Approved 7/11/16

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SAMPLING AND ANALYSIS PLAN

VOLUME 1: FIELD SAMPLING PLAN

ADDENDUM 11 Rev. 1

Monitoring Well Installation, DPT Groundwater and Soil Gas Sampling, and Vapor Intrusion Air Sampling

Hemphill Road TCE Site

Gastonia, Gaston County, North Carolina

PREPARED FOR:

U.S. ENVIRONMENTAL PROTECTION AGENCY

REMEDIAL ACTION CONTRACT II LITE

REGION 4

EPA CONTRACT No. EP-S4-08-03

TASK ORDER 031

DCN: 031FSP070516-ADDENDUM 11

PREPARED BY:

Versar, Inc.

VERSAR

July 2016

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Figure 1 - Proposed Monitor Well and DPT Groundwater Sampling Locations

1.0 INTRODUCTION AND OBJECTIVE

This report serves as Field Sampling Plan (FSP) Addendum No. 11 to the Sampling and Analysis Plan (SAP) for Task Order (TO) No. 031 for Hemphill Road TCE Site located in Gastonia, Gastonia County, North Carolina. Specifically, this FSP Addendum provides the details for additional groundwater, soil gas, and vapor intrusion investigation activities. These activities will include the installation of four additional groundwater monitoring wells, the collection of groundwater samples from up to 22 temporary direct push technology (DPT) well locations, and the collection of soil gas samples and vapor intrusion crawl space air samples from up to 20 residential properties. Figure 1 shows the locations of the proposed monitoring wells and the DPT groundwater sampling locations.

All activities described herein will be performed in accordance with the approved Final SAP dated January 2014 (J.M. Waller, 2014a) and Addendums 1 through 10, except where explicitly stated by this document. The following sections contain discussions of relevant changes or additions to the Final SAP and appropriate revisions to the figures.

2.0 FIELD SAMPLING PLAN ACTIVITIES

2.1 Monitoring Well Installation

Monitoring well installation will include hollow stem auger and/or Rotosonic, and air rotary/hammer drilling methods to install four monitoring wells to estimated depths of around 20 feet below ground surface (bgs) for the shallow wells and 350 feet bgs for the deep well. Drilling and well installation will be performed in accordance with EPA Region 4 Field Science and Ecosystem Support Division Guidance: Design and Installation of Monitoring Wells *(SESDGUID-101-R1)* (EPA, 2013).

Three wells (WT01, WT02, and WT03) will be installed to sample groundwater near the water table (assumed to be approximately 20 feet deep). One well (BW16) will be installed downgradient of the site near the location of the abandoned Kensington Estates community well to sample the deep bedrock fracture network(s) present (assumed to be approximately 350 feet deep) and delineate the vertical extent of the contaminant plume. Figure 1 indicates the general locations for the four wells.

The three shallow wells (WT01, WT02, and WT03) will be completed as single-cased monitoring wells completed with conventional riser casing and filter pack assemblies screened across the water table in the saprolitic regolith. These three wells will be drilled via hollow stem auger, emplaced in a borehole of at least 6 inches in diameter, and completed in accordance with Section 2.1.6 of this document.

Well BW16 will be completed as a double-cased monitoring well to sample the fractured rock aquifer zone. Surface casing will extend approximately 5 to 10 feet into the fractured yet largely unweathered granitoid gneiss bedrock present at the site. After completing the BW16 boring below the surface casing, the borehole will be logged by the USGS using wireline geophysical methods and the productive fracture zones sampled via packer assembly as describe in later sections of this document. Well construction in both double cased wells will include a conventional riser casing and completed annular space within the fractured rock borehole and surface casing.

2.1.1 Surface Casing Boring and Installation

Surface casing will be required for the bedrock borehole (BW16). The surface casing boring will be advanced via a combination of Rotosonic and air rotary tooling, producing a finished borehole of at least 10 inches in diameter. The borehole will be logged via soil cores, soil cuttings, and observed resistance to drilling by the Versar onsite geologist. Headspace analysis via PID will be performed on core soil samples and cuttings.

The surface casing boring will be advanced 5 to 10 feet into competent bedrock via air rotary drilling methods. The anticipated bedrock depth is approximately 100 feet bgs at BW16. Versar's onsite geologist will determine the total boring and surface casing installation depth based on analysis of the rock cuttings.

The surface casing will be set only after the rock cuttings exhumed via return air circulation consist of fresh rock fragments representative of largely unweathered granitoid gneiss with fresh, well defined, and angular mineral cleavage surfaces, and mineral grains without evidence of alteration of parent mineralogy to clays and iron oxides as observed under ~10x magnification (hand lens).

Surface casing will consist of 6-inch inner diameter (ID) Schedule 40 carbon steel with machine threaded joints. The surface casing will be installed with a pre-cured grout "plunger" sealing the bottom section of casing.

The surface casing annular space will be grouted from the bottom of the borehole up via pressure methods using a tremie pipe. Grout will consist of a bentonite-cement slurry mixed in the proportions 94 pounds (lbs) Type I Portland Cement, 6 gallons of potable water, and no more than 2 lbs bentonite powder to yield a grout slurry of at least 15 lbs/gal. The drilling subcontractor will be responsible for verifying grout density with a scale designed for that purpose. Final grout density will be measured from grout pumped out (circulated) of the borehole at the ground's surface.

