Self-Implementing PCB Remediation Work Plan

Emerson Power Transmission Site
Building 24
Ithaca, New York

October 28, 2014

WSP Project No. 4255

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Client

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Table of Contents

Figures

Tables

Appendices

Certification

This certification, prepared in accordance with Title 40 of the Code of Federal Regulations 761.61, designates Emerson headquarters located at 8000 West Florissant Avenue in St. Louis, Missouri, as the location where site decontamination documents will be maintained. Documents maintained include sampling plans, sample collection procedures, extraction procedures, and instrumental/chemical analysis procedures used to assess or characterize the PCB contamination at the site. These documents will be maintained onsite for U.S. Environmental Protection Agency inspection.

Under civil and criminal penalties of law for the making or submission of false or fraudulent statements or representations (19 U.S.C. 1001 and 15 U.S.C. 2615), I certify that the information contained in or accompanying this document is true, accurate, and complete. As to the identified section(s) of this document for which I cannot personally verify truth and accuracy, I certify as the company official having supervisory responsibility for the persons who, acting under my direct instructions, made the verification that this information is true, accurate, and complete.

Certification of Property Owner:

Derek E Chase

Director, Environmental Affairs

Name and Title

October 27, 2014

Date

Derek E Chase

Signature

1 Introduction

WSP, on behalf of Emerson, has prepared this Self-Implementing Polychlorinated Biphenyl (PCB) Remediation Work Plan for the Emerson Power Transmission (EPT) facility (Site) located at 620 South Aurora Street in Ithaca, New York (Figure 1). This work plan presents the results of investigation activities performed in the area of a former transformer pad located on the west side of Building 24 (Figure 2), and describes the proposed remedial activities to address the media affected by polychlorinated biphenyls (PCBs).

1.1 Scope of the Work Plan

This work plan describes investigations that were conducted to delineate PCBs in the Building 24 transformer concrete pad and adjacent areas and presents the resulting data. The work plan describes the proposed remediation activities to address PCB-affected media, and the confirmation sampling program to demonstrate attainment of the proposed cleanup level.

Delineation activities were designed to comply with the U.S. Environmental Protection Agency (EPA) self-implementing cleanup option under Title 40 of the Code of Federal Regulations (CFR) Part 761.61, which requires delineation and characterization in accordance with 40 CFR 761.260 to 761.274 (Subpart N). Three media were investigated: concrete associated with the former pad, surrounding soil, and underlying bedrock. All are considered porous surfaces as defined in 40 CFR 761.3. Concrete and soil containing PCBs at concentrations greater than the applicable high occupancy cleanup criterion were identified and delineated.

The proposed remedial activities include removal of the former transformer pad (concrete surface and sidewalls), removal of gravel fill beneath the pad, removal of asphalt and excavation of soil from areas around the pad, and offsite disposal of concrete, gravel, soil, and asphalt. Confirmation samples will be collected in accordance with 40 CFR 761 Subpart O, and the site will be restored to beneficial use as a high occupancy area.

All site activities, including sample collection and handling, decontamination, and quality assurance procedures, will be performed in accordance with WSP's standard operating procedures (SOPs) presented in Appendix A, unless specific procedures or protocols are required for sampling and testing equipment, or are required by applicable sections of 40 CFR 761.

1.2 Remedial Objectives

The remedial action goal is to remediate and restore the PCB-affected areas for high occupancy use without further restrictions. The following actions will be performed to achieve this goal:

- Remove the concrete pad (surface and sidewalls), and gravel fill beneath the pad that contain PCB concentrations greater than the high occupancy cleanup level of 1 milligram per kilogram (mg/kg).
- Remove asphalt, subbase material, and soil that contain PCBs greater than 1 mg/kg in the paved areas west and northwest of the transformer pad.
- Remove soil that contains PCBs greater than 1 mg/kg in the grassed areas north and south of the transformer pad.
- Segregate materials based on the PCB concentrations above and below 50 mg/kg. Transport and dispose of the materials at an appropriately licensed disposal facility. Bulk remediation waste with PCB concentrations of 50 mg/kg or greater will be disposed of in a Resource Conservation and Recovery Act (RCRA) Section 3004 or 3006 permitted hazardous waste landfill or an approved PCB disposal facility; non-liquid cleanup waste at any concentration and bulk PCB remediation wastes at concentrations less than 50 mg/kg will be disposed of at either an approved PCB disposal facility, a permitted municipal solid waste or non-municipal non-hazardous waste facility under 40 CFR 761.61(a) or (c), or a RCRA Section 3004 or 3006 permitted hazardous waste landfill.

- Protect active utility service running through the work areas. Temporarily disconnect, isolate, or relocate utility service if affected by remediation activities.
- Collect confirmation samples of each type of media encountered to verify attainment of the 1 mg/kg cleanup level. Confirmation sampling shall be in accordance with Subpart O of 40 CFR 761.
- Restore affected areas in kind, except for the former transformer pad to be covered with crushed stone.

These activities are described in more detail in Sections 3.0 and 4.0.

2 Site Background

This section provides a brief description of the site, the site history and location, and PCB investigations completed at the site.

2.1 Site Description and History

The EPT facility is located at 620 South Aurora Street in Ithaca, New York (Figure 1). The site is approximately 100 acres, and there is one main structure consisting of a series of connected buildings and two separate buildings (Buildings 21 and 24) located in the northern portion of the site (Figure 2). Undeveloped woodland borders the site to the southwest along the steep embankments of the hill. West Spencer Street, which runs parallel to the EPT property, marks the western limit of the wooded area and the base of South Hill. Beyond Spencer Street to the west and in areas along the steep northern approach to South Hill and the EPT property are residential areas. These neighborhoods are bordered by Six Mile Creek, which flows north along the base of South Hill and eventually empties into Cayuga Lake, approximately 2 miles northwest of the property. The site has been vacant since 2011.

The original buildings at the site were constructed in 1906 by Morse Industrial Corporation, which manufactured steel roller chain for the automobile industry. From approximately 1928 to 1983, Borg-Warner Corporation owned the property and manufactured automotive components and power transmission equipment using similar processes, but not necessarily the same materials, as those conducted by EPT. In 1983, Morse Industrial Corporation was purchased from Borg-Warner Corporation by Emerson and became known as Emerson Power Transmission. EPT manufactured industrial roller chain, bearings, and clutching for the power transmission industry until ceasing operations in 2009.

Building 24 is located on the northeast portion of the property. A concrete pad which housed one or more transformers is located on the west side of Building 24. The pad is 22 feet long by 9 feet wide and the surface is 8 inches thick. A wooden roof supported by metal fence posts covers the pad and the pad is enclosed by chain-link fencing. Steel rails are embedded in the concrete at approximately 8-inch intervals. The pad is raised above the surrounding ground approximately 3.75 feet on the south end and 5 feet on the north end (the variance is due to the slope of the surrounding ground surface). A diagram of the transformer pad is illustrated in the detail in Figure 3. There are no records indicating the installation or removal dates of the transformers.

2.2 Investigation and Delineation Activities

Investigations conducted in 2013 included the collection of two concrete chip samples from the surface of the former transformer pad (B24-T1 and B24-T2) and the collection of a soil sample at 1 to 1.6 feet below ground surface (bgs) from boring LBA-MW-24, west of the pad. The concrete chip samples contained 19 mg/kg and 71 mg/kg total PCBs and the soil sample contained 11.3 mg/kg total PCBs.

From April 29 to May 1, 2014, WSP conducted an initial delineation investigation of the Building 24 pad area. Soil samples were collected from borings SB-627 to SB-634, west of the pad. The borings were located on an approximate 10-foot (3-meter) grid oriented north to south. Shallow soil samples were collected of the raised grassed area north of the pad (SD-636, SD-637, and SD-638) and soil cover on bedrock south of the pad (SD-639 and SD-640). Concrete chip samples CS-600 and CS-601 were collected from the concrete pad in front of a building access door north of the transformer pad (door stoop), and CS-602 through CS-609 were collected of the transformer pad. The transformer pad concrete samples were located on an approximate 10-foot spacing oriented to the pad, with samples CS-608 and CS-609 collected from heavily-stained areas within the grid. The sampling locations are shown on Figure 3.

On September 9, 2014, WSP conducted additional delineation in the Building 24 pad area. Borings SB-641 through SB-645 were advanced on a 10-foot grid oriented north to south, and shallow soil sample SD-656 was

collected 10 feet south of SD-640. Boring SB-630 was deepened to collect an underlying bedrock sample at 1.5 feet bgs, and underlying bedrock samples were collected at locations SD-639 and SD-640. Concrete chip samples CS-647 and CS-648 were collected from the north end of the door stoop, CS-608 was deepened to determine the thickness of the transformer pad and collect samples, and concrete samples CS-649 through CS-655 were collected of the north, east, and south sides of the transformer pad. The sample locations are shown on Figure 3.

Sample collection and analytical methods are discussed in the following sections. Quality control (QC) samples were collected of each medium at a frequency of one duplicate sample per 20 samples. All samples were collected, labeled, secured, and held in accordance with proper chain-of-custody procedures and WSP SOPs.

2.2.1 Concrete Sampling

In April 2014, the concrete chip samples were collected using a laboratory-cleaned chisel. The sample area was chipped horizontally, then vertically to 1 inch. The chipped fragments were collected using a decontaminated dustpan and brush and transferred into a labeled sample bottle.

In September 2014, concrete samples were collected from the sides of the former transformer pad using a rotary impact hammer equipped with a 1-inch-diameter carbide drill bit. The bit was first advanced to 1 inch. The powder was collected in disposable plastic bags taped under the boring and placed in jars provided by the laboratory. The bit was then advanced to 2 inches, with the powder collected in a different bag taped under the boring. The drill bit was cleaned between each boring and depth using soapy water, potable water rinse, and alcohol wipe.

A hydraulically-driven Geoprobe® direct push rig outfitted with a star bit was used to collect concrete samples at CS-647 and CS-648. The top 1 inch was pulverized using the bit, and all concrete and powder was removed from the hole. The hole was then deepened to 2 inches using the bit and the sample was placed in laboratory-supplied jars. The drill bit was cleaned between each boring and depth using soapy water, potable water rinse, and alcohol wipe.

Concrete samples were collected at CS-608 using a small-diameter concrete coring bit. The recovered core was divided into 2-inch sections using a clean chisel, then each section was pulverized using a clean rock hammer, and the sample was placed in laboratory-supplied jars. A sample of the gravel underlying the pad at 8 to 9 inches was collected using a clean small-diameter hand auger.

2.2.2 Soil Sampling

A hydraulically-driven Geoprobe® direct push rig collected the soil samples using 4-foot-long by 2-inch-diameter lined MacroCore sampler. The sampler was driven to refusal, encountered between 1.5 and 2 feet bgs. Upon recovery of the sample barrel, the liner was removed from the sampler and split open using a utility knife. The soil was described for lithology and logged in the field book.

For the April/May 2014 sampling, the sample at 0 to 1.5 feet bgs was submitted for analysis. For the September 2014 sampling, the soil samples at 0 to 1 foot bgs were submitted. For borings where bedrock was deeper (SB-642 and SB-646) a sample at 1 to 1.5 feet or 1.5 to 2 feet bgs was also submitted. The samples were placed in laboratory-supplied jars. The soil samples below 1 foot bgs were held at the laboratory pending the analytical results for the shallow samples. The deeper samples were analyzed if the detected total PCB concentration in the shallow sample was greater than 1 mg/kg.

All sampling equipment was decontaminated between sample locations using a detergent solution, potable water rinse, and alcohol final rinse.

2.2.3 Bedrock Sampling

In September 2014, to collect bedrock samples from the borings, the Geoprobe® sampler was driven at least 0.5 foot into the bedrock. Samples of the bedrock were retrieved, placed in laboratory-supplied jars, and submitted for

analysis. Other than the 1.5 to 2-foot sample from location SB-630, the bedrock samples from the borings were only analyzed if the detected total PCB concentration in the overlying soil sample was greater than 1 mg/kg. The bedrock sample from SB-645 at 2 to 2.5 feet bgs was the only other bedrock sample from the borings that was analyzed.

Bedrock samples were also collected at locations SD-639 and SD-640, south of the transformer pad. The bedrock was pulverized using a clean rock hammer and the sample was placed in a laboratory-supplied jar.

2.2.4 Sample Analysis

All samples were submitted to Accutest Laboratories in Marlborough, Massachusetts, and analyzed for PCBs using EPA Method 8082. Accutest is a certified laboratory meeting specifications for documentation, sample login, internal chain of custody procedures, sample/analysis tracking, data reduction, and reporting.

2.3 Sampling Results

The sampling results are presented in Table 1. Seven PCB Aroclors were analyzed; Aroclor 1260 and, to a lesser degree, Aroclor 1254 were detected at the site. The sum of the individual Aroclor detections represent the total PCB concentration that are shown on Figure 3. The total PCB concentrations greater than the high occupancy cleanup level of 1 mg/kg form the basis for the remediation plan.

2.3.1 Concrete

Total PCB concentrations above 1 mg/kg were detected in 5 of the 9 chip samples collected on the former transformer pad, and at all depths in location CS-608. For the pad sidewalls, total PCB concentrations above 1 mg/kg were detected in the sample representing the west portion of the north side, and the samples representing the north and central portions of the west side (see Figure 3). Total PCB concentrations above 50 mg/kg were detected in samples CS-608 (0 to 4 inches below grade), CS-609, and CS-652.

The gravel underlying the transformer pad contained 3.5 mg/kg of PCBs.

2.3.2 Soil

Total PCB concentrations above 1 mg/kg were detected in the samples from borings SB-630, SB-632, and SB-645, and surface samples SD-639 and SD-640 (Figure 3). No soil samples contained PCBs above 50 mg/kg. The extent of PCB concentrations to the north and west of SB-645 is uncertain and will be addressed by the confirmation sampling proposed in the following sections.

2.3.3 Bedrock

Total PCB concentrations did not exceed 1 mg/kg in any bedrock sample.

3 Proposed Remedial Activities

The remedial activities will include site preparation, removal of the former transformer pad including the sidewalls and underlying gravel, remediation of the soil in the asphalt and grassed areas surrounding the transformer pad, confirmation sampling, waste management, and site restoration. These activities are described in the following sections.

This plan provides the applicable notifications and certifications described in 40 CFR 761.61(a)(3). After approval of the work plan, additional notification will be provided by electronic mail when the remediation work is scheduled.

PCB-affected media will be segregated into two categories based on total PCB concentration: concrete to be disposed of offsite as Toxic Substances Control Act (TSCA) waste (PCB concentration greater than 50 mg/kg), and concrete, soil, asphalt, and gravel to be disposed of offsite as non-TSCA waste (PCB concentration less than 50 mg/kg).

3.1 Site Preparation

Site preparation and pre-excavation activities will include:

- Preparation of a site-specific Health and Safety Plan (HASP)
- Development of a Community Air Monitoring Plan (CAMP)
- Public and private utility location and protection of identified utilities
- Installation of silt fences and other sediment and erosion controls
- Management of the active utility lines
- Removal of the fence and roof associated with the transformer pad

Site preparation tasks are described in the following sections.

3.1.1 Health and Safety Plan

A site-specific HASP will be prepared for the work which will comply with 29 CFR 1910.120, the Hazardous Waste Operations and Emergency Response regulations. All subcontractors will be required to prepare and follow their own HASP that is commensurate with the work and activities.

The primary anticipated hazards include potential worker and public exposure to construction hazards and potential chemical exposure. Worker and public safety hazards will include those typically found at a construction site using heavy equipment. Potential chemical exposures are anticipated to derive from inhalation of particulates containing PCBs, and direct dermal contact with soil containing PCBs. The following engineering controls will be established to minimize these exposures:

- The excavation surfaces will be maintained damp to minimize dust generation
- Continuous air monitoring will be conducted while work is being performed to reliably measure airborne contaminants, to delineate areas where respiratory protection is required, and to verify that control measures are adequate
- Work zones will be established, including exclusion zones, contaminant reduction zones, and support zones, and workers will wear personal protective equipment as specified in the HASP

A copy of WSP's HASP will be available at the site during the conduct of all activities to which it is applicable.

