Environmental Protection Agency [EPA], depending on the site) may require more stringent decontamination procedures than those listed in this SOP, specify the types and grades of various cleaning detergents and reagents (e.g., acids and solvents), or allow the use of phosphate-containing detergents, such as Alconox®. Many of these reagents, such as nitric acid or pesticide-grade hexane, are U.S. Department of Transportation (DOT) hazardous materials and must be shipped using a ground delivery service. These compounds may also require specialized PPE (e.g., eye protection for concentrated acids) or have other special handling or disposal procedures that must be considered before arriving onsite. Decontamination equipment (e.g., spray bottles, brushes, etc.) should be constructed of non-reactive, non leachable materials (e.g., metal, glass, Teflon®-coated, polyethylene, etc.) which are compatible with the reagents and solvents being used for decontamination.

In specific cases, it may be necessary to steam clean the field equipment before proceeding with the decontamination steps presented in Section 6.5 (e.g., hollow stem augers). Generally, WSP's subcontractors are responsible for bringing or building a decontamination pad, if necessary, to contain the spray from a steam jenny. Decontamination pads should be constructed on a level, paved surface (if possible) in an area known or believed to be free of surface contamination, and should be of sufficient size to contain the decontamination water. Equipment that is steam cleaned should be placed on racks or saw horses and not on the floor of the decontamination pad. Decontamination water should be removed from the decontamination pad frequently to minimize the potential for leaks or overflow.

Consult and involve WSP's compliance professionals for storage procedures and disposal requirements of solvent rinsate, detergent wastes, and other decontamination materials.

6.4.2 OTHER CONSIDERATIONS

In preparing for decontamination, you should perform the following activities (with all observations and measurements noted in the field book):

- Perform a quick reconnaissance of the site to identify a decontamination (pad) area and evaluate the accessibility to and safety of the location.
- Record a description of the decontamination (pad) area.

Survey the breathing zone around the decontamination area with the appropriate air quality meter(s), as necessary (see HASP), to ensure that the level of PPE is appropriate. When decontaminating equipment, it is important to find a suitable location away from any sources of cross-contamination that could compromise the integrity of the decontamination. As possible, position the decontamination area away from fuel-powered equipment, such as drill rigs or excavators, and upwind of other site activities (e.g., purging, sampling).

6.5 DECONTAMINATION PROCEDURES

The decontamination procedures are based on a nine-step process, which is tailored in the field depending on the samples to be collected. Decontaminate all non-dedicated equipment that contacts the sample directly, including spoons, trowels, pumps, etc., before and between each sample location and sampling interval. Record decontamination procedures in the field book. Disposable, single use items, such as bailers or tubing, do not require decontamination.

The decontamination process includes the following four basic steps:

1. Physical removal of debris
2. Wash with non-phosphate detergent, such as Liquinox®, and nylon brush
3. Potable water rinse
4. Deionized (DI) water rinse (distilled water can be used as a substitute)

The first step is to remove as much soil or other debris from the sampling device as possible near the sampling area to limit the spread of potentially-contaminated materials into clean areas of the site.

Cleaning and decontamination should occur at a designated area(s) (decontamination pad) on the site. If gross contamination or an oily film or residue is observed on the equipment, use steam jenny or wash by hand using a brush to remove the particulate matter or surface film. Heavy oils or grease may be removed with paper towels soaked with isopropyl alcohol.

The physical removal is followed by a hand wash using non-phosphate detergent (mixed to the appropriate dilution in potable water) followed by a potable water rinse. If not using a decontamination pad, the most common set-up uses 5-gallon plastic buckets for washing and rinsing, although plastic garbage pails or plastic tubs can also be used. Place containers on polyethylene sheeting to limit spillage of the decontamination fluids.

Be sure to scrub the equipment thoroughly with a nylon bristle brush (or similar) and allow enough submersion time for the non-phosphate detergent to effectively clean the surfaces (a simple dunk of the equipment in the detergent solution is insufficient). If decontaminating submersible pumps, flush both the non-phosphate detergent wash fluid and the potable water rinse through the pump body itself (usually done in separate buckets) to ensure that the internal components are thoroughly cleaned. The internal decontamination of motorized pumps can be accomplished by pumping the non phosphate detergent wash fluid and the potable water rinse through the pump. Replace the detergent solution and rinse water when it becomes oily or silty.

Place the DI water for the rinse in a small spray bottle or pour over the equipment after the potable water rinse. **Typically, this level of decontamination (i.e., steps 1 through 4) is sufficient**.