3.1.2 Community Air Monitoring Plan

A site-specific CAMP will be prepared for the work outlined in this plan. The CAMP will identify measures and/or actions to ensure that the public living and working near the site as well as employees or visitors to any building located on the site are protected from exposure to site contaminants during remedial activities. In general, the CAMP will require particulate air monitoring using a MIE PDM-3 Miniram direct sensing, real-time monitor (or equivalent), with data logging capabilities. The device selected will be suitable for detection of airborne particulates at levels below the CAMP particulate action level.

3.1.3 Public and Private Utility Location

New York's one-call system will be contacted before starting work to mark all public utilities at the Site. A private utility locator will also be contracted to locate and mark all utilities within the anticipated work area. Identified utilities that are outside the proposed remediation areas will be protected throughout the work.

3.1.4 Erosion and Sedimentation Controls

Because the area to be disturbed is less than 1 acre, a storm water pollution prevention plan is not required for the proposed excavation activities. Best Management Practices (BMPs) will be implemented to limit the amount of erosion and sedimentation in surface water runoff. BMPs will be planned using the New York States Department of Environmental Conservation (NYSDEC) Division of Water - New York State Standards and Specifications for Erosion and Sediment Control (August 2005) as a guide.

The BMPs will include the installation of sediment controls. Silt fence will be installed at downgradient locations in unpaved areas and within the drainage ditch that runs along the pad and wall. Soil berms or hay bales may be constructed around the upgradient sides of the excavations as necessary to prevent surface water from entering open excavations. The BMPs will be removed after the areas have been backfilled and stabilized.

The excavation surface will be maintained damp and additional dust suppressant will be applied, as needed, to prevent or reduce dust emissions resulting from construction activities. Dust suppressant will be applied when exposed ground surfaces are dry and wind or vehicular traffic result in visible dust generation. Dust suppression will also be utilized when action levels in the HASP or CAMP are exceeded. Dust suppressant applications will consist of applying potable water via a mobile broadcast applicator in a controlled manner.

3.1.5 Utility Management

Traffic and work patterns will be established to minimize the potential for contact with any utilities. The power lines within the transformer pad enclosure are live. The lines will be de-energized by a licensed electrician and relocated if necessary before remediation work proceeds.

Underground utility lines identified during the public and private utility location will be protected throughout the remediation. If remediation is required within five feet of an active underground utility line, the utility providers will be notified to determine the appropriate measures to be taken to temporarily deactivated, isolated, or relocated during remediation. Utility services that are disrupted by remediation activities will be restored in kind following completion of the remedial activities.

3.1.6 Fence and Roof Removal

The chain-link fencing, posts, and roof will be demolished and the materials disposed of offsite. Based on the volume of demolition debris, decontamination of the materials is not anticipated. The results of wipe samples collected from the surfaces of the non-porous materials will be used to determine the proper management of the materials. Non-porous materials with PCB concentrations less than 100 micrograms per 100 square centimeters

(μg/100 cm^2) will be disposed of as a non-TSCA waste. Non-porous materials with PCB concentrations greater than 100 μg/100 cm^2 will be disposed of as a TSCA waste. Porous demolition debris that is not sampled will be assumed to contain PCBs greater than 50 mg/kg and managed as a TSCA waste.

Suspected asbestos containing materials (ACM) were not identified in an asbestos survey of Building 24 in 2005. If suspect ACM is identified during the selective demolition activities, the work will be temporarily suspended until the material is sampled and analyzed. Confirmed ACM will be abated before demolition work is performed.

3.2 Former Transformer Pad Removal

After completion of the site preparation activities, the entire concrete pad including sidewalls and underlying gravel will be removed. Based on PCB concentrations from samples collected to date (Figure 3), the concrete will be segregated based on concentration above and below 50 mg/kg. The removed concrete will be saw cut for segregation purposes and direct loaded to rolloff boxes for subsequent transportation to the appropriate waste disposal facilities.

One sample of the gravel collected just beneath the transformer concrete pad contained a total PCB concentration of 3.5 mg/kg. One additional composite sample of the gravel will be collected for PCB characterization purposes. The gravel will be managed for disposal based on the concentration of the composite sample. Free liquids that may be present in the gravel fill will be collected and placed in drums. One sample of the liquid, if present, will be collected for PCB characterization. While the depth of the gravel fill beneath the pad is unknown, all fill materials (i.e., gravel and soil) will be removed to native bedrock during the remedial activities.

The exposed portion of the Building 24 foundation wall will be pressure washed to remove remaining solid and liquid residuals. The wash water will be collected and managed with other decontamination fluids generated during remediation activities. The foundation wall will be sampled as described in Section 3.4.3.

3.3 Soil Excavation

Soil containing PCBs above the high occupancy cleanup level of 1 mg/kg is present in the unpaved areas north and south of the transformer pad and the asphalt-paved area west and northwest of the transformer pad. The results of soil samples collected demonstrate that the soil does not contain PCBs greater than 50 mg/kg. A hydraulic excavator will be used to excavate the PCB-containing soil from the areas north and south of the transformer pad (Figure 4). The soil will be direct-loaded into labeled rolloff containers for disposal as a non-TSCA waste. The soil will be removed to the top of the native bedrock estimated to be 1 to 2.5 feet below the ground surface.

In the areas west of the transformer pad, the asphalt will be saw cut to the dimensions shown on Figure 4. Aggregate subbase will be excavated with the affected soil down to the native bedrock surface. A composite sample of the removed asphalt will be collected and analyzed for PCBs for characterization purposes.

3.4 Confirmation Sampling

After completion of the transformer pad and soil removal actions, confirmation samples will be collected in accordance with 40 CFR 761 Subpart O to verify that the remaining media contains less than 1 mg/kg of PCBs. The confirmation sampling plan will include bedrock sampling in all of the excavation areas, perimeter sampling of asphalt and soil in areas north, west, and south of the transformer pad, and sampling of the Building 24 foundation wall. Confirmation samples will be collected and equipment decontamination will be performed as described in WSP's SOPs (Appendix A). All confirmation samples will be analyzed for PCBs by EPA Method 8082. Details of each type of confirmation sampling are provided below.

3.4.1 Bedrock Confirmation Sampling

Using the established 10-foot grid pattern from the delineation sampling, a 5-foot grid will be interlaid over the excavated areas including the former transformer pad as shown on Figure 5. Samples will be collected from the 5-foot grid nodes that fall within the excavated areas. Bedrock samples will be analyzed as discrete samples; no compositing will be performed.

Bedrock samples will be collected using a rotary impact hammer equipped with a 1-inch diameter carbide drill bit. The maximum depth of drill bit penetration will be 3 inches. The powder will be collected and placed in jars provided by the laboratory. Sampling equipment will be decontaminated after each sample.

If PCBs are detected in the bedrock confirmation samples above 1 mg/kg, additional bedrock will be material will be excavated in that area and a second round of confirmation samples collected on a grid shifted approximately 3 feet to the north. Secondary confirmation sampling will be performed at the same minimum frequency as the initial phase in the areas that require additional excavation. If removal of additional bedrock is not feasible and the PCB sample results are less than 10 mg/kg, the contingency measures described in Section 4.2 will be implemented.

3.4.2 Excavation Perimeter Confirmation Sampling

Confirmation samples will be collected from the excavation perimeters that were not originally bound by a delineation sample that contained less than 1 mg/kg PCBs. These sample locations are shown on Figure 5. For the perimeter confirmation samples, each type of media (asphalt and soil) above the bedrock will be sampled.

Soil confirmation samples will be analyzed as discrete samples. Asphalt samples will be composited by combining equal aliquots of asphalt from each excavation area into one sample. The laboratory will be instructed to pulverize and homogenize the asphalt samples before analysis.

If PCBs are detected in the soil and asphalt samples, the excavation area will be expanded by one 10-foot grid interval followed by additional confirmation sampling of the bedrock below the grid and along the new perimeter. This process will continue until the perimeter confirmation samples are less than 1 mg/kg.

The raised concrete slab (Figure 3) did not contain PCBs above 1 mg/kg; however, the soil beneath the slab will be sampled to confirm the endpoints of the soil excavation to the north and to the south. The proposed locations of these confirmation samples are shown on Figure 5. The concrete slab will be cored at each location and soil sample collected using a decontaminated hand auger. If PCBs are detected in the soil, the slab will be removed and the soil excavated to native bedrock. Confirmation samples of the bedrock below the raised slab will be collected as described in Section 3.4.1.

3.4.3 Building 24 Foundation Wall Confirmation Sampling

After pressure washing of the Building 24 foundation wall, a 5-foot grid will be overlaid onto the vertical surface that is exposed by the pad excavation activities. Wall samples will be collected at each grid node (three minimum) using a rotary impact hammer equipped with a 1-inch diameter carbide drill bit. The maximum depth of drill bit penetration will be 3 inches. The powder will be collected and placed in jars provided by the laboratory. Sampling equipment will be decontaminated after each sample collection using soapy water, potable water rinse, and alcohol wipe.

If PCB concentrations are greater than 1 mg/kg in the foundation wall, the contingency actions described in Section 4.1 will be implemented.

3.5 Backfilling and Site Restoration

After excavation and confirmation sampling that show PCB concentrations less than 1 mg/kg, the former transformer pad and the areas north and south of the pad will restored with a minimum of 6 inches of crushed

stone imported from a NYSDEC-permitted quarry. Because this fill type is excluded from imported fill testing requirements of NYSDEC DER-10, no imported fill sampling and analysis will be required. The final surface of the backfill will be compacted with a minimum of four passes with a roller or plate compactor such that the final surface matches the surrounding ground level.

Excavation areas west of the former transformer pad will be restored with asphalt to match the existing conditions. Crushed stone will be placed as subbase beneath the asphalt. The crushed stone will be compacted with a minimum of four passes with a roller or plate compactor to a depth that will accommodate the thickness of the existing asphalt. Asphalt materials and placement methods will conform to New York State Department of Transportation (NYSDOT) standards.

The drainage ditch and affected utilities will be restored in kind following the completion of the excavation activities.

The temporary erosion and sediment controls will be removed upon completion of the crushed stone and asphalt placement.

3.6 Management of PCB-Affected Media

Concrete from the transformer pad and other excavated materials containing as-found concentrations of PCBs greater than 50 mg/kg will be loaded into rolloff boxes. This material and any other debris that is not sampled to determine PCB content will be managed as TSCA hazardous waste and will be disposed of in a RCRA Section 3004 or 3006 permitted hazardous waste landfill. Final disposal will likely be at Chemical Waste Management's Model City facility near Lewiston, New York.

In accordance with 40 CFR 761.208, a Uniform Hazardous Waste Manifest will accompany the TSCA hazardous waste. A signed copy of each manifest will be retained for at least 3 years (40 CFR 761.209(a)). For any PCB waste shipment that requires a manifest, Emerson, or WSP, acting as the authorized agent for Emerson (the generator of the PCB waste), will comply with the following:

- Sign the manifest certification by hand
- Obtain the handwritten signature of the initial transporter and date of acceptance on the manifest
- Retain one copy and provide the copy to Emerson for its records
- Give to the transporter the remaining copies of the manifest that will accompany the shipment of TSCA waste
- Collect completed manifests and disposal certificates from disposal facility

Soil and other materials containing less than 50 mg/kg PCBs will be directly loaded to a rolloff container. Bulk PCB remediation wastes (soil, asphalt, gravel, and metal debris) will be disposed of at an approved PCB disposal facility, a permitted municipal solid waste, or non-municipal non-hazardous waste facility under 40 CFR 761.61(a) or (c). Manifesting and recordkeeping requirements do not apply to this category of waste (40 CFR 761.61(a)(5)(i)(B)(2)(ii) and 761.61(a)(5)(v)(A)); however, WSP will retain bill of lading documentation for all offsite shipments and provide the documents to Emerson in the final report documentation.

Liquid wastes including free liquids that may be present in the gravel beneath the transformer pad, decontamination fluids, and precipitation that accumulates in the excavation areas will be collected in drums, characterized, and disposed of offsite at a properly permitted facility as either a TSCA or non-TSCA waste.

4 Contingency Measures

Contingency measures will be implemented if confirmation samples do not meet the high occupancy cleanup level of 1 mg/kg and additional remediation is not practical. Remediation activities are planned for four types of media – concrete comprising the transformer pad, gravel fill beneath the pad, soil surrounding the pad, and asphalt west of the pad. The concrete pad and gravel will be removed in its entirety and the asphalt and soil can be removed laterally until the endpoints meeting the 1 mg/kg cleanup level are reached. Therefore, no contingency actions are proposed for these media.

No data have been collected to determine if PCBs have penetrated the Building 24 foundation wall and limited data have been collected to investigate the bedrock underlying the site. Confirmation sampling is planned for the foundation wall and bedrock. If PCBs are present above the high occupancy cleanup level, the following contingency measures have been developed for these media.

4.1 Building 24 Foundation Wall

The exposed portion of the Building 24 foundation wall will be pressure washed to remove solid and liquid residuals that may be present after removal of the transformer pad. The wall will be sampled as a porous surface as described in Section 3.4.3. If samples of the concrete contain PCBs at concentrations greater than the high occupancy cleanup level, Emerson will petition the EPA for a use authorization under 40 CFR 761.30(p) for continued use of porous surfaces for the remainder of its useful life. If approved, Emerson will submit a work plan for the additional sampling, double wash rinse procedure, encapsulation or barrier installation, and PCB markings that are required for this use authorization.

4.2 Bedrock

The transformer pad, gravel, and soil in the proposed excavation areas will be removed down to the native bedrock surface. Confirmation samples will be collected from the bedrock surface as described in Section 3.4.1. Samples of the bedrock collected to date show that PCBs have not penetrated the bedrock surface. However, if the confirmation samples contain PCBs greater than the high occupancy cleanup level, attempts will be made to scrape the surface to remove a portion of the bedrock surface. If bedrock removal proves to be impractical and the PCB concentrations are less than 10 mg/kg, Emerson will evaluate capping the bedrock that contains PCBs greater than 1 mg/kg in accordance with 40 CFR 761.61(a)(7) and (a)(8).

If the capping approach is selected, Emerson will submit a separate work plan detailing the cap design and plans for a deed restriction, fence, PCB markings, inspection, and maintenance procedures.

5 Reporting and Recordkeeping

At the completion of field activities, a summary report will be prepared documenting characterization, delineation, concrete and soil remediation, confirmation sampling and analyses, and demobilization activities completed at the site. In addition, waste manifests and bills of lading, laboratory data, and other documentation related to remediation and waste management will be included in the report. The report will also identify any further notifications required in accordance with 40 CFR 761. The final report will certified by a professional engineer licensed in the state of New York.

The report will be maintained for at least 3 years from the date of the final remediation work and will be made available to the EPA if or when requested. In addition, records will be maintained as required in accordance with 40 CFR 761.180(a) for all wastes regulated for disposal under this subpart.

The notification and certification and cleanup records required under 40 CFR 761.125(c)(5) will be retained for a period of at least 5 years.

6 Project Schedule

This work plan serves as the 30-day notification for site cleanup in accordance with 40 CFR 761.61(a)(3). Emerson will proceed with implementing the remedial activities in this plan within 3 weeks following presumptive approval or EPA comments on the plan. Site preparation and remedial activities are anticipated to take 2 to 3 weeks to complete.

The summary report will be completed within 60 days following the remedial activities.

7 Acronyms

bgs	below ground surface
BMP	Best Management Practice
CAMP	Community Air Monitoring Plan
CFR	Code of Federal Regulations
EPA	U.S. Environmental Protection Agency
EPT	Emerson Power Transmission
HASP	Health and Safety Plan
$\mu g/100\ cm^2$	micrograms per 100 square centimeters
mg/kg	milligrams per kilogram
NYSDOT	New York State Department of Transportation
NYSDEC	New York State Department of Environmental Conservation
PCBs	polychlorinated biphenyls
QA/QC	quality assurance / quality control
RCRA	Resource Conservation and Recovery Act
SOP	standard operating procedure
TSCA	Toxic Substances Control Act

Figures

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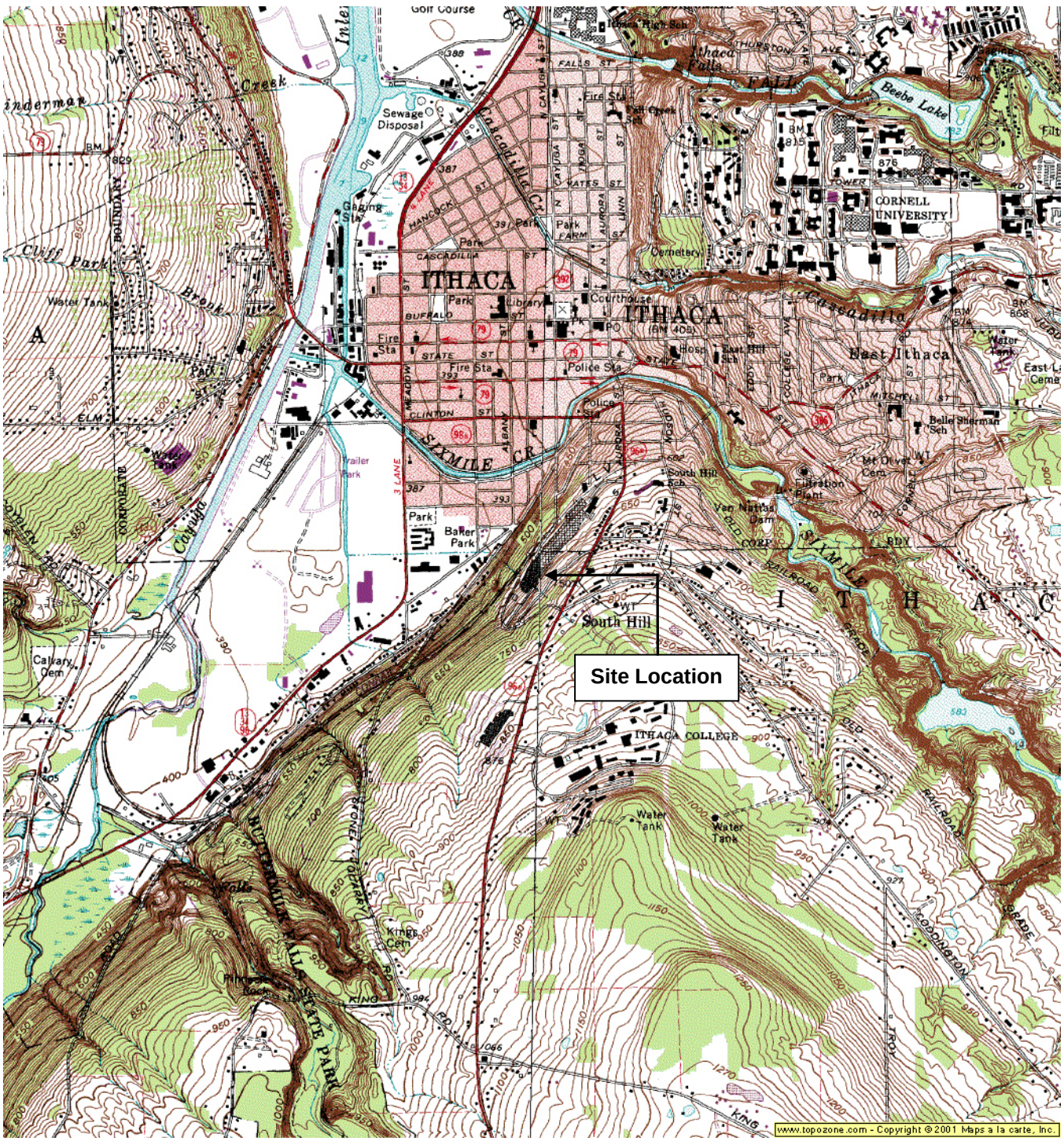


Reference
7.5 Minute Series Topographic Quadrangle
Ithaca East, New York
Photorevised 1976 Scale 1:25,000 Metric

N

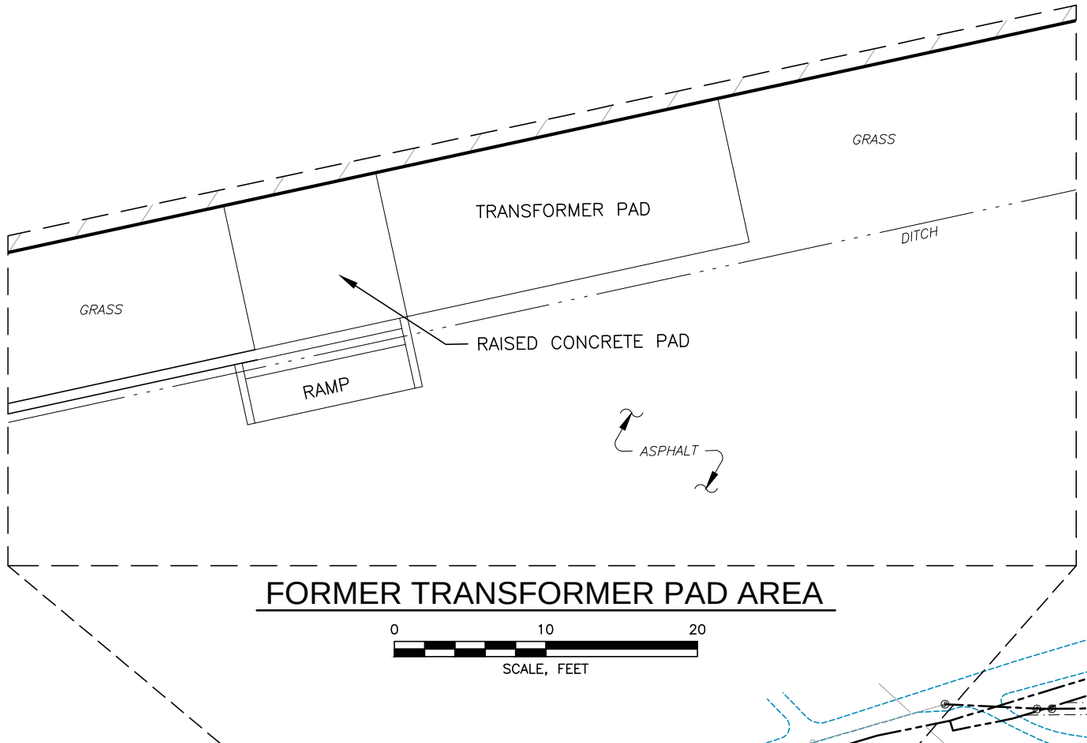
Quadrangle Location

Scale in Meters
0 500 1000

0 1000 2000
Scale in Feet

WSP Environment & Energy
11190 Sunrise Valley Drive
Suite 300
Reston, Virginia 20191
703-709-6500

Figure 1
Site Location
Emerson Power Transmission
Ithaca, New York



FORMER TRANSFORMER PAD AREA

0 10 20

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LEGEND

SANITARY SEWER

34 BUILDING NUMBER

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DWG Name: 00004255-B04

EMERSON POWER TRANSMISSION
ITHACA, NEW YORK

PREPARED FOR
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ST. LOUIS, MISSOURI

FIGURE 2

SITE LAYOUT

WSP USA Corp.
11190 Sunrise Valley Drive, Suite 300
Reston, Virginia 20191
(703) 709-6500
www.wspgroup.com/usa

R:\CAD\Acad\CADD\00004\00004255-Ithaca_NY\CAD\00004255-B04.dwg 10/23/2014 12:22 PM Usr201165

WSP-CS-650		
Depth BGS	0-1"	1-2"
Total PCBs	4.34	0.789

WSP-SB-655	
Depth BGS	0-1"
Total PCBs	0.096

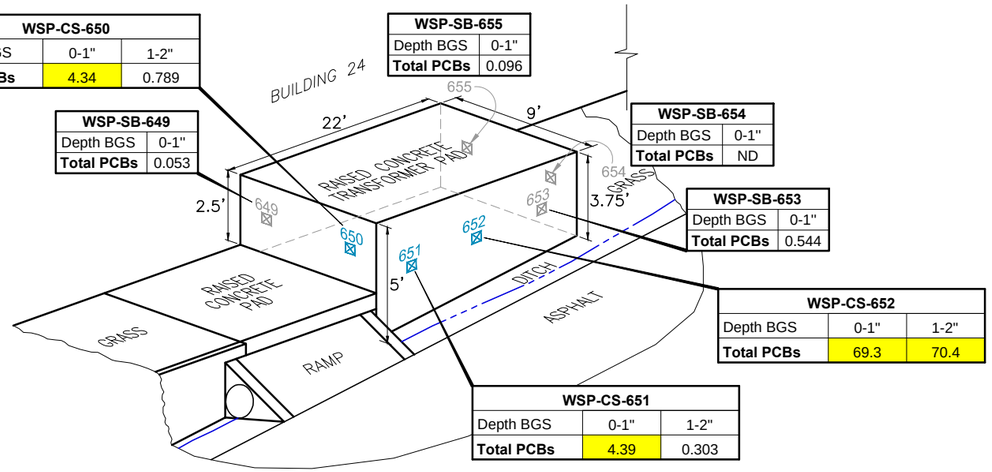
WSP-SB-649	
Depth BGS	0-1"
Total PCBs	0.053

WSP-SB-654	
Depth BGS	0-1"
Total PCBs	ND

WSP-SB-653	
Depth BGS	0-1"
Total PCBs	0.544

WSP-CS-652		
Depth BGS	0-1"	1-2"
Total PCBs	69.3	70.4

WSP-CS-651		
Depth BGS	0-1"	1-2"
Total PCBs	4.39	0.303



TRANSFORMER PAD DETAIL

NOT TO SCALE

NOTES:

1. TOTAL PCB CONCENTRATION IN MILLIGRAMS PER KILOGRAM (mg/kg).
2. YELLOW HIGHLIGHT EXCEEDS EPA HIGH OCCUPANCY CLEANUP LEVEL.
3. WSP–CS–608/8–9" IS GRAVEL LAYER BELOW CONCRETE PAD.
4. SAMPLE LOCATION NAMES HAVE BEEN CHANGED FROM THE ORIGINAL DESIGNATION FOUND IN THE LOGBOOK AND LABORATORY DATA PACKAGE. THE ORIGINAL FIRST THREE LETTERS DESIGNATION WAS LBA– AND HAS BEEN CHANGED TO WSP–, WHILE THE REMAINDER OF THE LABEL REMAINS THE SAME.

LEGEND

	LABELLA MONITORING WELL
	WSP SOIL BORING
	WSP CHIP SAMPLE
	WSP SURFACE SOIL SAMPLE
1 mg/kg	EPA HIGH OCCUPANCY CLEANUP LEVEL
BGS	BELOW GROUND SURFACE
ND	NOT DETECTED

WSP-CS-608						
Depth BGS	0-1"	2-3"	3-4"	4-6"	6-8"	8-9"
Total PCBs	211	125	52.9	22.8	5.4	3.5

WSP-CS-605	
Depth BGS	0-1"
Total PCBs	4.55

WSP-CS-609	
Depth BGS	0-1"
Total PCBs	128

WSP-SB-639		
Depth BGS	0-0.3'	0.5-1'
Total PCBs	3.25	0.071

WSP-SB-656	
Depth BGS	0-0.5'
Total PCBs	0.115

WSP-SB-603	
Depth BGS	0-1"
Total PCBs	0.264

WSP-SB-607	
Depth BGS	0-1"
Total PCBs	0.599

WSP-SB-632	
Depth BGS	0-0.8'
Total PCBs	1.97

WSP-SB-647	
Depth BGS	0-1"
Total PCBs	0.059

WSP-SB-600	
Depth BGS	0-1"
Total PCBs	0.166

WSP-SB-606	
Depth BGS	0-1"
Total PCBs	0.358

WSP-SB-640		
Depth BGS	0-0.1'	0.5-1'
Total PCBs	2.46	0.018

WSP-SB-641	
Depth BGS	0-1'
Total PCBs	0.274

WSP-SB-633	
Depth BGS	0-0.5'
Total PCBs	0.171

WSP-SB-601	
Depth BGS	0-1"
Total PCBs	0.058

WSP-SB-646		
Depth BGS	0-0.1'	1.5-2'
Total PCBs	0.768	0.450

WSP-SB-642		
Depth BGS	0-1'	1-1.5'
Total PCBs	0.457	0.475

WSP-SB-648	
Depth BGS	0-1"
Total PCBs	0.063

WSP-CS-604	
Depth BGS	0-1"
Total PCBs	9.98

WSP-CS-602	
Depth BGS	0-1"
Total PCBs	1.20

WSP-SB-634	
Depth BGS	0-0.5'
Total PCBs	0.938

WSP-SB-644	
Depth BGS	0-1'
Total PCBs	0.023

WSP-SB-638	
Depth BGS	0-0.3'
Total PCBs	0.752

WSP-SB-629	
Depth BGS	0-1.5'
Total PCBs	0.059

WSP-SB-645			
Depth BGS	0-1'	1-1.5'	2-2.5'
Total PCBs	21.2	1.25	0.169

WSP-SB-631	
Depth BGS	0-1.5'
Total PCBs	0.029

WSP-SB-643	
Depth BGS	0-1'
Total PCBs	ND

WSP-SB-637	
Depth BGS	0-0.3'
Total PCBs	0.837

(ACTUAL LOCATION IS 20' LEFT)

LBA-MW-24	
Depth BGS	1-1.6'
Total PCBs	11.3

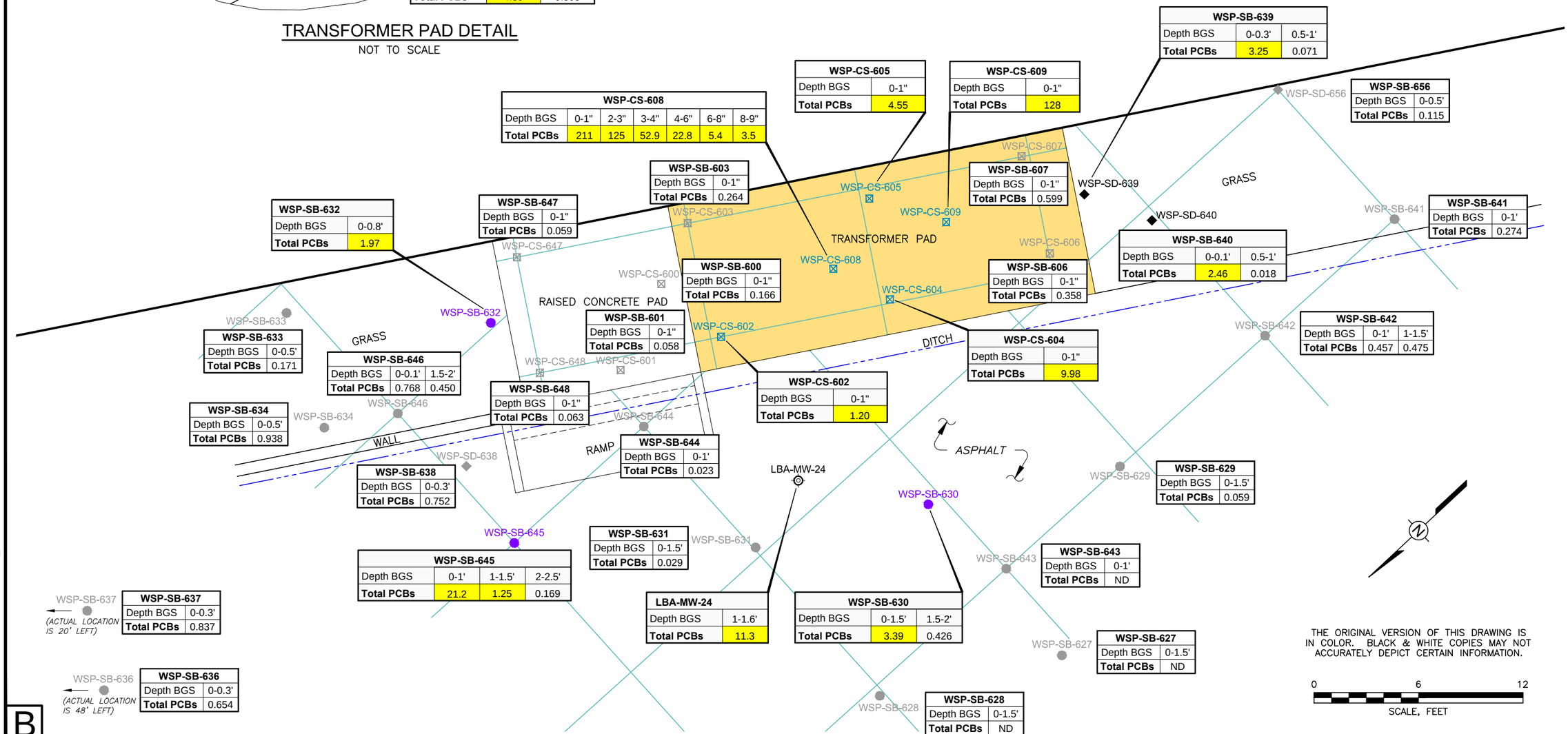
WSP-SB-630		
Depth BGS	0-1.5'	1.5-2'
Total PCBs	3.39	0.426