Following Steps 1 through 4, additional decontamination (steps 5 through 9) may be required by the applicable federal or state guidelines, the project-specific work plan or the QAPP. Typically, these decontamination steps are performed when sampling for inorganics using non-motorized equipment. These steps include:

5. 10% nitric acid rinse
6. DI water rinse
7. Pesticide-grade solvent rinse (e.g., hexane or isopropyl alcohol)
8. Air dry (solvent must evaporate)
9. DI water rinse

Isopropyl alcohol is the recommended solvent for organic contaminants because it is readily available (at most drug and department stores) and is not a DOT hazardous material. However, other solvents (e.g., hexane and methanol) may be more effective in removing certain contaminants, such as oils or polychlorinated biphenyls, but any waste generated using these solvents must be managed accordingly.

Handle the solvents and acid with care and store unused chemicals in their original, labeled, protective containers when not in use. It is a good idea to transfer small quantities of each solution into labeled, laboratory-grade spray bottles, which offer a convenient and controllable way to rinse the equipment. The equipment can then be rinsed over a 5-gallon plastic bucket or other suitable container placed on plastic sheeting as with the first part of the cleaning process. Nitric acid rinses must be used only on non-carbon steel sampling devices. Do not spray acid into pumps.

6.6 HANDLING DECONTAMINATED EQUIPMENT

Handle any decontaminated equipment using clean gloves to prevent re-contamination. Place the equipment away (preferably upwind) from the decontamination area once the process has been completed on clean plastic sheeting to allow it to air-dry. Once the equipment is dry, protect it from re-contamination by securely wrapping and sealing with aluminum foil (shiny side out) or clean, disposable plastic bags. Plastic bags may be wrapped directly around wet or dry equipment except when the expected contaminants include volatile and extractable organics; under those circumstances, allow the equipment to completely dry or wrap it in aluminum foil.

All sampling equipment must be decontaminated at the end of the investigation (i.e., prior to departure from the site). Label each piece of equipment with the date of decontamination, the initials of personnel performing the decontamination, and the type of decontamination solution(s) used. Containerize all solvent rinsate, detergent wastes, and other disposable decontamination materials in DOT-compliant containers in accordance with SOP 5 or the project-specific work plan. Dispose of all wastes in conformance with the project-specific work plan and applicable regulations.

FIELD STANDARD OPERATING PROCEDURE #9
SOIL SAMPLING PROCEDURE

The soil sampling procedures outlined in this standard operating procedure (SOP) are designed to ensure that collected soil samples are representative of current site conditions. Soil samples can be collected for onsite screening or for laboratory analysis. The user is advised to read the entire SOP and review the site health and safety plan (HASP) before beginning any onsite activities. In accordance with the HASP, proper personal protective equipment (PPE) must be selected and used appropriately.

9.1 ACRONYMS AND ABBREVIATIONS

ºF	degrees Fahrenheit
HASP	Health and Safety Plan
IDW	investigation derived waste
PID	photoionization detector
PPE	personal protective equipment
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
SOP	
USCS	standard operating procedure

9.2 MATERIALS

- Field book
- PPE
- Air quality monitoring equipment, (e.g., photoionization detector [PID]), as needed
- Field test kits, as needed
- Sampling containers and labeling/shipping supplies
- Knife or scissors
- Ruler or tape measure
- Soil sampling method specific materials, as needed:
  - Stainless steel trowels, probes, or shovels
  - Stainless steel spatulas or spoons
  - Bucket augers, auger extension rods, auger handle, pipe wrenches
  - Split-spoon samplers, pipe wrenches
  - Direct-push acetate liners
  - Shelby tube samplers, plastic or wax caps
  - Mixing tray or bowl
- Munsell color chart
- Decontamination supplies

9.3 PRECONDITIONS AND BACKGROUND

This SOP has been prepared as part of the company's Environmental Quality Management Plan and is designed to provide detailed procedures for common field practices. Compliance with the methods presented in this document is mandatory for all field personnel and will ensure that the tasks are performed in a safe and consistent manner, are in accordance with federal and state guidance, and are technically defensible.

This SOP is written for the sole use of company employees and will be revised periodically to reflect updates to company policies, work practices, and the applicable state and/or federal guidance. Employees must verify that this document is the most recent version of the company SOPs. Employees are also strongly advised to review relevant state and/or federal guidance, which may stipulate program-specific procedures, in advance of task implementation.