WSP-SB-627	
Depth BGS	0-1.5'
Total PCBs	ND

WSP-SB-636	
Depth BGS	0-0.3'
Total PCBs	0.654

(ACTUAL LOCATION IS 48' LEFT)

WSP-SB-628	
Depth BGS	0-1.5'
Total PCBs	ND



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EMERSON POWER TRANSMISSION
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ST. LOUIS, MISSOURI

FIGURE 3

PCB CONCENTRATIONS
BUILDING 24 TRANSFORMER PAD

WSP USA Corp.
11190 Sunrise Valley Drive, Suite 300
Reston, Virginia 20191
(703) 709-6500
www.wspgroup.com/usa

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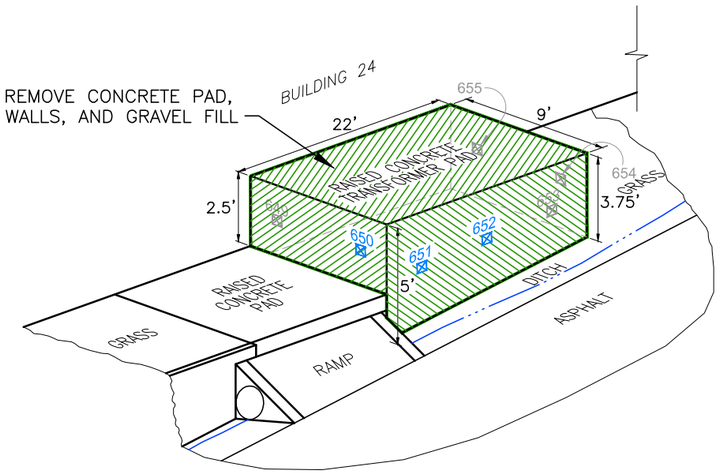


TRANSFORMER PAD DETAIL
NOT TO SCALE

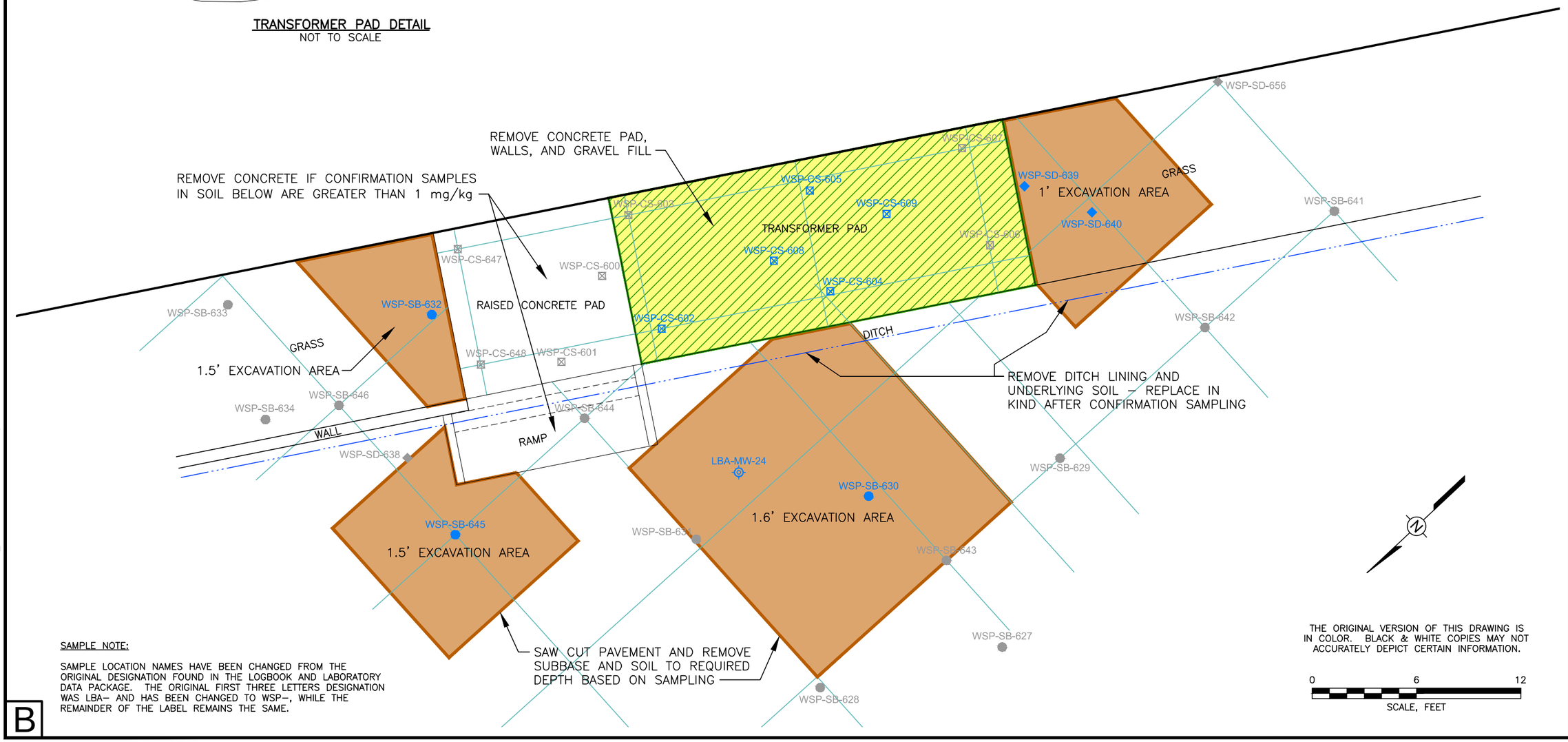
NOTES:

1. UNDERGROUND UTILITIES SHALL BE LOCATED AND PROTECTED. IF AFFECTED SOIL IS PRESENT AROUND OR BENEATH UNDERGROUND UTILITIES, THE UTILITY SERVICE SHALL BE TEMPORARILY DISCONNECTED FROM SERVICE, REMOVED DURING REMEDIATION, AND REPLACED IN KIND AFTER CONFIRMATION SAMPLING.
2. THE TRANSFORMER PAD FENCE ENCLOSURE AND ROOF SHALL BE REMOVED. SUSPECTED ASBESTOS CONTAINING MATERIALS SHALL BE SAMPLED AND ABATED IF NECESSARY BEFORE DEMOLITION ACTIVITIES BEGIN. OVERHEAD UTILITIES SHALL BE REROUTED AS NECESSARY TO COMPLETE THE REMOVAL WORK.
3. MATERIALS SHALL BE SEGREGATED TO THE EXTENT PRACTICAL BASED ON PCB CONCENTRATION ABOVE AND BELOW 50 MG/KG. MATERIALS NOT SAMPLED SHALL BE ASSUMED TO HAVE A PCB CONCENTRATION OVER 50 MG/KG. REMOVED MATERIALS SHALL BE DISPOSED OF AT LANDFILLS PERMITTED TO ACCEPT THE WASTES.
4. ASPHALT AND SUBBASE SHALL BE REPLACED IN KIND FOLLOWING CONFIRMATION SAMPLING.
5. THE FORMER TRANSFORMER PAD FOOTPRINT SHALL BE RESTORED WITH CRUSHED STONE FOLLOWING CONFIRMATION SAMPLING.

LEGEND

- LABELLA MONITORING WELL
- WSP SOIL BORING
- WSP CHIP SAMPLE
- WSP SURFACE SOIL SAMPLE
- SOIL TO BE EXCAVATED
- CONCRETE TO BE EXCAVATED (INCLUDING UNDERLYING GRAVEL LAYER)
- 1 mg/kg EPA HIGH OCCUPANCY CLEANUP LEVEL

SAMPLE IDs SHOWN IN BLUE REPRESENT PCBs >1 mg/kg.
SAMPLE IDs SHOWN IN GRAY REPRESENT PCBs <1 mg/kg.



SAMPLE NOTE:

SAMPLE LOCATION NAMES HAVE BEEN CHANGED FROM THE ORIGINAL DESIGNATION FOUND IN THE LOGBOOK AND LABORATORY DATA PACKAGE. THE ORIGINAL FIRST THREE LETTERS DESIGNATION WAS LBA– AND HAS BEEN CHANGED TO WSP–, WHILE THE REMAINDER OF THE LABEL REMAINS THE SAME.

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EMERSON POWER TRANSMISSION
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PREPARED FOR
EMERSON
ST. LOUIS, MISSOURI

FIGURE 4

PCB REMEDIATION PLAN
BUILDING 24 TRANSFORMER PAD

WSP USA Corp.
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Reston, Virginia 20191
(703) 709-6500
www.wspgroup.com/usa

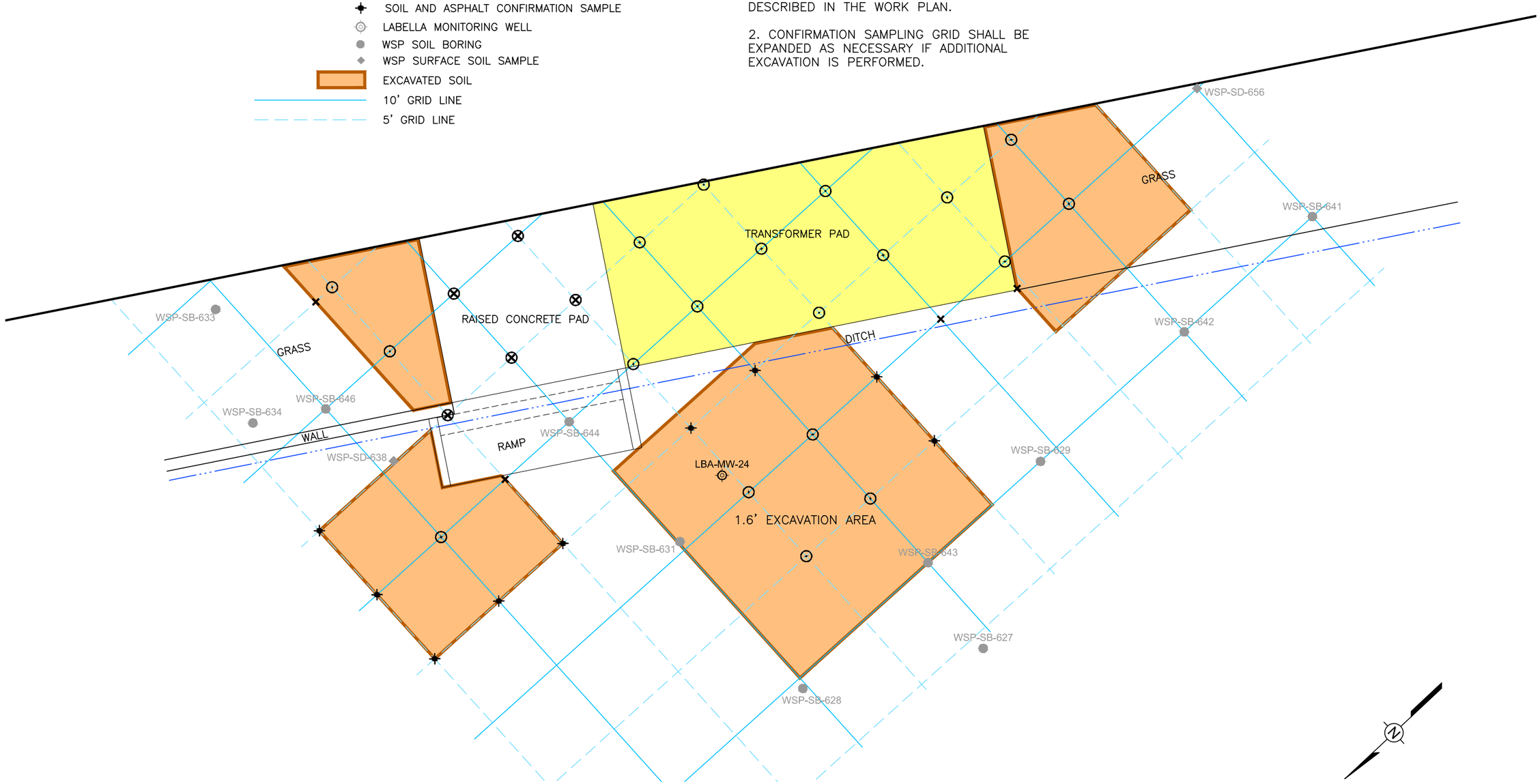
LEGEND

- BEDROCK CONFIRMATION SAMPLE
- SOIL CONFIRMATION SAMPLE
- SOIL AND ASPHALT CONFIRMATION SAMPLE
- LABELLA MONITORING WELL
- WSP SOIL BORING
- WSP SURFACE SOIL SAMPLE
- EXCAVATED SOIL
- 10' GRID LINE
- 5' GRID LINE

NOTES:

1. CONFIRMATION SAMPLES FROM THE BUILDING 24 FOUNDATION WALL SHALL COLLECTED AS DESCRIBED IN THE WORK PLAN.

2. CONFIRMATION SAMPLING GRID SHALL BE EXPANDED AS NECESSARY IF ADDITIONAL EXCAVATION IS PERFORMED.



SAMPLE NOTE:

SAMPLE LOCATION NAMES HAVE BEEN CHANGED FROM THE ORIGINAL DESIGNATION FOUND IN THE LOGBOOK AND LABORATORY DATA PACKAGE. THE ORIGINAL FIRST THREE LETTERS DESIGNATION WAS LBA– AND HAS BEEN CHANGED TO WSP–, WHILE THE REMAINDER OF THE LABEL REMAINS THE SAME.