This SOP is designed to provide the user with a general outline for conducting soil sampling and assumes the user is familiar with basic field procedures, such as recording field notes (SOP 1), utility location (SOP 2), sample shipment procedures (SOP 3), sample collection and quality assurance procedures (SOP 4), investigation-derived waste (IDW) management procedures (SOP 5), equipment decontamination (SOP 6), and use and calibration of sampling and monitoring equipment (SOPs 7 and 8). This SOP does not cover investigation planning, nor does it cover the evaluation of the analytical results. These topics are more appropriately addressed in a project-specific work plan. Before soil sampling, be sure to review the project-specific work plan or Quality Assurance Project Plan (QAPP) and any applicable state and federal guidelines or sampling procedures. All sampling and monitoring references must be available for consultation in the field, including:

- Company's SOPs
- Applicable state and federal guidelines or sampling procedures
- Manufacturer's manuals
- Project-specific work plan and HASP
- QAPP

9.4 GENERAL PROCEDURES

Soil samples are collected using a variety of techniques and equipment, depending on the type (e.g., surface, subsurface) and purpose (e.g., lithological logging, headspace evaluation, laboratory analysis) of the sampling, and most sampling events employ more than one equipment type or methodology. Subsurface soil sampling, for example, often includes sample collection from split-spoon, macro-core, or other dedicated sampling devices advanced into the subsurface. Recovered cores are often logged (using a Munsell color chart and other logging aids), screened for volatile organic compounds (VOCs) using a PID, and sampled for laboratory analysis using disposable stainless steel spoons or other discrete sampling devices.

Each sampling configuration is associated with a unique set of sampling equipment requirements and techniques. The selected procedures and equipment are project-specific and should be discussed by the project team before arriving onsite. All types of soil sampling, regardless of the equipment used, share common handling and management procedures that are designed to ensure the integrity of the samples collected. These procedures include:

- The use of new, disposable or decontaminated sampling equipment
- The use and rotation of the appropriate PPE
- Selection of a suitable sampling location and staging area

Wear a clean pair of new, disposable gloves each time a different sample is collected and don the gloves immediately prior to collection. This limits the possibility of cross-contamination from accidental contact with gloves soiled during collection of the previous sample. The gloves must not come in contact with the medium

being sampled and must be changed any time during sample collection when their cleanliness is compromised. In no case should gloved hands be used as a soil sampling device; if the soil cannot be transferred directly from the sampling device to the laboratory-supplied containers use a stainless steel spoon or spatula to transfer the soil from the sampling device to the laboratory-supplied containers.

9.4.1 EQUIPMENT SELECTION

Collect all samples using either new, disposable equipment, such as polyethylene liners or single-use stainless steel spoons; or properly decontaminated sampling equipment, such as hand augers, split-spoon samplers, or trowels. Soil sampling equipment should be selected based on the analytical requirements of the project and the project-specific conditions likely to be encountered. The equipment should be constructed of non-reactive, non-leachable materials (e.g., stainless steel, Teflon®, Teflon®-coated steel, polyethylene, polypropylene) which are compatible with the chemical constituents at the site. When choosing sampling equipment, give consideration to:

- the types of soil or fill present
- the required depth of the sample
- the volume of sample required
- the analytes of interest

Select the types of equipment and decontamination procedures based on the types of sampling to be performed. Decontamination may require multiple steps or differing cleaning methods, depending on the sampling goals (see SOP 6 for decontamination procedures). In no case should disposable, single use materials (e.g., acetate liners, soil baskets) be used to collect more than one sample.

9.4.2 SAMPLING CONSIDERATIONS

In preparing for sampling, you should perform the following activities (with all observations and measurements noted in the field book):

- Perform a quick reconnaissance of the site to identify sampling locations and evaluate the accessibility (physical obstructions, slope, overhead and underground utilities) to the sampling location.
- Record the approximate ambient air temperature, precipitation, wind (direction and speed), tide, and other field conditions in the field book. In addition, any site-specific conditions or situations that could potentially affect the samples at the sample locations should be recorded.
- Record a description of the sampling location and the approximate distance to and direction from at least one permanent feature.
- Should any sample location require a vertical or horizontal offset from the proposed location, indicate the reason and record the actual sample location in the field book.

Survey the breathing zone around the sampling location with the appropriate air quality meter(s), as necessary (see HASP), to ensure that the level of PPE is appropriate. When sampling soil, it is important to find a suitable sampling location away from any sources of cross-contamination that could compromise the integrity of the samples. Consider the following:

- Position the sample collection area away from fuel-powered equipment, such as drill rigs or excavators, and upwind of other site activities (e.g., purging, sampling, decontamination) that could influence the sample. This is particularly important when screening samples in the field for VOCs with a PID, but should not be limited to the active sample collection.
- Store samples already collected from the field for laboratory analysis in clean containers in an ice-filled cooler (as required) and securely stage, if possible, in an uncontaminated area of the site.

9.5 SOIL COLLECTION

Soil samples can be collected from surface or subsurface depths, depending on the project requirements. Surface soils are generally those collected at depths less than 2 feet below ground surface (bgs) and can be collected using trowels, soil probes, shovels, or hand augers. Be aware that some states have specific definitions of what constitutes a surface soil sample. Subsurface soils are generally deeper and require specialized equipment to recover the samples. In most cases, subsurface soils will be collected using a drill rig or excavator to prevent the soil from being mixed with soils from a shallower interval.

Push or drive the method-specific sampling equipment (e.g., trowel, hand auger, hollow corers, split-spoon, direct push sampler, rotosonic core barrel sampler, excavator bucket) into the soil to the desired sampling depth using cleaned equipment. Record in the field book the depth interval through which the sampler was advanced and, when using a split-spoon sampler, the number of blows needed to drive the sampler 6 inches. If additional soil is needed to provide sufficient sample volume, repeat this step taking care to ensure that the same depth interval is collected during the resample. Use core catchers on the leading end of the sampler (if available) for soils that lack cohesiveness and are subject to falling out of the sampler (i.e., poor recovery).

Withdraw the sampling equipment from the interval, open the sampler (as appropriate), and collect the sample safely (e.g., avoid entering an excavation by collecting the sample from an excavator bucket at ground surface). Samples collected from an excavator bucket should be taken from the center of the material to ensure material is representative of the desired sampling interval.

Recovered soils should be placed on plastic sheeting in a consistent manner such that the orientation of the sample (i.e., which end is “up”) and the depth interval is readily apparent to the sampling personnel. Measure the length of the material recovered relative to the interval the sampler was advanced in percent notation (e.g., 75%) or as a fraction of the total length of the sample interval (e.g., [3/4] indicating 3 out of 4 feet) and record this information in the field book. If field screening for organic vapors is required, break or cut the soil core every 3 to 4 inches and quickly scan the breaks in the core material with the appropriate air quality monitoring equipment (e.g., PID) and record the readings and approximate depth in the field book. These measurements can be used to select appropriate soil samples for VOC or headspace analysis, if required (see procedures below).

9.5.1 UNDISTURBED SOIL SAMPLES

Undisturbed soil samples collected for geotechnical parameters (e.g., porosity, permeability) generally require the use of specialized undisturbed sampling equipment (e.g., Shelby tube or sealed Geoprobe® liner) and collection procedures. The sampling device, once retrieved, is typically capped or sealed (to maintain the sample in its relatively undisturbed state), labeled with the sample name, orientation of the sample (i.e., top and bottom), depth interval, and shipped to the appropriate geotechnical laboratory. Follow sample labeling, preparation, and shipping procedures in SOPs 3 and 4.

9.5.2 VOLATILE ORGANIC COMPOUND SAMPLING

Analytical soil samples for VOC analysis should be collected immediately after screening with the PID to avoid loss of constituents to the atmosphere. Transfer the soil from the portion of the soil core to be sampled (usually the area where the highest PID readings were observed) directly into the sample containers; do not homogenize soils for VOC analysis. Place the soil in the sampling container such that no headspace is present above the soil when the cover is placed on the jar. If U.S. Environmental Protection Agency Method 5035 (e.g., Encore® samplers) is required, follow manufacturer’s specifications and company recommended shipping procedures. Collect quality assurance/quality control (QA/QC) samples, if appropriate, in accordance with SOP 4, the project-specific work plan, and the QAPP.

9.5.3 SOIL HEADSPACE ANALYSIS

Collect soil samples for field-based headspace analysis, if required as part of the project-specific work plan, after collecting the VOC sample. First, examine the soil and remove coarse gravel, organic material (e.g., roots, grass, and woody material) and any other debris. Transfer the soil from the portion of the soil core to be sampled and place in a heavy-duty zipper-style plastic bag and seal the bag. Label the sample indicating the sampling location, depth, and date. Shake the sample vigorously for approximately 15 seconds to disaggregate the sample and expose as much surface area of the soil as possible (to release the VOCs to the atmosphere within the bag). If necessary, warm the sample to room temperature (70º Fahrenheit, [ºF]) by placing the bag in a heated room or vehicle. This step is critical when the ambient temperature is below 32ºF.