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ST. LOUIS, MISSOURI

FIGURE 5

CONFIRMATION SAMPLING PLAN
BUILDING 24 TRANSFORMER PAD

WSP USA Corp.
11190 Sunrise Valley Drive, Suite 300
Reston, Virginia 20191
(703) 709-6500
www.wspgroup.com/usa

Tables

Table 1

Investigation and Delineation Sample Results
Self-Implementing PCB Remediation Work Plan
Emerson Power Transmission
Ithaca, New York (a)

Concrete Chip Samples

		Raised Concrete Pad				Transformer Pad											
Location:		**WSP-CS-600**	**WSP-CS-601**	**WSP-CS-647**	**WSP-CS-648**	**WSP-CS-602**	**WSP-CS-603**	**WSP-CS-604**	**WSP-CS-605**	**WSP-CS-606**	**WSP-CS-607**	**WSP-CS-608**	**WSP-CS-608**	**WSP-CS-608**	**WSP-CS-608**	**WSP-CS-608**	**WSP-CS-609**
Depth (inches bgs):		**0-1**	**0-1**	**0-1**	**0-1**	**0-1**	**0-1**	**0-1**	**0-1**	**0-1**	**0-1**	**0-1**	**2-3**	**3-4**	**4-6**	**6-8**	**0-1**
Date Sampled:		**04/29/14**	**04/29/14**	**09/09/14**	**09/09/14**	**04/29/14**	**04/29/14**	**04/29/14**	**04/29/14**	**04/29/14**	**04/29/14**	**05/01/14**	**09/09/14**	**09/09/14**	**09/09/14**	**09/09/14**	**05/01/14**
	High Occupancy Cleanup Level																
PCBs (µg/kg)																	
Aroclor 1016	-	7.1 U	7.5 U	7.0 U	6.9 U	7.1 U	7.0 U	7.3 U	6.8 U	7.4 U	7.2 U	6.8 U	7.2 U	6.7 U	7.1 U	7.2 U	7.0 U
Aroclor 1221	-	14 U	15 U	14 U	13 U	14 U	14 U	14 U	13 U	14 U	14 U	13 U	14 U	13 U	14 U	14 U	14 U
Aroclor 1232	-	13 U	14 U	13 U	13 U	13 U	13 U	14 U	13 U	14 U	14 U	13 U	13 U	13 U	13 U	14 U	13 U
Aroclor 1242	-	14 U	15 U	14 U	14 U	14 U	14 U	15 U	14 U	15 U	15 U	14 U	15 U	14 U	14 U	15 U	14 U
Aroclor 1248	-	12 U	13 U	12 U	12 U	12 U	12 U	13 U	14 U	13 U	13 U	12 U	13 U	12 U	12 U	13 U	12 U
Aroclor 1254	-	72.5	26.1	40.6	42.1	15 U	15 U	16 U	14 U	16 U	15 U	14 U	15 U	14 U	15 U	15 U	15 U
Aroclor 1260	-	94	32.0 J	18.3 J	20.6 J	1,200	264	9,980	4,546	358	599	211,000	125,000	52,900	22,800	5,400	128,000
Total PCBs	1,000	166	58	59	63	1,200	264	9,980	4,546	358	599	**211,000**	**125,000**	**52,900**	22,800	5,400	**128,000**

Concrete Chip Samples

		Transformer Pad Sidewalls										
Location:		**WSP-CS-649**	**WSP-CS-650**	**WSP-CS-650**	**WSP-CS-651**	**WSP-CS-651**	**WSP-CS-652**	**WSP-CS-652**	**WSP-CS-653**	**WSP-CS-654**		**WSP-CS-655**
Depth (inches bgs):		**0-1**	**0-1**	**1-2**	**0-1**	**1-2**	**0-1**	**1-2**	**0-1**	**0-1**	**0-1**	**0-1**
Date Sampled:		**09/09/14**	**09/09/14**	**09/09/14**	**09/09/14**	**09/09/14**	**09/09/14**	**09/09/14**	**09/09/14**	**9/9/2014** (b)	**9/9/2014** (b)	**09/09/14**
	High Occupancy Cleanup Level											
PCBs (µg/kg)												
Aroclor 1016	-	7.3 U	7.1 U	7.1 U	6.9 U	7.2 U	7.1 U	6.9 U	7.1 U	7.2 U	7.3 U	7.0 U
Aroclor 1221	-	14 U	13 U	14 U	13 U	14 U	14 U	13 U	14 U	14 U	14 U	14 U
Aroclor 1232	-	14 U	13 U	13 U	13 U	13 U	13 U	13 U	13 U	14 U	14 U	13 U
Aroclor 1242	-	15 U	14 U	14 U	14 U	15 U	14 U	14 U	14 U	15 U	15 U	14 U
Aroclor 1248	-	13 U	12 U	12 U	12 U	12 U	12 U	12 U	12 U	13 U	13 U	12 U
Aroclor 1254	-	16 U	15 U	15 U	15 U	15 U	15 U	15 U	15 U	15 U	15 U	15 U
Aroclor 1260	-	53.0	4,340	789	4,390	303	69,300	70,400	544	13 U	14.2 J	95.9
Total PCBs	1,000	53	4,340	789	4,390	303	**69,300**	**70,400**	544	0	14	96

Table 1

Investigation and Delineation Sample Results
Self-Implementing PCB Remediation Work Plan
Emerson Power Transmission
Ithaca, New York (a)

Soil Samples

		Soil West of Pad (under asphalt)						Soil North of Pad (under asphalt)									
Location:		**WSP-SB-627**	**WSP-SB-628**	**WSP-SB-629**	**WSP-SB-630**	**WSP-SB-631**	**WSP-SB-643**	**WSP-SB-632**	**WSP-SB-633**	**WSP-SB-634**		**WSP-SB-644**		**WSP-SB-645**	**WSP-SB-645**	**WSP-SB-646**	**WSP-SB-646**
Depth (feet bgs):		**0-1.5**	**0-1.5**	**0-1.5**	**0-1.5**	**0-1.5**	**0-1**	**0-0.8**	**0-0.5**	**0-0.5**	**0-0.5**	**0-1**	**0-1**	**0-1**	**1-1.5**	**0-0.1**	**1.5-2**
Date Sampled:		**04/30/14**	**04/30/14**	**04/30/14**	**04/30/14**	**04/30/14**	**09/09/14**	**05/01/14**	**05/01/14**	**05/01/14** (b)	**05/01/14** (b)	**9/9/2014** (b)	**9/9/2014** (b)	**09/09/14**	**09/09/14**	**09/09/14**	**09/09/14**
	High Occupancy Cleanup Level																
PCBs (µg/kg)																	
Aroclor 1016	-	7.2 U	7.5 U	7.1 U	7.1 U	7.0 U	7.3 U	8.7 U	9.1 U	8.2 U	9 U	7.1 U	7.2 U	8.2 U	6.9 U	8.7 U	8.1 U
Aroclor 1221	-	14 U	15 U	14 U	14 U	14 U	14 U	17 U	18 U	16 U	17 U	14 U	14 U	16 U	13 U	17 U	16 U
Aroclor 1232	-	13 U	14 U	13 U	13 U	13 U	14 U	16 U	17 U	15 U	17 U	13 U	14 U	15 U	13 U	16 U	15 U
Aroclor 1242	-	15 U	15 U	14 U	15 U	14 U	15 U	18 U	19 U	17 U	18 U	14 U	15 U	17 U	14 U	18 U	17 U
Aroclor 1248	-	12 U	13 U	12 U	12 U	12 U	13 U	15 U	16 U	14 U	16 U	12 U	13 U	14 U	12 U	15 U	14 U
Aroclor 1254	-	15 U	16 U	58.9	15 U	29.3 J	16 J	1,200	74.4	58.4	64	15 U	15 U	17 U	324	623	390
Aroclor 1260	-	13 U	13 U	12 U	3,390	12 U	13 U	765	96.7	880	155	22.5 J	13 U	21,200	928	145	60.2
Total PCBs	1,000	0	0	59	3,390	29	0	1,965	171.1	938	219	23	0	21,200	1,252	768	450

Soil Samples

		Soil North of Pad			Surface Soil South of Pad					
Location:		**WSP-SD-636**	**WSP-SD-637**	**WSP-SD-638**	**WSP-SD-639**	**WSP-SD-640**	**WSP-SB-641**	**WSP-SB-642**	**WSP-SB-642**	**WSP-SD-656**
Depth (feet bgs):		**0-0.3**	**0-0.3**	**0-0.3**	**0-0.3**	**0-0.1**	**0-1**	**0-1**	**1-1.5**	**0-0.5**
Date Sampled:		**05/01/14**	**05/01/14**	**05/01/14**	**05/01/14**	**05/01/14**	**09/09/14**	**09/09/14**	**09/09/14**	**09/09/14**
	High Occupancy Cleanup Level									
PCBs (µg/kg)										
Aroclor 1016	-	9.7 U	8.8 U	9.5 U	11 U	9.7 U	7.3 U	7.3 U	7.3 U	8.7 U
Aroclor 1221	-	19 U	17 U	19 U	21 U	19 U	14 U	14 U	14 U	17 U
Aroclor 1232	-	18 U	17 U	18 U	20 U	18 U	14 U	14 U	14 U	16 U
Aroclor 1242	-	20 U	18 U	19 U	22 U	20 U	15 U	15 U	15 U	18 U
Aroclor 1248	-	17 U	15 U	17 U	18 U	17 U	13 U	13 U	13 U	15 U
Aroclor 1254	-	439	566	558	22 U	21 U	199	372	374	18 U
Aroclor 1260	-	215	271	194	3,250	2,460	74.9	85.4	101	115
Total PCBs	1,000	654	837	752	3,250	2,460	274	457	475	115

Rock Samples (c)

Location:		**WSP-CS-608**	**WSP-SB-630**		**WSP-SD-639**	**WSP-SD-640**	**WSP-SB-645**
Depth (feet bgs):		**0.7-0.8 (d)**	**1.5-2**	**1.5-2**	**0.5-1**	**0.5-1**	**2-2.5**
Date Sampled:		**09/09/14**	**9/9/2014** (b)	**9/9/2014** (b)	**09/09/14**	**09/09/14**	**09/09/14**
	High Occupancy Cleanup Level						
PCBs							
Aroclor 1016	-	6.9 U	6.9 U	6.9 U	7.0 U	7.2 U	7.5 U
Aroclor 1221	-	13 U	13 U	13 U	14 U	14 U	15 U
Aroclor 1232	-	13 U	13 U	13 U	13 U	14 U	14 U
Aroclor 1242	-	14 U	14 U	14 U	14 U	15 U	15 U
Aroclor 1248	-	12 U	12 U	12 U	12 U	13 U	13 U
Aroclor 1254	-	15 U	365	171	15 U	15 U	67.6
Aroclor 1260	-	3,540	61.2	33.9	71.2	18.2 J	101
Total PCBs	1,000	3,540	426	205	71	18	169

a/ Boxed value indicates concentration exceeds the High Occupancy Cleanup Level of 1 mg/kg.
Bolded and shaded value indicates concentration exceeds 50 mg/kg.
b/ Duplicate samples.
c/ Bedrock samples collected from below the soil layer.
d/ Sample is gravel from below the transformer pad.

Appendix A – WSP Standard Operating Procedures

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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 that may become involved in litigation. It is of the utmost importance that your notes be 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 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 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 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.

The purpose of the field book is to provide a 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.) will be based. It is critical that field book chain of custody is 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 WSP, 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 the end of the line. Any acronyms written in the field book (including your initials) must be spelled out prior to the first use. Record your initials and date 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 out of sequence notes need to be entered, 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.

List all field equipment used (e.g., photoionization detector, water testing equipment, personal protective equipment, etc.) and equipment calibration activities, and record field measurements, including distances, monitoring and testing instrument readings. Include the following information in entries describing sampling activities:

- The equipment and materials used by subcontractors, if appropriate (e.g., drill rig type, boring sizes, well casing materials, etc.)
- The sample media and analyses to be performed

- The sampling procedures (e.g., split-spoon sampling, hand trowel, low flow, etc.)
- The equipment used to obtain the sample (e.g., bailers, pump types, geochemical monitoring equipment, etc.)
- The sizes and types of containers, preservation (if any), and any resulting reactions
- The sample identification (especially for duplicate samples)
- The sample collection time
- The shipping and handling procedures, including chain-of-custody, air bill, and seal numbers
- If supplemental data recording logs (digital or hard copy), such as low flow groundwater sheets, the above information must be entered in the field book and the supplemental records cross-referenced.

For most sampling activities, the log entries must also include:

- The decontamination and disposal procedures for all equipment, samples, and protective clothing
- 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

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 #2
Utility Locating Procedure

The purpose of this procedure is to ensure that all required and appropriate procedures are followed to locate and mark subsurface utilities (e.g., electrical lines, natural gas lines, communication lines) before initiating any intrusive field activities (e.g., drilling, test pits, trenching, excavation). WSP's preference, as indicated in our standard and remediation subcontractor agreement templates, is for our Contractors to be responsible for both public and private utility mark-outs; this includes contacting the public authority and obtaining a subcontractor for private utility locating services, if needed. Guidance for Contractor's to follow to conduct utility clearance is provided in our Request for Proposal (RFP) template and must be included in all RFP's for intrusive field activities. **In certain extraordinary circumstances, WSP may choose to be responsible for clearing utilities, this will require a change in the template language of our subcontractor agreement and the revised agreement requires the approval and signature of a member of the Environmental Leadership Team (ELT)**.

For projects where WSP will be responsible for clearing utilities, compliance with this procedure is mandatory. **ALL** deviations from this standard operating procedure (SOP) **MUST** be approved by the project manager and a member of the ELT **BEFORE** beginning intrusive work.

Field personnel have the authority and responsibility to postpone intrusive activities if a Contractor has not completed utility clearances to WSP's satisfaction; if sufficient information, as stipulated in this SOP, is not available; or if onsite reconnaissance identifies inconsistencies in the findings of utility locators. In these instances, field personnel must notify the project manager or the WSP health and safety officer, or their designee, before proceeding with the proposed work; approval from a member of the ELT is required before the work commences.

The user is advised to read the entire SOP and review the site health and safety plan (HASP) before beginning any onsite activities.

2.1 Acronyms and Abbreviations

HASP	health and safety plan
ELT	Environmental Leadership Team
RFP	Request for Proposal
SOP	standard operating procedure

2.2 Materials

- Utility Locating Form (Attachment 1)
- Field book
- Wood stakes
- Spray paint
- Flagging tape
- As-built drawings for sub grade utilities (if available)
- Hand auger or post-hole digger

2.3 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.

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 procedure is intended to allow the work to proceed safely and minimize the potential for damaging underground and aboveground utilities. Intrusive work includes all activities that require WSP's employees or its subcontractors to penetrate the ground surface. Examples of intrusive work include, but are not limited to, hand augering, probing, drilling, injections, test pit excavations, trenching, and remedial excavations.

This SOP assumes the user is familiar with basic field procedures, such as recording field notes (SOP 1).

2.4 Pre-Field Mobilization Procedures

Regardless of who is responsible for completing these activities (WSP or a Contractor), public rights-of-way and private property must be cleared of potential buried utilities before any intrusive work can begin. The first step in this process is notifying the state public utility locating service of the planned work. These services provide a link between the entities performing the work and the various utility operators (e.g., the water company, the electric company, etc.). All of the public utility locating service call centers in the United States have been streamlined under a single "Call Before You Dig" phone number: 811.

Please note, some state laws have changed such that the person who will actually be conducting the intrusive work must be the person who places the call to the public utility locating service. This means that WSP cannot make this call on the Contractor's behalf; the Contractor must place the call in those states where required. The Common Ground Alliance has established a web site that includes state-specific information to assist in making this determination (http://www.call811.com/state-specific.aspx) for sites in the US and some parts of Canada. If there is any doubt about the requirements for the state where a project is located, the relevant state authority must be contacted.

When the call center is contacted, information regarding the site (e.g., location, nearest cross street, township, etc.) and work activity (e.g., drilling, excavation) will need to be provided to the operator to aid in locating the likely utilities at the work site. The information provided on WSP's Utility Locating Form (Attachment 1) must be recorded (by the Contractor or WSP) and a completed copy of this form must be maintained as part of the project file. Be aware that several states, including California, require that the proposed drilling locations be marked with white spray paint before contacting the locating services.

The following information must accompany the WSP field team at all times during the field project:

- The utility clearance ticket number
- The ticket's legal dig date
- The ticket's expiration date
- Utility providers that were contacted

The ticket number serves as a point of reference for both the utility service providers and for WSP or Contractor personnel should follow up (e.g., renewing the ticket) with the locating service be required. The legal dig and expiration dates reflect the times when it will be legal to perform the proposed work. The legal dig date reflects the

lead time necessary, typically between 48 and 72 hours after you call, for the utility service providers to mark the utilities in you work area. Be sure to include this delay when planning your work. Most utility clearance tickets expire about 2 weeks after the legal dig date. If your work is delayed beyond the expiration date, 811 will need to be called again and the ticket renewed. The renewed ticket will have a new legal dig date that incorporates the same lead-time as the original ticket.

The locating service will also provide the caller with a list of utility companies that will be notified. Compare this list with utilities generally expected at all sites (e.g., sewer, water, gas, communication, and electric). Some utilities (e.g., sewer, water, cable TV) may not be included. If any expected utilities are absent from the contact list, you **MUST** contact the utilities directly for clearance before the start of intrusive activities. Record all contacts on the Utility Locating Form.

2.4.1 Private Utility Locators and Other Sources

Public utility service providers will generally mark their underground lines within the public right-of-way up to the private property boundary. You can request that the utility companies locate their utilities in work areas on private property; however, be aware that most service providers will not mark their utilities on private property. If your work is to be conducted on private property, you **MUST** use a private utility locating service. These companies typically use a variety of methods (e.g., electromagnetic detectors, ground-penetrating radar, acoustic plastic pipe locator, trace wire, etc.) to locate buried utilities in both inside and outside locations (witching is not an acceptable method).

For all operating facilities and the extent possible for closed facilities, identify a site contact familiar with the utilities on the property (e.g., plant manager, facility engineer, maintenance supervisor), and provide this individual with a site plan showing the proposed locations of all soil borings, monitoring wells, test pits, and other areas where intrusive activities will be conducted. These individuals often have knowledge of buried structures or process-specific utilities that may not be identified by the private utility locator. This is particularly important for work performed inside industrial buildings where reinforced concrete and other metallic components of the structure may interfere with the scanning devices used by the private utility locator. You should ask the site contact for all drawings concerning underground utilities in the proposed work areas for future reference.

Keep in mind that no intrusive work may be done before the legal dig date provided by the state utility locating service and no digging, drilling, or other ground-breaking activities may be begin until all utilities on the list have been marked and visually verified in the work area (see below). It is **NOT ACCEPTABLE** to rely solely on as-built drawings or verbal utility clearances from the site contact (these should be used as guides only). A private locator may not be necessary in rare instances; however, nonconformity with the private locate requirement must be approved by the project manager **AND** a member of the ELT before work proceeds.

2.5 Site Mobilization Procedures

Upon arrival, the first step in determining if you are clear of buried and overhead utilities is to locate all of the proposed drilling and trenching locations and mark them with spray paint, stakes, or other appropriate markers. This will help you judge distances from marked utilities and minimizes any potential misunderstandings regarding the locations between you, the subcontractors (drillers, excavators, private utility locator), and the site contact.

Once you have the proposed work areas marked, verify that ALL utility companies listed by the state public utility locating service, and any contacted directly by WSP or the Contractor, have either marked the underground lines in the specified work areas or have responded (via telephone, facsimile, or e-mail) with “no conflict.” Document on the Utility Locating Form (Attachment 1) and in the field book as each utility mark is visually confirmed. When receiving verbal clearances by telephone from utility companies, or their subcontractors, it is imperative that you verify which utilities are being cleared, particularly when dealing with subcontractors that may be marking more than one utility.

Review all available as-built utility diagrams and plans and conduct a site walk to identify potential areas where underground lines may be present; include the site contact in these activities. It is a good idea to survey your surroundings during the walk to identify any features that may indicate the presence of underground utilities, such

as linear depressions in the ground, old road cuts, catch basins, or manholes. Keep in mind that many sewer lines can be offset from catch basins. The presence of aboveground utilities, such as parking lot lights or pad-mounted transformers, is also a good indicator of buried electrical lines. Check these items against the Utility Locating Form checklist and discuss the locations with the private utility locating service.

2.5.1 Safe Working Distances and Hand Clearing

A minimum of 4 feet clearance must exist between utilities and proposed drilling locations, and a minimum of 6 feet between utilities and proposed trenching locations. Be aware that some states and localities (e.g., New York City, Long Island) may require greater minimum working distances, depending on the utility (e.g., for high pressure gas mains). A minimum distance of 15 feet must be maintained by heavy equipment (e.g., excavator buckets, drill rig towers and rods) from overhead power lines and a safe distance of 25 feet must be maintained from high-tension overhead power lines. In the event that work must be conducted within 25 feet of high tension wires, the lines must be wrapped and insulated by the local utilities. Increase these minimum distances whenever possible to offer additional assurance that buried or overhead utilities will not be encountered.

If a utility conflict is identified within the minimum safe clearance distance, adjust the proposed location(s) using the criteria given above. It is a good idea to have the private utility locator sweep a relatively large area (e.g., a 20-foot circle around a proposed drilling location) to provide room for adjustment should the proposed drilling or excavation area need to be moved to avoid a buried utility.

Uncertainty may exist in some circumstances (inside a building, for example) even after the area has been swept for utilities. In these cases, advance the first few feet of a soil boring (or probe the area for excavation) using a hand auger or post-hole digger. If hand digging is unable to penetrate the subsurface soils, soft dig or air knife equipment service providers are often retained to clear the location. This equipment applies high pressure air to penetrate, loosen, and extract subsurface soils in the borehole, thereby safely exposing any utilities. If using either hand digging or soft digging, the probe hole should be advanced a minimum of 5 feet below ground surface at each proposed drilling or excavation location. Complete a sufficient number of probe holes so that the area is cleared for the proposed intrusive activity (i.e., use several holes for a proposed excavation). The use of hand digging or soft digging methods **does not** replace the need for state and private utility locating services.

2.5.2 Expanded Work Areas and Ticket Renewal

Many projects begin with well-defined work areas only to expand quickly as the investigation or remediation progresses. If the scope of the intrusive activity locations changes, the scope of intrusion expands or includes new onsite or offsite area(s), you will need to review the existing ticket and work performed by the private utility locator to determine whether work can progress into the new area safely. It may be necessary, depending on the scope, to contact (or for the Contractor to contact) the state locating service and request another clearance for the new area(s) of investigation and retain a private locating service. Remember, the new request will provide a new legal dig date before which NO INTRUSIVE WORK CAN BEGIN. Additionally, if a clearance ticket will expire while the work is ongoing (typically after 14 days), a new clearance must be requested before the first ticket expires so that work can continue uninterrupted. Refer to the Utility Locating Form (Attachment 1) for the legal dig date time frame required by the state locating service.

2.5.3 Utility Damage

It is possible, even if you followed all of the procedures outlined in this SOP, to damage an underground or overhead utility. Assuming it can be done safely, quickly turn off the drilling or excavating equipment, or move the equipment from the damaged line. Avoid contact with escaping liquids, live wires, and open flames. Abandon the equipment, evacuate the personnel from the area, and maintain a safe perimeter if there are any concerns about safety. If a fiber optic cable is damaged, do not handle the cable or look into the end of the cable as serious eye damage may occur. Once personnel are in a secure location, immediately notify the facility operator or site contact,

811, and the WSP project manager. If the damaged utility has the potential to cause, or is causing, dangerous conditions, immediately notify the local emergency response number listed in your HASP.

** This form is mandatory for all intrusive work performed by WSP or a WSP subcontractor, regardless of who is responsible for the public and/or private locate.

Utility Locating Form

Project Name	Project No. and Task	Work being done for (Company or Individual Name)	Project Manager

WSP Office Address	WSP Office Phone	WSP Field Contact	WSP Field Contact Phone

Project Location: Street Address	City/Township	County	State

Nearest Intersecting Street

Description of Work Area (street working on, which side of street, how far in which direction from nearest intersecting street; etc.)

Type of Work	Explosives (Y/N)	Directional Borings (Y/N)	Dig Locations Marked (Y/N)	Mark Type (e.g., stake)

Scheduled Work Start (Date & Time)	Estimated Work Stop Date	One-call Phone Number/Website Address	One-call Service Name

Call/Web Notification Made By (Name, Title and Company)	Date & Time of Call/Web Notification	Operator Name

Ticket No.	Legal Dig Date	Ticket Expiration Date	Ticket Renewal Date

Utilities Notified	Complete After Receiving Notification (e.g., e-mail, facsimile) from Utilities or Subcontactor		
	Utilities Present (Y/N)	Onsite Meeting (Y/N; if "Y" Date & Time)	Contact Name and Phone
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Form Completed By (Signature)	
	(e-mail completed page 1 to Project Manager)

** This form is mandatory for all intrusive work performed by WSP or a WSP subcontractor, regardless of who is responsible for the public and/or private locate.

Utility Locating Form

Private Utility Locator Information Company	Contact Name	Phone	E-mail

Who Contracted Locator?	Scheduled Start (Date & Time)	WSP Contract Executed (Y/N/NA)

Onsite Visual Confirmation of Utilities

Marking Color	Utility Type and Visual Clues	Cleared or Marked (Y/N)	No Markings - Comments
Blue	Potable water: fire hydrant, manholes; water meter, ASTs, interior connections, hose bib, valve box		
Yellow	Gas, oil steam, petroleum: gas meter, manholes; yellow bollards, interior connections, valve box		
Red	Electric power lines, lighting cables, parking lot lights, overhead lines (telephone poles), conduits: interior connections, underground vaults, manholes, transformers/switchgear, conduit on buildings		
Green	Sewer and drain lines: underground vaults, manholes, drain grates, leach field, sand mound, no evidence of sanitary sewer (for septic system)		
Orange	Communication, alarm or signal lines, cables or conduits: red/orange bollards, telephone poles, interior connections; manholes; conduit on buildings		
Purple	Reclaimed water, irrigation, and slurry lines: sprinkler heads, hose bibs		
Pink	Survey markings		
White	Proposed locations for excavation and drilling		

Project Manager Notified of any Conflicts? (Y/N)

Notes:

Marks Verified By (Signature)	
	(scan and save to client file)

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 WSP activities include the collection of environmental samples. Proper packing and preservation of those samples is critical to ensuring the integrity of WSP'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
- WSP 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 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 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 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 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 WSP's U.S. Department of Transportation (DOT) Hazardous Materials training.

> **NOTE: WSP 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 WSP employees do not have IATA training and therefore, anyone who needs to ship by air MUST consult with a WSP 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 WSP 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, WSP 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. Where WSP does not know the physical characteristics of the samples, 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 WSP 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 WSP register with them before shipping hazard materials. In most cases, it is the sampling location, not the WSP office address, which needs to be registered. Therefore, each project will likely have unique requirements. Please contact your WSP 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 not allow them to freely move 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 an insulated cooler for the bottle shipment, which can be used to return the samples once they have been collected. Be sure that the container is sufficiently large to contain both your samples, cushioning material, and enough wet ice to maintain the samples at the preservation temperature (usually 4° Celsius). Do not use lunch-box sized coolers or soft-sided coolers, which do not offer sufficient insulation or protection from damage.

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. 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.

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 with bubble wrap or other packing material to limit the airspace and minimize the in-transit melting. Securely close and seal, with tape, the top of the heavy-duty plastic bag. 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. 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 WSP's return address to the top of the shipping container. Ship environmental samples to the contracted analytical laboratory using an appropriate delivery schedule. If applicable, check the appropriate box on the 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 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 WSP project manager.

3.4.2 Hazardous Materials Samples

WSP personnel 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 WSP 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 WSP 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 the ways and means of selecting the appropriate sampling containers 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
MS/MSD	matrix spike and matrix spike duplicate
MSA	Master Service 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 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 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 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 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.

4.4 Sample Identification Procedures

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

The sample identification number must, unless otherwise approved by your project manager or specified in your site-specific work plan, follow the WSP 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 and the second number indicating the bottom of the sample interval; not all sample types will include depth information.

Additional label information may be added after the last character of the sample ID (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 samples
CC -	Concrete core/chip sample
CS -	Confirmation/verification soil samples collected from an excavation
HA -	Soil samples collected with a hand auger
IAB -	Indoor air samples – basement
IAC -	Indoor air samples – crawl space
IAF -	Indoor air samples – first floor
MW -	Soil samples collected from a monitoring well borehole or a groundwater sample collected from a monitoring well
PZ -	Groundwater samples collected from a piezometer
SB -	Soil samples collected from boreholes that will not be converted to monitoring wells
SED -	Sediment samples
SG -	Soil gas samples other than sub-slab samples (e.g., samples collected from temporary or permanent PVC sample points or stainless steel screen implants)
SL -	Sludge samples
SS -	Surface soil samples collected using hand tools (e.g., trowel, spoon, etc.) and typically at depths less than 2 feet below ground surface
SSV -	Sub-slab vapor samples
SW -	Surface water samples
TC -	Tree core samples
TP -	Soil samples collected from a test pit
WC -	Waste characterization samples
WP -	Wipe samples

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 Quality Assurance Project Plan [QAPP]). 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.

Take special effort to prevent cross contamination and contamination of the environment when collecting samples. Protect equipment, sample containers and supplies from accidental contamination. 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 and 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 (C).

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 WSP naming protocol as discussed in the sections below. QA/QC samples must be clearly identified on WSP's copy of 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. Collect equipment blanks in the field at a rate of one per type of 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, 2013, would be designated EB070413-1.

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) will be prepared at the laboratory and will be sent to the facility along with sample containers. Never open trip blank sample bottles, but 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. 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, 2013, would be designated TB070413-1. If a second trip blank is needed on that same day, the designation would be TB070413-2.

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 least at a rate of 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 WSP’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 WSPs 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 soils, sediments, wastes, and sludge is not recommended because the homogenization necessary for a true split sample in these matrices is not possible.

Spilt samples should have the same sample location (e.g., MW-01, SB-03 (4-6), but 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 eliminate possible tampering. Legal chain of custody (COC) begins when the pre-cleaned sample containers are dispatched to the field from the laboratory and continues through the sample analysis and eventual disposal. 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 WSP's COC be used to ensure that all necessary data are recorded. 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

- WSP 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 #5
Investigation Derived Waste Management Procedure

The purpose of this standard operating procedure (SOP) is to provide instructions for handling, storing, and managing Investigation Derived Waste (IDW) pending disposal. All IDW, which includes (but is not limited to) soil cuttings, development water, purge water, drilling fluids, decontamination fluids, personal protective equipment (PPE), and sampling equipment, must be managed in compliance with applicable or relevant and appropriate requirements. 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.

5.1 Acronyms and Abbreviations

DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency
HASP	health and safety plan
IDW	investigation derived waste
PCB	polychlorinated biphenyl
PPE	personal protective equipment
RCRA	Resource Conservation and Recovery Act
SOP	standard operating procedure
TSCA	Toxic Substances Control Act

5.2 Materials

- Non-hazardous waste, hazardous waste, and/or polychlorinated biphenyl (PCB) labels
- Investigation derived waste (IDW) log (figure 1)
- Permanent ink marking pen, paint, stick/pen
- Sampling equipment (refer to sampling SOPs)
- Impermeable covers (e.g., tarps), as needed
- Duct tape, rope, or other material to secure tarp
- Copy of the waste manifest or bills of lading

5.3 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 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 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 handling, storing, and managing IDW pending disposal and assumes the user holds a current U.S. Department of Transportation (DOT) training and Resource Conservation and Recovery training (if required) certificates and 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 equipment decontamination (SOP 6). The SOP does not cover investigation planning, DOT regulations, nor does it cover the evaluation of the analytical results. **Consult and involve WSP's compliance professionals during all phases of IDW management and disposal.**

5.4 IDW General Procedures

Nearly all intrusive field activities performed at WSP will generate solid or liquid wastes. Examples include:

Solid Wastes	Liquid Wastes
■ Soil Cuttings	■ Decontamination water
■ Drilling mud	■ Development water
■ Plastic sheeting	■ Drilling fluids
■ Spent carbon or filters (e.g., bag filters)	■ Purge water
■ PPE (e.g., Tyvek, gloves, respirator cartridges, etc.)	■ Soap or wash solutions
■ Disposable or dedicated sampling equipment (e.g,, bailers, hose, clamps, buckets, cartridge filters, etc.)	■ Reagents (e.g,, hexane, nitric acid, methanol, etc.)
■ Field analytical waste (HACH kits, Chlor-n-Soil kits, etc.)	

The specific procedures for dealing with these materials after the field activities have been completed will vary depending on whether the materials are considered non-hazardous, Resource Conservation and Recovery Act (RCRA) hazardous (characteristic or listed wastes), or contain PCBs at concentrations above 50 milligrams per kilogram (i.e., PCB wastes regulated under the Toxic Substances Control Act [TSCA]). The characterization of the wastes to be generated is ideally determined in conjunction with a WSP compliance professional before the field event occurs, based on previously generated data; however, in some cases, particularly for new sites, the status of the wastes may not be known. In these cases, handle IDW as hazardous waste until the status can be verified. Field personnel must consult their assigned WSP compliance professionals for assistance in proper waste characterization.

It is important to note that information contained in this SOP is based on federal regulations and interpretive guidance provided by the U.S. Environmental Protection Agency (EPA) and other federal regulatory sources; therefore, information provided in this SOP may be superseded by state or local-specific statutes or regulations. Field personnel must discuss the handling procedures with the project manager and assigned WSP compliance professional before mobilizing to the field.

5.4.1 Waste Minimization

Select investigation methods and techniques that will minimize the amount of wastes generated during field activities, particularly if the IDW is hazardous. Examples include using direct-push methods instead of hollow stem augers (to minimize soil cuttings) during a soil investigation, if appropriate, and limiting contact with the materials to reduce the amount of PPE required. Minimizing the amount of waste generated will reduce handling requirements and overall project costs, and is consistent with WSP's corporate goals for sustainability.

5.4.2 Hazardous Waste Generator Status

The hazardous waste generator requirements that pertain to a site depend on how much hazardous waste is generated at a site in a calendar month. In coordination with your assigned WSP compliance professional, determine the site's hazardous waste generator status (conditionally exempt, small, or large quantity generator) before site work begins and inform the site contact and/or client representative of the quantity of hazardous waste that will be generated as a result of its activities.

The following table provides a summary of requirements for each class of hazardous waste generator: Conditionally Exempt Small Quantity Generators (CESQGs), Small Quantity Generators (SQGs), and Large Quantity Generators (LQGs). Note that this is provided for guidance purposes only and should not substitute for close coordination with your assigned WSP compliance professional for all IDW-related activities.