The VOCs, if present, will volatilize into the sealed bag. Allow the bag to stand (to achieve equilibrium) for approximately 15 minutes. Carefully open the bag slightly and place the tip of the PID into the opening. Do not insert the tip of the probe into the soil material and avoid the uptake of water droplets. Allow the PID to equilibrate and record the highest PID measurement noted. Erratic PID responses may result from high organic vapor concentrations or elevated headspace moisture. If these conditions exist, qualify the headspace data in the field book. It is also important to record the ambient temperature, humidity, and whether moisture was present in plastic bag. Duplicate 10% of the headspace samples by collecting two samples from the same location. Generally, duplicate sample values should be consistent to ±20%. Samples collected for headspace screening cannot be retained for laboratory analysis.

9.5.4 SEMI- AND NON-VOLATILE ANALYTICAL SAMPLE COLLECTION

Collect remaining organic samples then inorganic samples in the following order of volatilization sensitivity:

- Extractable organics, petroleum hydrocarbons, aggregate organics, and oil and grease
- Metals
- Inorganic non-metallic and physical and aggregate properties
- Microbiological samples
- Radionuclides

If homogenization is required, mix the soils (using stainless steel bowls and spoons, or other appropriate equipment) to a homogeneous particle size and texture. Transfer the soils from the sampler or mixing bowl to the sample container using a decontaminated or dedicated stainless steel spoon or spatula. Collect QA/QC samples in accordance with SOP 4, the project-specific work plan, and the QAPP.

If approved by the appropriate regulatory agency and specified in the project-specific work plan, composite soil samples can be collected to minimize the total number of analytical samples. Composite samples consist of equal aliquots (same sample size) of soil from each location being sampled (e.g., from each borehole or from multiple areas of a soil pile), by mixing the waste to a homogeneous particle size and texture using new or decontaminated stainless steel bowls and a stainless steel spoon or trowel. Transfer the contents to the appropriate laboratory supplied sample container using a stainless steel spoon. Collect QA/QC samples in accordance with SOP 4, the project-specific work plan, and the QAPP, if required.

If necessary, conduct field tests or screening on soils in accordance with the project-specific work plan and manufacturer's specifications for field testing equipment.

9.5.5 SAMPLE LABELING AND PREPARATION FOR SHIPMENT

Once collected, prepare the soil samples for offsite laboratory analysis:

1. Clean the outside of the sample container with paper towels or appropriate materials, if necessary

2. Affix a sample tag or label to each sample container and complete all required information (sample number, date, time, depth interval, sampler's initials, analysis, preservatives, place of collection)
3. Place clear tape over the tag or label (if non-waterproof labels are used)
4. Preserve samples immediately after collection by placing them into an insulated cooler filled with bagged wet ice to maintain a temperature of approximately 4°Celcius (if required by analytical method)
5. Record the sample designation, date, time, depth interval, and the sampler's initials in the field book and on a sample tracking form, if appropriate
6. Complete the chain-of-custody forms with appropriate sampling information, including:
    - Location
    - Sample name
    - Sample collection date and time
    - Number of sample containers
    - Analytical method
7. Complete sample packing and ship in accordance with proper procedures

Do not ship hazardous waste samples without first consulting a company compliance professional.

9.5.6 SOIL CLASSIFICATION

Soil classification should be performed whenever soil samples are being collected to provide context for the analysis. Follow the Unified Soil Classification System (USCS) logging procedures as described in ATSM D2488[1]. The emphasis of soil classification in the field must be on describing the soils using ALL of the required descriptors; categorization of the USCS group name or symbol alone may not provide details about the soils that could later prove useful. Avoid geologic interpretation or the use of local formation names, which are often difficult to determine in the field without the regional framework. Record ALL of the following information for each sample interval/soil type:

- Depth interval
- USCS group name
- USCS group symbol
- Color, using Munsell chart (in moist condition)
- Percent of cobbles or boulders, or both (approximate; by volume)
- Percent of gravel, sand, or fines, or all three (approximate; by dry weight)
- Particle-size range:
    - Gravel—fine, medium, coarse
    - Sand—fine, medium, coarse
    - Fines – clay or silt
- For gravel and sand:
    - Particle angularity: angular, subangular, subrounded, rounded
    - Particle shape: (if appropriate) flat, elongated, flat and elongated

[1] Note that certain states/regulatory programs may require soil classification under a secondary system (e.g., US Department of Agriculture) or the use of hydrochloric acid to test the reaction with soil (none, weak, strong).