	CESQGs	**SQGs**	**LQGs**
Quantity Limits	≤100 kg/month ≤1 kg/month of acute hazardous waste ≤100 kg/month of acute spill residue or soil §§261.5(a) and (e)	Between 100 - 1,000 kg/month §262.34(d)	≥1,000 kg/month >1 kg/month of acute hazardous waste >100 kg/month of acute spill residue or soil Part 262 and §261.5(e)
EPA ID Number	Not required §261.5	Required §262.12	Required §262.12
On-Site Accumulation Quantity	≤1,000 kg ≤1 kg acute ≤100 kg of acute spill residue or soil §§261.5(f)(2) and (g)(2)	≤6,000 kg §262.34(d)(1)	No limit
Accumulation Time Limits	None §261.5	≤180 days or ≤270 days (if greater than 200 miles) §§262.34(d)(2) and (3)	≤90 days §262.34(a)

	CESQGs	SQGs	LQGs
Storage Requirements	None §261.5	Basic requirements with technical standards for tanks or containers §§262.34(d)(2) and (3)	Full compliance for management of tanks, containers, drip pads, or containment buildings §262.34(a)
Sent To:	State approved or RCRA permitted/interim status facility §§261.5(f)(3) and (g)(3)	RCRA permitted/interim status facility §262.20(b)	RCRA permitted/interim status facility §262.20(b)
Manifest	Not required §261.5	Required §262.20	Required §262.20
Biennial Report	Not required §261.5	Not required §262.44	Required §262.41
Personnel Training	Not required §261.5	Basic training required §262.34(d)(5)(iii)	Required §262.34(a)(4)
Contingency Plan	Not required §261.5	Basic plan §262.34(d)(5)(i)	Full plan required §262.34(a)(4)
Emergency Procedures	Not required §261.5	Required §262.34(d)(5)(iv)	Full plan required §262.34(a)(4)
DOT Transport Requirements	Yes (if required by DOT)	Yes §§262.30-262.33	Yes §§262.30-262.33

5.5 Onsite IDW Management Procedures

Onsite handling procedures typically involve containerization of the IDW for offsite disposal at a regulated facility (RCRA hazardous waste, TSCA PCB waste, or certain non-hazardous wastes) or, in the case of certain non-hazardous wastes, onsite disposal. The procedures for each type of waste are presented below.

5.5.1 Hazardous Waste Management

If site data or generator knowledge indicates that the IDW is determined to be RCRA hazardous, the following procedures will apply:

- Place IDW in DOT-authorized containers (e.g., 55-gallon drum, roll-off container, or temporary storage tank). Before placing IDW in the containers, ensure that they are in good condition and will not leak.
- Containers must remain closed except when adding, sampling, or inspecting the material. The containers cannot be used as a work surface once waste is put in the container.
- Mark the container with an appropriate waterproof, self-adhesive RCRA hazardous waste label. The label must include the accumulation start date, a description of the contents of the container (e.g., soil cuttings, purge water, etc.), the EPA identification number, the generator name (the client or the facility, never WSP), and the

hazardous waste codes, if known. Field personnel must consult the assigned WSP compliance professional for help in properly completing the labels.

- The IDW containers must be properly closed, wiped clean, and stored in a secure onsite location (facility hazardous waste storage area if one exists) to limit access. At a minimum, place the drums on an impermeable surface (if available) in an area of limited access. If stored outside, cover the containers with a secured tarp at the end of each field day until the containers are picked up for disposal.
- Complete the IDW Logs (Figure 1) before leaving the site. Present one copy of the log to the site contact and the original to the project manager.
- Ensure that weekly inspections are conducted and the proper inspection forms for documentation are completed during the entire time the waste is stored onsite.

If the IDW is presumed to be hazardous and sampling is required to confirm its classification, it must be labeled "Hazardous Waste-Pending Analysis" and sampled for the parameters specified by the project regulatory specialist or project manager before leaving the site (see sampling SOPs). Treatment, storage, and disposal facilities will usually specify the required analysis for waste profiles (see below).

5.5.2 Polychlorinated Biphenyl Waste Management

If information exists to classify the IDW as TSCA-regulated PCB-containing IDW, the following procedures must be implemented:

- Place the PCB-containing IDW in DOT-authorized containers (55-gallon drum, roll-off container, or temporary storage tank).
- Containers must remain closed except when adding, sampling, or inspecting the material. The containers cannot be used as a work surface once waste is put in the container.
- Mark the container with an appropriate waterproof, self-adhesive yellow label with the words "Caution Contains PCBs", the "removed from service" date (the accumulation start date), and a description of the contents of the container (e.g., soil cuttings). Complete the label with the name and phone number of the WSP field personnel to contact in the event of an accident or spill. Field personnel must consult the assigned WSP compliance professional for help in properly completing the labels.
- The IDW containers must be properly closed, wiped clean, and stored in a secure PCB storage area onsite. If a PCB storage area is not available, construct a temporary PCB storage area. Cover the containers with a secured tarp at the end of each field day until the drums are picked up for disposal. Place one yellow 6" x 6" "Caution Contains PCBs" label on the outside of the tarp, and note the "Removed from service date" on the label.
- Inspect the area and the containers for leaks once every 30 days in accordance with 40 Code of Federal Regulations 761.65(c)(5) during the entire period the waste is stored onsite.
- Complete the IDW Logs (Figure 1) before leaving the site. Present one copy of the log to the site contact and the original to the project manager.

5.5.3 Onsite Non-Hazardous Waste Management

If information exists to classify the IDW as non-hazardous waste, the following procedures must be implemented only after being discussed and approved by the project manager and assigned WSP compliance professional:

- Soil can be spread around the borehole or other onsite location (with the approval of the client and in accordance with any applicable regulatory requirements), placed back in the boring or excavated test pit, or containerized and disposed of offsite.

- Groundwater and decontamination fluids can be poured onto the ground next to well to allow infiltration, or discharged to either the publically-owned treatment works or onsite wastewater treatment plant with approval of the client.
- PPE can be double bagged and deposited in the site dumpster with approval of the client and facility personnel or containerized and disposed of offsite.

If the IDW is containerized and is classified as non-hazardous, the following procedures will apply:

- Place the non-hazardous IDW in DOT-authorized containers (55-gallon drum, roll-off container, or temporary storage tank).
- Containers must remain closed except when adding, sampling, or inspecting the material. The containers cannot be used as a work surface once waste is put in the container.
- Mark the container with an appropriate waterproof, self-adhesive non-hazardous waste label. The label must include a description of the contents of the container (e.g., soil cuttings, purge water, etc.) and the generator (the client or the facility, never WSP). Field personnel must consult the assigned WSP compliance professional for help in properly completing the labels.
- Complete the IDW Logs (Figure 1) before leaving the site. Present one copy of the log to the site contact and the original to the project manager.
- The IDW containers must be properly closed, wiped clean, and stored in a secure onsite location.

5.6 Post-Field IDW Management Activities

It is important to follow-up on the management of the IDW once the field personnel have returned from the field. RCRA Hazardous and TSCA-regulated PCB-containing wastes have time limits and periodic inspection requirements to remain in compliance with state and federal regulations. The general post-field activities are listed below.

5.6.1 Waste Classification and Waste Profiles

Waste classifications and waste profiles must be reviewed and approved by WSP's project manager, WSP compliance professional, and the client before field work begins. Waste profiles are generated based on new or existing site data (i.e., soil and groundwater results) and generator knowledge, although some disposal facilities may require additional composite or grab samples for characterization of the waste. WSP's compliance professionals must be consulted to verify that proper waste classifications have been identified. Waste profiles for the same waste stream are generally valid for one year; ensure that no additional sampling is required to update existing waste profiles before conducting field activities.

5.6.2 Waste Disposal Oversight

Although exceptions may apply, generally, disposal of RCRA hazardous must be completed within **90 days** of the accumulation start date. If the facility is a small quantity generator, up to **180 days** is allowed for shipment. Disposal of TSCA-regulated PCB-containing IDW must generally be completed within 30 days of the "removal of service" date. WSP's compliance professionals must be consulted to determine if any exemptions apply.

Before the IDW is removed, the waste disposal subcontractor must provide WSP with a copy of the waste profile and printed manifest for review and approval. Your assigned WSP compliance professional must review and approve these documents. WSP must have written authorization from the client on file to act **on behalf of (never "as an agent of")** the client for waste disposal (handled on a site-by-site basis).

- The transport driver will present you with a pre-printed manifest that has been reviewed and approved by WSP. Review and verify that all information is complete and correct and that the total estimated weight of the material is written on the manifest. (Note: Manifests for PCB wastes must be completed in accordance with TSCA regulations. 40 CFR 761.207 requires that the weight of the PCBs be in kilograms and the date removed from service be on the manifest.) Remember, only a DOT-trained WSP employee is allowed to review and sign the manifest.
- Sign the manifest "On behalf of [insert client name]." Do not us "as an agent of."
- Ensure that all containers are properly labeled and transferred to the transporting vehicle; ensure that the vehicle is properly placarded.
- Once the IDW has been removed from the site, the IDW log must be marked "Removed," placed in the project file, and a copy must be forwarded to WSP's DOT compliance manager.

The manifest, certificate of disposal, IDW log, and inspection reports must be maintained on file for at least 3 years.

Investigation Derived Waste Log

Date:_____

Site Information

Site Name: _____ Site EPA ID #:_____

Site Contact: _____ Site Address: _____

Contact Telephone No: _____

Waste Identification:

Type of Waste Generated (check one of the following):

☐ Soil Cuttings ☐ PPE ☐ Decontamination Water

☐ Groundwater ☐ Storm Water ☐ Drilling Fluids

☐ Other (Describe):_____

Field Activities that Generated the Waste:

☐ Soil Borings ☐ Well Sampling ☐ Well Installation

☐ Decon ☐ Excavation ☐ Pumping Tests

☐ Other (Describe): _____

Generation Date:_____ ***90-Day Deadline***: _____

Quantity of Waste Generated and Container Type:

_____

_____

Storage Location:_____

Waste Identification (Check One of the Following):

☐ Non Hazardous Waste (pending analysis)

☐ Non Hazardous Waste (based on site information or generator knowledge)

☐ Hazardous Waste (pending analysis)

☐ Hazardous Waste (based on site information or generator knowledge)

If generator knowledge or site information was used for identification, explain: _____

_____

_____

Type of Label Applied to Container: ☐ Non Haz ☐ Hazardous ☐ PCB ☐ Used Oil

WSP Information (Note: One copy to site contact - the original in project file)

Personnel/Contact:_____ Project No.: _____

Telephone:_____

FIELD STANDARD OPERATING PROCEDURE #6 Decontamination

The decontamination procedures outlined in this standard operating procedure (SOP) are designed to ensure that all equipment that contacts a sample during sample collection 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
IDW	investigation derived waste
PPE	personal protective equipment
SOP	standard operating procedure

6.2 Materials

- Polyethylene sheeting and/or garbage bags
- Non-phosphate detergent (e.g., Luminox®, Liquinox®, or Alconox®)
- Cleaning reagents, as needed (e.g., isopropyl alcohol, methanol, hexane, etc.)
- Tap water
- Deionized (DI) water
- Containers (e.g., garbage cans, buckets, plastic tubs)
- Nylon brushes
- Aluminum foil
- Spray bottles
- Paper towels
- Duct tape
- Pressurized steam cleaner (e.g., steam jenny), as needed
- Portable wet/dry vacuum
- Shovel, funnel, and/or squeegee

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 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 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 IDW management procedures (SOP 5).

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 supported with the collection of equipment blanks. The sampling procedures and equipment blank collection frequency are discussed in SOP 4.

It is important for WSP personnel to evaluate the expected types of contamination prior to mobilization to a site. Some state programs (or the U.S. Environmental Protection Agency [EPA], depending on the site) may require more stringent decontamination procedures than those listed here or specify the types and grades of various cleaning detergents and reagents (e.g., acids and solvents). Many of these compounds, such as nitric acid or pesticide grade hexane, are available from a limited number of suppliers and can be difficult to obtain in short order (i.e., most solvents and acids must be shipped using a ground service and are not available for overnight delivery). 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.

6.4 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 spools, trowels, pumps, etc., before and between each sample location or interval. Disposable, single-use items, such as bailers or tubing, do not require decontamination.

The process includes the following four basic steps[1:]

1. Physical removal of debris
2. Bucket wash with non-phosphate soap such as Alconox®, or equivalent and scrub brush
3. Tap water rinse
4. Deionized water rinse (distilled water can be used as a substitute)
5. 10-percent nitric acid rinse (for metals sampling only; see below)
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

[1] Steps 5-9 are for more critical sampling applications and are not typically performed.

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. If gross contamination or an oily film or residue is observed on the equipment, use 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 wash using non-phosphate soap (mixed to the appropriate dilution in tap water) followed by a tap water rinse. The most common set-up uses 5-gallon pails or buckets for the wash and rinse, although garbage pails or plastic tubs can also be used. Place buckets on polyethylene sheeting to limit spillage of the cleaning fluids.

Be sure to scrub the equipment thoroughly and allow enough time for the non-phosphate soap to be effective and clean the surfaces (a simple dunk of the equipment in the soapy water is insufficient). If decontaminating submersible pumps, pump both the non-phosphate soap wash fluid and the tap water rinse through the pump body itself (usually done in the bucket) to ensure that the internal impeller and other components are thoroughly cleaned. Replace the soap solution and rinse water when it becomes oily or silty.

Place the DI water for the rinse in a small squirt bottle or poured over the equipment or device after the tap water rinse. **In some cases, such as decontaminating a split-spoon between sample recoveries or when working with submersible pumps, this level of decontamination (i.e., steps 1 through 4) may be sufficient.**

Steps 5 through 9 are for more critical sampling applications and are typically performed on non-motorized equipment. Isopropyl alcohol is the recommended solvent for organic contaminants because it is readily available (at most drug and department stores) and is not a U.S. Department of Transportation (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 them 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 squirt bottles, which offer a convenient and controllable way to rinse the equipment. The equipment can then be rinsed over a 5-gallon bucket or other suitable container placed on plastic sheeting as with the first part of the cleaning process. Steps 5 and 6 are for metals sampling only and must be used only for non-carbon steel sampling devices (do not spray acid into pumps) and can be skipped for projects where inorganics are not included in the sampling scheme.

6.5 Handling Decontaminated Equipment

After decontamination, handle equipment using clean gloves to prevent re-contamination. In addition, move the equipment away (preferably upwind) from the decontamination area to prevent re-contamination. As soon as the equipment is air-dried, protect decontaminated field equipment from environmental contamination by securely wrapping and sealing with aluminum foil (shiny side out) or clean, untreated, 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.

On completion of site work, decontaminate all equipment prior to departure, then label each piece of equipment with the date of decontamination, the initials of decontamination personnel, and the type of decontamination solution(s) used. Containerize all solvent rinsate, detergent wastes, and other decontamination materials for offsite or regulated disposal (see SOP 5). Dispose of all wastes in conformance with 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 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.

9.1 Acronyms and Abbreviations

bgs	below ground surface
F	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	standard operating procedure
VOC	volatile organic compound

9.2 Materials

- Field book
- PPE
- Air quality monitoring equipment
- Utility knife
- Mixing tray or bowl
- Heavy-duty zipper-style plastic bags (quart or snack size)
- Plastic sheeting
- Expanding ruler or tape measure
- Munsell color chart
- Sampling containers and labelling/shipping supplies
- Field test kits, as needed
- Soil sampling method specific materials:
- Stainless steel trowels, shovels, or spoons
- Bucket augers, auger extension rods, auger handle, pipe wrenches

- Split-spoon samplers, pipe wrenches
- Direct push acetate liners
- Shelby tube samplers
- Decontamination supplies

9.3 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.

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 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 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. 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:

- WSP'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 by a drill rig. Recovered cores are often logged (using a Munsell color chart and other logging aids), screened for volatile organic compounds (VOCs) using a photoionization detector (PID), and sampled for laboratory analysis using disposable stainless steel spoons or other discrete sampling devices.

All types of soil sampling, however, 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

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-spoons cutting shoes, or trowels. Select the types of equipment and 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 (e.g., macro-core liners, soil baskets, etc.) be used to collect more than one sample.

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: always use the appropriate spoon, trowel, or sampler to move the soil from the sampling device to the laboratory-supplied containers.