  - Maximum particle size or dimension
  - Hardness of coarse sand and larger particles
- For clay and silt:
- Plasticity: non-plastic, low, medium, high
- Dry strength: none, low, medium, high, very high
- Dilatancy: none, slow, rapid
- Toughness: low, medium, high
- Odor (mention only if organic or unusual; factual descriptions only, no interpretations)
- Moisture: dry, moist, wet
- Additional comments: presence of roots or root holes, presence of mica, gypsum, etc., surface coatings on coarse-grained particles, caving or sloughing of auger hole or trench sides, difficulty in augering or excavating, etc.

For intact samples also include:

- Consistency (fine-grained [clay] soils only): very soft, soft, firm, hard, very hard
- Structure: stratified, laminated, fissured, lensed, homogeneous
- Cementation: weak, moderate, strong

Use the following standard descriptors for the textural percentages:

- Trace: <5% [2]
- Few: 5-10%
- Little: 15-25%
- Some: 30-45%
- Mostly: 50-100%

Example descriptions, using the information listed above, would read as follows:

- 8-10’ – Well Graded Sand, SW (5YR 2/6) fine- to medium-grained sand, trace medium sub-angular rounded gravel (less than 0.5-inch diameter); medium dense to dense; wet; moderate petroleum-like odor between 9 feet bgs and 10 feet bgs.
- 10-12’ – Lean Clay with Gravel, CL (5YR 2/6) some fine- to coarse-grained angular to subangular gravels (less than 0.25-inch diameter), trace fine- to medium-grained rounded sands; very stiff; low plasticity; low dry strength; no dilatancy; moist; no odors.

9.6 CLOSING NOTES

Once sampling is completed, restore and mark all sample locations with spray paint, stakes, or other appropriate marker for future reference or survey in accordance with the project-specific work plan. Decontaminate all equipment prior to departure and properly

[2] The use of “Trace” for describing the fraction of clay soils is inappropriate for field-based logs as clay contents of less than 20% in fine-grained soils cannot be reliably determined in the field.

FIELD STANDARD OPERATING PROCEDURE #16

SURFACE MATERIAL SAMPLING PROCEDURE

Surface material sampling procedures outlined in this Standard Operating Procedure (SOP) are designed to ensure that samples are representative of the surfaces from which they were collected and that they have not been altered or contaminated by the sampling and handling methods. Types of surface samples include chip samples for porous surfaces (e.g., concrete or painted surfaces), dust or sweep samples, concrete core or powder samples, and non-porous surfaces (e.g., metal) for wipe samples. Surface samples may be collected for onsite screening or for offsite laboratory analysis. The user is advised to read the entire SOP and review the site health and safety plan (HASP) before beginning any onsite activities. In accordance with the HASP, proper personal protective equipment (PPE) must be selected and used appropriately.

16.1 ACRONYMS AND ABBREVIATIONS

GFCI	ground fault circuit interrupter
HASP	health and safety plan
IDW	investigation derived waste
PID	photoionization detector
PPE	personal protective equipment
QA/QC	quality assurance/quality control
QAPP	Quality Assurance Project Plan
SOP	standard operating procedure

16.2 MATERIALS

- Field book
- PPE
- Air quality monitoring equipment
- Utility knife
- Aluminum foil or heavy-duty zipper-style plastic bags (quart size)
- Plastic sheeting
- Expanding ruler or tape measure
- Sampling containers and labeling/shipping supplies
- Chip sampling method specific materials:
  - Rubber mallet
  - Steel chisel, or equivalent
  - Dustpan
  - Dedicated, clean medium-sized, bristle brush
  - Scale (digital)
  - Aluminum foil or weighing pans
  - Stainless steel spatulas
- Wipe sampling method specific materials:
  - Sterile wrapped gauze pad (e.g., 3 inches by 3 inches)
  - Clean medium-sized, bristle brush

  - Appropriate type and grade solvent
  - Sample area template (10 centimeters [cm] by 10 cm; typical)
  - Marking chalk
  - Tweezers or forceps
- Concrete core or powder method specific materials:
  - Concrete corer and drill, or impact hammer drill, with power supply
  - Portable ground fault circuit interrupter (GFCI) cable (if no GFCI is available at the jobsite)
  - Sandpaper or grinder with power supply, as necessary
  - Steel chisel or sharp cutting knife
  - Rubber mallet
  - Brush and cloths to clean area
  - Digital scale
  - Aluminum foil and/or aluminum weigh pans
  - Stainless steel spatulas
- Water or water supply, as necessary
- Wet/dry vacuum
- Decontamination supplies

16.3 PRECONDITIONS AND BACKGROUND

This SOP has been prepared as part of the company's USA Corp. Environmental Quality Management Plan and is designed to provide detailed procedures for common field practices. Compliance with the methods presented in this document is mandatory for all field personnel and will ensure that the tasks are performed in a safe and consistent manner, are in accordance with federal and state guidance, and are technically defensible.