Finding a suitable sampling location involves 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. 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 and securely stage, if possible, in uncontaminated portions of the site.

9.5 Soil Collection

Soils can be collected from surface or subsurface depths, depending on the project requirements. Surface soils are generally those within 0.5 to 1 foot of the ground surface and can be collected using trowels, soil probes, 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.
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, if appropriate, the number of blows needed to drive the sampling device (i.e., when using a cathead-equipped drill rig; record the blows for every 6 inches the split-spoon sampler is advanced). 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 crumbling and falling out of the sampler.

Withdraw the sampling equipment from the borehole or excavation. Do not physically enter excavations to collect a sample; soil samples can be collected from a backhoe bucket. If the soil sample will be analyzed for geotechnical parameters (i.e., using a Shelby tube), the undisturbed sampler is typically capped, maintaining the sample in its relatively undisturbed state, and shipped to the appropriate geotechnical laboratory. Follow sample preparation and shipping procedures in SOPs 3 and 4. If the soil is to be logged in the field, place soil samplers/soils on plastic sheeting noting the orientation of the sample (i.e., which end is “up”) and the depth interval. Measure the length of the material recovered relative to the interval the sampler was advanced (in percent), 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). Record the readings in the field book.

9.5.1 Volatile Organic Compound Sampling

If part of the sampling plan, immediately collect samples for VOC analysis after screening the soils 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 composite or mix 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 sampling by US Environmental Protection Agency Method 5035 is required, follow manufacturer's specifications to use a closed-system sampler (e.g., Encore samplers). Collect quality assurance/quality control (QA/QC) samples in accordance with SOP 4, the project-specific work plan, and the QAPP.

9.5.2 Soil Headspace Analysis

If required as part of the project-specific work plan, collect samples for field-based headspace analysis after obtaining the sample for VOC analysis. First, examine the contents of the sample and remove coarse gravel, organic material (e.g., roots, grass, and woody material) and any other debris. Collect the sample using decontaminated spoons or trowels 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, F) by placing the bag in a heated room or vehicle. This step is very important when the ambient temperature is below 32ºF.

After waiting 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 and avoid the uptake of water droplets. Record the highest meter response, which typically occurs within the first 2 to 5 seconds. Erratic PID response 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 plus or minus 20%. Samples collected for headspace screening cannot be retained for laboratory analysis.

9.5.3 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
- Total metals
- Dissolved metals (see filtering procedures below)
- Inorganic non-metallic and physical and aggregate properties
- Microbiological samples
- Radionuclides

Collect soil samples for semi- and non-volatile parameters by separating clumps of soil material and mixing the soils (using stainless steel bowls and spoons, or other appropriate equipment) to a homogeneous particle size and texture. Transfer the contents to the 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 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 and the project-specific work plan or 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.

9.5.4 Sample Labeling and Preparation for Shipment

Once collected, prepare the soil 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 WSP compliance professional.

9.5.5 Soil Classification

Soil classification should be performed whenever soil samples are being collected to provide context for the analysis. WSP prefers following 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 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

[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).

- Particle angularity: angular, subangular, subrounded, rounded
- Particle shape: (if appropriate) flat, elongated, flat and elongated
- Maximum particle size or dimension
- Hardness of coarse sand and larger particles
- Plasticity of fines: 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)
- Moisture: dry, moist, wet

For intact samples also include:

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

Use the following standard descriptors for the textural percentages:

- Trace: 0 to 10%[2]
- Little: 11 to 20%
- Some: 21 to 35%
- And: 36 to 50%

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

8-10' – 5YR2/6 fine- to medium-grained sand, trace medium sub-angular rounded gravel (up to 0.5" in diameter); medium dense to dense; wet with slow dilatancy; moderate solvent-like odor between 9' and 10'.

10-12' – 5YR2/6 low plasticity clay with some fine to coarse grained angular to subangular gravels (up to 0.25" in diameter) and trace fine to medium grained rounded sands, very stiff, moist with no dilatancy, no odors.

9.6 Closing Notes

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

[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-perent 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 surface 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. Potential surface sample media include porous surfaces (e.g., concrete or painted surfaces) for chip samples, dust or sweep samples, and 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
    - Clean medium-sized, bristle brush
    - Digital scale
    - 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
  - Ground fault circuit interrupter (GFCI)
  - 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
  - GFCI
- Decontamination supplies

16.3 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.

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 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 WSP 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:

- WSP'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

As the following steps are completed, note all observations and measurements in the field book.

- Verify sampling locations and analytes.

- 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.
- The sampling location should be described.
- 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 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 of approximately 1/8 inch across the measured area. Collect the chip fragments using a clean dustpan and bristle brush or spatula and transfer the sample directly into an appropriately prepared sample container. Weigh the sample using a digital scale 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 using a dedicated brush or spatula and collect the sample with a clean dustpan or aluminum foil. 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.

16.5.3 Concrete Core and Powder Sample Collection Procedures

Concrete core and concrete powder samples are normally collected from concrete surfaces to determine whether or not they are contaminated or to evaluate the effectiveness of decontamination procedures.

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.

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 CFR 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 WSP 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.

FIELD STANDARD OPERATING PROCEDURE #17
Solid Waste Sampling Procedure

Solid waste sampling procedures outlined in this standard operating procedure (SOP) are designed to ensure that solid waste samples are representative of the materials from which they were collected and that they have not been altered or contaminated by the sampling and handling methods. Solid waste materials are commonly stored or staged in open (e.g., waste piles, outfalls, surface impoundments) or closed units (e.g., drums, tanks and associated ancillary equipment, containers, sumps). Solid waste samples can 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.

17.1 Acronyms and Abbreviations

F	Fahrenheit
HASP	health and safety plan
IDW	investigation derived waste
NAPL	non-aqueous phase liquid
PID	photoionization detector
PPE	personal protective equipment
QAPP	Quality Assurance Project Plan
QA/QC	quality assurance/quality control
SOP	standard operating procedure
VOC	volatile organic compounds

17.2 Materials

- Field book
- PPE
- Air quality monitoring equipment
- Utility knife
- Mixing tray or bowl
- Hip-waders or rubber boots, as necessary
- Aluminum foil or heavy-duty zipper-style plastic bags (quart size)
- Plastic sheeting
- Expanding ruler or tape measure
- Sampling containers and labeling/shipping supplies
- Field test kits, as needed
- Waste sampling method-specific sampling equipment and materials:

- Stainless steel trowels, shovels, or spoons
- Bucket augers, auger extension rods, auger handle, pipe wrenches
- Split-spoon samplers, pipe wrenches
- Direct push acetate liners
- Shelby tube samplers

- Decontamination supplies

17.3 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.

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 conducting waste and wastewater 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), use and calibration of all sampling and monitoring equipment (SOPs 7 and 8), and waste water sampling (SOP 18). 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. 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:

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

17.4 General Procedures

Solid waste sampling presents a number of unique challenges for safe collection due to the potentially hazardous environment(s) where waste materials are located. Sampling of closed waste containers (e.g., drums, tanks, etc.) is considered a higher hazard risk because of the potential of exposure to toxic gases and flammable/explosive atmospheres. While opening closed waste containers for sampling purposes, monitor the breathing zone to ensure that the working environment does not contain hazardous levels of flammable/explosive gasses or toxic vapors, and follow the appropriate safety requirements stipulated in the HASP. Do not bodily enter tanks, sumps, waste containers, pipes, such as storm sewers or other drainage conveyances, during sample collection. **WSP personnel are not authorized to open closed units that are unlabeled or contain unknown contents.**

Each sampling situation will have unique set of 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 solid waste sampling, however, 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 (e.g., hip-waders or rubber boots and gloves, and Saranex or Tyvek duct-taped to nitrile gloves, etc.)
- Selection of a suitable sampling location and staging area

Collect all samples using either new, disposable equipment, or properly decontaminated sampling equipment. Solid waste 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, etc.) which are compatible with the chemical constituents at the site. When choosing sampling equipment, give consideration to:

- the type and location of the waste unit
- the required depth of the sample
- the volume of sample required
- the analytes of interest

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

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 analytical samples 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. Extension rods or other appropriate devices can be used, as necessary, to allow the sample to be collected at a distance (or through deeper water) to minimize the risk to the sampler.

Once you have arrived on site and are prepared to conduct the waste sampling, note all observations and measurements in the field book.

- Perform a quick reconnaissance of the site to identify sampling locations
- Record the approximate ambient air temperature, precipitation, wind (direction and speed), tidal, and other field conditions in the field book. In addition, any site-specific conditions or situations that could potentially affect the sampling should be recorded
- Describe the sampling location
- Position fuel powered equipment downwind and at least 10 feet from the sampling location; make sure that the exhaust faces downwind
- Record pertinent information about the waste unit (e.g., type, capacity, markings, condition, and contents)
- Evaluate the accessibility to the waste unit, including ladders or stairs, and ensure that proper grounding is present, if needed

- Survey around the sampling location with a photoionization detector (PID), as necessary (see HASP), to ensure that the level of PPE is appropriate
- Mark sampling locations with a stake or flag for future reference; if available, record locations with respect to a permanent feature

17.4.1 Safety Considerations

Solid waste sampling may present a number of unique challenges for safe collection. Solid waste materials are frequently heterogeneous due to the physical characteristics of the matrix (e.g., particle size, viscosity, etc.), the distribution of hazardous constituents within the matrix, or the manner in which the material was managed or disposed. Because waste often stratifies over time due to different densities of phases, settling of solids, or varying wastes constituents generated at different times, both solid and liquid waste samples may need to be collected (see SOP 18 for waste water sampling procedures). Consult and involve WSP's compliance professionals during all phases of solid waste sampling.

Caution should be exercised when sampling *in situ* wastes (e.g., soil piles) because of the potential presence of explosive/flammable gases and/or toxic vapors. Ground or sediment surface or stockpiles may not be stable and could present an engulfment hazard. Do not attempt to sample surface impoundments used to manage potentially hazardous wastes from a boat; all sampling should be conducted from the banks or piers of surface impoundments.

Caution should be exercised when sampling closed waste containers, such as sealed drums, because of the potential presence of explosive/flammable gases and/or toxic vapors. Visually inspect all waste units for the following:

- pressurization (bulging/dimples)
- crystals formed around the drum opening
- leaks, holes, stains
- labels, markings, hazardous warnings
- composition and type (steel/poly and open/bung)
- dead vegetation around drum
- condition, age, rust, potential shock sensitivity (as indicated by contents listed on waste label)
- sampling accessibility (including a determination if it qualifies as a confined space)

Waste containers showing evidence of pressurization and/or crystals should be furthered assessed to determine if remote opening is needed. If containers cannot be accessed for sampling, heavy equipment may be necessary to stage the containers before sampling. Adequate time should be allowed for the contents to stabilize after a container is handled.

A grounding strap must be used when sampling metal waste containers, such as 55-gallon steel drums, due to the potential presence of explosive/flammable gases. First attach a grounding strap, then touch the waste container opening with a gloved hand and allow an electrically conductive path to form, as appropriate. Using spark-resistant tools, slowly open the waste container (e.g., vents, pressure release valves, bung or drum ring and/or lid) to allow the unit to vent to the atmosphere. Do not attempt to use a manual bung wrench or de-header on drums that potentially contain shock-sensitive, reactive, explosive or flammable materials. Screen the breathing zone for explosive gases and toxic vapor with air monitoring instruments before commencing sampling. Once sampling is complete (re)seal the waste container in accordance with the manufacturer's instructions.

17.4.2 Sampling Considerations

When collecting solid waste samples, consider the following:

- Collect waste water samples first to avoid disturbing the bottom and suspending solid wastes or sediment in the water column
- If collecting several solid waste samples from a stream, ditch, or river, start sampling at the downstream location and progressively move upstream

17.5 Solid Waste Sample Collection Procedures

Solid waste samples should be collected in accordance with the project-specific work plan. Typical sampling equipment includes : (1) scoops or trowels, (2) corers or grab samplers (e.g., hand augers, sludge judge), (3) dredges (e.g., Ekman, Peterson, or Ponar), (4) composite liquid waste samplers, bailers, or drum thief samplers, and (5) excavating or drilling equipment (e.g., split-spoon sampler, backhoe bucket). Follow the manufacturer's operation manual for proper sampling procedures.

At the desired sampling location, clear away any accumulated surface debris. Place absorbent pads (if appropriate), sampling equipment and sample containers in a safe location near the waste that is to be sampled. If a grid system is being used to collect samples, lay out the grid according to the project-specific work plan.

Push the method-specific sampling equipment into the solid waste materials to the desired sampling depth using decontaminated or dedicated, disposable equipment. Tilt the sampling equipment at a slight angle, if necessary, to avoid losing waste materials. If a liquid sample is not required, decant liquid into a separate container or back into the vessel being sampled. If a liquid sample is required, decant any liquid directly into sample containers (see SOP 18). Record the depth interval through which the sampler was advanced in the field book. If additional sample volume is needed, repeat this step. Occasionally solid waste materials lack cohesiveness and are subject to crumbling and falling out of the sampler. The use of core catchers on the leading end of the sampler may help retain the sample until it is retrieved to the surface; core catchers must be evaluated for compatibility with the proposed analytical program before use.

Note the state, quantity, phases, and color of the solid waste in the field book. If field screening for organic vapors is required, break or cut the waste materials and quickly scan the breaks in the material with the appropriate air quality monitoring equipment (e.g., PID). Record the readings in the field book.

17.5.1 Volatile Organic Compound Sampling

If required by the project-specific sampling plan, immediately collect samples for analysis of volatile organic compound (VOC) after screening the sample with the PID to avoid loss of the compounds to the atmosphere. Transfer the waste materials from the center portion of the sample interval to be sampled directly into the sample containers; do not composite or mix waste materials for VOC analysis. If sampling by US Environmental Protection Agency Method 5035 is required, follow manufacturer's specifications to use a closed-system sampler (e.g., Encore samplers). Collect quality assurance/quality control (QA/QC) samples in accordance with SOP 4 and the project-specific work plan or QAPP, if required.

17.5.2 Headspace Analysis

If required by the project-specific work plan, collect samples for field-based headspace analysis after obtaining the sample for VOC analysis. First, examine the contents of the sample and remove coarse gravel, organic material (e.g., roots, grass, and woody material) and any other debris. Collect the sample using decontaminated spoons or trowels and seal it in a heavy-duty zipper-style plastic 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, F) by placing the bag in a heated room or vehicle. This step is very important when the ambient temperature is below 32ºF.

After waiting 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 and avoid the uptake of water droplets. Record the highest meter response, which typically occurs within the first 2 to 5 seconds. Erratic PID response 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 plus or minus 20%. Samples collected for headspace screening cannot be retained for laboratory analysis.

17.5.3 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

Collect solid waste samples for non-volatile parameters by separating clumps of waste material and 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 and the project-specific work plan or QAPP, if required.

If approved by the appropriate regulatory agency and/or specified in the project-specific work plan, composite waste 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 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 and the project-specific work plan or QAPP, if required.

Interstitial water, or pore water, is the water occupying the space between solid particles. It can be isolated to provide either a matrix for toxicity testing or an indication of the concentration and partitioning of contaminants with a solid matrix. Pore water samples may be collected in the field using any available technology that will preserve the integrity of the analytes of interest during collection (e.g., lysimeter) or extracted in the laboratory from field-collected waste. The substrate type will dictate the volume of sample needed. In all cases, consult the laboratory conducting the analyses to provide estimates of the amount of sample necessary to obtain the desired quantity of pore water.

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

17.5.4 Non-Aqueous Phase Liquid Sampling Procedures

Non-aqueous phase liquids (NAPL) are not typically collected from solid waste units. However, if NAPL samples are required, the sampling options and techniques should be discussed with the assigned WSP compliance professional and project manager to ensure that the NAPL is not considered to be a hazardous material for the purpose of shipping to the laboratory (SOP 3). Samples of NAPL should be collected using the same procedures

as above and placed in the appropriate laboratory-supplied containers, packed on ice, and shipped to the analytical laboratory using procedures outlined in SOP 3.

17.5.5 Sample Labeling and Preparation for Shipment

Once collected, prepare the waste samples for offsite laboratory analysis by:

- 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 WSP compliance professional.

17.6 Closing Notes

Once sampling is completed, secure the waste unit(s) in accordance with the project-specific project work plan. Decontaminate all equipment prior to departure and properly manage all PPE and IDW in conformance with applicable regulations.

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