This SOP is written for the sole use of company employees and will be revised periodically to reflect updates to company policies, work practices, and the applicable state and/or federal guidance. Employees must verify that this document is the most recent version of the company's SOPs. Employees are also strongly advised to review relevant state and/or federal guidance, which may stipulate program-specific procedures, in advance of task implementation.

This SOP is designed to provide the user with a general outline for conducting surface sampling and assumes the user is familiar with basic field procedures, such as recording field notes (SOP 1), utility location (SOP 2), sample shipment procedures (SOP 3), sample collection and quality assurance procedures (SOP 4), IDW management procedures (SOP 5), equipment decontamination (SOP 6), and use and calibration of all sampling and monitoring equipment (SOPs 7 and 8). This SOP does not cover investigation planning, nor does it cover the analysis of the analytical results. These topics are more appropriately addressed in a project-specific work plan. Additionally, this SOP does not provide site-specific health and safety procedures that are required for each site where samples are collected; refer to the site-specific HASP for these procedures and safe work practices. Before sampling, be sure to review the project-specific work plan or Quality Assurance Project Plan (QAPP) and any applicable state and federal guidelines or sampling procedures.

All sampling and monitoring references must be available for consultation in the field, including:

- Company's SOPs
- Applicable state and federal guidelines or sampling procedures

- Manufacturer's manuals
- Project-specific work plan and HASP
- QAPP

16.4 GENERAL SURFACE SAMPLING PROCEDURES

The procedures and equipment that are used to accomplish surface sampling are project-specific and should be discussed by the project team before arriving onsite. All types of surface sampling, regardless of the equipment used, share common handling and management procedures that are designed to ensure the integrity of the samples collected. These procedures include:

- The use of new, disposable or decontaminated sampling equipment
- The use, changing, and disposal of the appropriate PPE
- Selection of a suitable sampling location and staging area

Wear a clean pair of new, disposable gloves each time a different sample is collected and don the gloves immediately prior to collection. This limits the possibility of cross-contamination from accidental contact. The gloves must not come in contact with the medium being sampled and must be changed any time during sample collection when their cleanliness is compromised.

If possible, find a suitable sampling location by selecting an area that is away from any sources of cross-contamination that could compromise the integrity of the samples. This includes positioning the sample collection area away from fuel-powered equipment, such as drill rigs or excavators, and upwind of other site activities (e.g., purging, sampling, decontamination) that could influence the sample.

16.4.1 EQUIPMENT SELECTION

Collect all samples using either new, disposable equipment, or properly decontaminated sampling equipment. The equipment should be constructed of non-reactive, non-leachable materials (e.g., stainless steel, Teflon®, Teflon®-coated steel, polyethylene, polypropylene, etc.) which are compatible with the chemical constituents at the site.

Select the decontamination procedures based on the types of sampling to be performed and decontamination may require multiple steps or differing cleaning methods, depending on the sampling goals (see SOP 6 for decontamination procedures). In no case should disposable, single use materials be used to collect more than one sample.

16.4.2 SAMPLING CONSIDERATIONS

Note all observations and measurements in the field book as the following steps are completed.

- Verify sampling locations and analytes; the sampling location should be described in the field note book so that the sample locations can be identified in the future
- Record the approximate ambient air temperature, precipitation, wind, tidal conditions, and other field conditions the field book. In addition, any site-specific conditions or situations that could potentially alter the surface samples should be recorded.
- Survey the ambient air around the sampling location with a photoionization detector (PID), as necessary.
- Clear the sampling area of utilities especially if following the concrete core and powder collection procedures below.
- As necessary, follow the procedures in the HASP to monitor and mitigate fugitive dust.

- Determine sample size based on the detection limit desired and the amount of sample requested by the laboratory.
- Tailor sampling methods to suit each sample location, recognizing that surface situations vary widely. In all instances, the procedures employed must be documented in the field book.
- Mark sampling locations with a stake or flag them for future reference. Record locations with respect to a permanent feature, if available.

If approved by the appropriate regulatory agency and specified in the project-specific work plan, composite samples can be collected to minimize the number of samples to be analyzed when sampling highly contaminated areas. Using the appropriate sampling technique, collect equal aliquots (same sample size) from each location and combine the aliquots of the sample directly in the sample container with no pre-mixing. Notify the laboratory that the sample is an unmixed composite sample, and request that the sample be thoroughly mixed before sample preparation or analysis.

16.5 SURFACE SAMPLE COLLECTION PROCEDURES

16.5.1 CHIP SAMPLE COLLECTION PROCEDURES

Chip sampling is conducted on porous surfaces, such as a concrete floor, and is generally accomplished with a hammer and a chisel. Measure the sample area. Using a clean chisel, or equivalent, chip the sample area vertically, then horizontally to achieve an even depth as defined in the project-specific work plan. Collect the chip fragments using a clean dustpan and bristle brush or spatula and transfer the sample directly into an appropriately prepared sample container. If necessary, weigh the sample using a scale and place in an appropriately prepared sample container; record the sample weight in the field book.

Collect quality assurance/ quality control (QA/QC) samples in accordance with SOP 4 and the project-specific work plan. Decontaminate all non-disposable equipment before and after each use in accordance with SOP 6 and the project-specific work plan.

16.5.2 SWEEP SAMPLE COLLECTION PROCEDURES

Sweep sampling is used to collect dust or residue from porous or non-porous surfaces. Sweep the sample area defined in the project-specific work plan using a dedicated brush or spatula and collect the sample with a clean dustpan or aluminum foil. If necessary, weigh the sample using a scale and place in an appropriately prepared sample container; record the sample weight in the field book.

Collect QA/QC samples in accordance with SOP 4 and the project-specific work plan. Decontaminate all non-disposable equipment before and after each use in accordance with SOP 6 and the project-specific work plan.

16.5.3 CONCRETE CORE AND POWDER SAMPLE COLLECTION PROCEDURES

Concrete core and concrete powder samples are normally collected from concrete surfaces. Remove any debris from the sample area with a clean brush or cloth prior to drilling. Move the concrete coring drill or impact hammer drill into position and, following the manufacturer's specifications, drill a hole to the depth specified in the project-specific work plan (typically 1 inch or less).

For core samples, remove the core from the hole using clean forceps (or similar). Measure the total length and width of the core and record the dimensions in the field book. Wrap the core in aluminum foil and place it in an appropriately prepared sample container.

For powder samples, remove the powder from the hole using a clean spatula and place on aluminum foil or weighing pan and homogenize the concrete powder. Weigh the sample using a digital scale and place in an appropriately prepared sample container; record the sample weight in the field book.

Collect QA/QC samples in accordance with SOP 4 and the project-specific work plan. Decontaminate all non-disposable equipment before and after each use in accordance with SOP 6 and the project-specific work plan.

16.5.4 WIPE SAMPLE COLLECTION PROCEDURES

Wipe samples are normally collected from non-porous, smooth surfaces, such as unpainted metal surfaces to determine whether or not they are contaminated or to evaluate the effectiveness of decontamination procedures. Wipe sampling is accomplished by using a gauze pad (or alternate absorbent material) saturated with a solvent (e.g., hexane) then thoroughly wiping a premeasured sample area. A standard wipe test, as specified in 40 Code of Federal Regulations 761.123, uses a 10 centimeter (cm) by 10 cm template to outline the sample area. Typically, the analytical laboratory will provide the prepared saturated gauze pad in a vial with a Teflon-lined cap.

Mark the sample area using the template or ruler and marking chalk. Remove the saturated gauze from the sample vial with forceps and immediately begin applying the gauze, with pressure, to the marked area from left to right and then top to bottom; wipe the area twice. Let the gauze air dry and return to the vial.

Collect QA/QC samples in accordance with SOP 4 and the project-specific work plan. Decontaminate all non-disposable equipment before and after each use in accordance with SOP 6 and the project-specific work plan.

16.5.5 SAMPLE LABELING AND PREPARATION FOR SHIPMENT

Once collected, prepare the groundwater samples for offsite laboratory analysis:

- Cleaning the outside of the sample container
- Affixing a sample tag or label to each sample container and complete all required information (sample number, date, time, sampler's initials, analysis, preservatives, place of collection)
- Placing clear tape over the tag or label (if non-waterproof labels are used)
- Preserving samples immediately after collection by placing them into an insulated cooler filled with bagged wet ice to maintain a temperature of approximately 4°Celcius
- Recording the sample designation, date, time, and the sampler's initials in the field book and on a sample tracking form, if appropriate
- Completing the chain-of-custody forms with appropriate sampling information
- Securing the sample packing and shipping in accordance with proper procedures

Do not ship hazardous waste samples without first consulting a company compliance professional.

16.6 CLOSING NOTES

Once sampling is completed, secure the sampling locations in accordance with the project-specific project work plan. Decontaminate all equipment prior to departure and properly manage all PPE and investigation-derived wastes in conformance with applicable regulations.