Surface casing grout will be allowed to cure for a minimum of 24 hours prior to drilling through the surface casing into the formation below.

2.1.2 Well Boring Construction

2.1.2.1 Single Cased Wells

Single cased wells WT01, WT02, and WT03 will be drilled via hollow stem auger methods, emplaced in a borehole of at least 6 inches in diameter. Well design and annular space completion will be performed in accordance with Section 2.1.6 of this document.

Soil samples will be collected via split spoon sampler on 5 foot centers from the ground surface to the potentiometric surface. Headspace analysis via PID will be performed on split spoon soil samples and cuttings.

2.1.2.1 Double Cased Wells

Well boring BW16 will be advanced through rock via air rotary methods. A rotary coring bit or roller cone bit will be used to penetrate the grout seal and into formation rock at the surface casing terminus, thereby reducing the likelihood of shattering the grout by the percussive action of an air hammer. After penetrating the rock beneath the surface casing, the well borings will be advanced to completion depth to resulting in finished borehole diameters of approximately 6 inches.

Hydrocarbon lubricants will not be used to lubricate or contact any downhole tooling. In addition, compressed air used to power downhole equipment/tooling will be filtered with a coalescing filter to remove

particulate and organic matter to meet or exceed the minimum standards described in EPA Region 4 Field Branches Quality System and Technical Procedures, Design and Installation of Monitoring Wells.

All drill cuttings and fluids generated during drilling will be directed into a waste container by means of a cyclone separator or diverter and not allowed to flow uncontrolled from the borehole. Cuttings and well effluents generated during drilling shall be temporarily contained in a double lined mud pit or tub at the drilling site to prevent release to the surrounding area, and covered if left unattended overnight to prevent precipitation induced runoff.

2.1.3 Borehole Development

Upon completion of air rotary drilling at BW16, the open borehole will be developed to remove residual mud cake and rock solids remaining in the borehole via airlift. Airlift development will be performed until the effluent produced is visibly free of coarse grained materials. All development water will be contained at the borehole and then transferred to a centralized holding tank(s) pending characterization.

2.1.4 USGS Wireline Geophysics

Following borehole development, borehole geophysical logging will be performed at BW16 by the United States Geological Survey (USGS). The borehole geophysical investigation will include: optical televiewer images, heat-pulse flow meter (both ambient and stressed), caliper, electrical resistivity, fluid temperature and resistivity, and natural gamma logs.

2.1.5 Fracture Zone Sampling

Based on the results of the USGS wireline logging at BW16, fracture zones will be selected for packer sampling. The purpose of the sampling will be to identify the productive fracture zone that contains the highest concentration of volatile organic compounds (VOCs). The drillers will use a packer system to isolate the fracture zones so that a discrete sample of the groundwater within the fracture can be sampled. The groundwater sample collected will be analyzed onsite for VOCs using the Color-Tec field screening method. The Color-Tec method combines the use of colorimetric gas detector tubes with sample purging to detect very low (ppb-range) concentrations of chlorinated compounds in groundwater and soil samples. The primary intent of this method is to provide fast, low-level, low cost, decision-quality data to identify and target the “hot” fracture zones. The Color-Tec data will be provided to the EPA in real time so that a decision can be made as to where to set the monitoring well screen. A description of the Color-Tec method is provided in Appendix A.

2.1.6 Monitoring Well Construction

The well screens will consist of 10 to 20 foot sections of 2-inch ID, machine threaded, Schedule 40 polyvinyl chloride (PVC) screen with 0.01-inch slotted openings. The bottom of the well will terminate with a Schedule

40 PVC end cap. The remaining well riser casing will consist of machine threaded sections of 2-inch ID, Schedule 40 PVC riser which will extend from the top of the screen to the ground surface.

Centralizers will be installed on all wells exceeding 100 feet total depth. Centralizers will be installed immediately above and below the screen. Centralizers will be constructed of inert material (stainless steel or PVC).

Filter packs will surround the screen in the well annulus to at least 2 feet above the top of the screen. Filter material will consist of 20-30 mesh sand or product with similar gradation. Filter pack grain size analysis shall be reviewed by the Versar field geologist prior to installation to determine the suitability for used with the specified 0.010 inch slotted screen openings. The filter pack will be placed within the annulus via the tremie method using reverse circulation techniques to ensure that the sand is evenly distributed and the screen/riser is centralized in the borehole. The settled depth of the filter pack will be measured with a weighted depth tape prior to emplacement of the annular seal.

Annular seals will consist of a minimum of a 2 foot thick layer of one-quarter inch diameter bentonite pellets. The seal will be placed above the screen and hydrated with for a minimum of 60 minutes or longer (in accordance with the manufacturer's instructions) prior to grouting. Depth of the hydrated seal will be verified with a weighted depth tape prior to grouting.

Borehole backfill (if required) shall consist of bentonite pellets. Filter sand shall extend at least two feet below the top of backfill and the lower terminus of the well casing/screen assembly.

Grout will be placed into the borehole annulus above the bentonite seal from the bottom up via pressure methods and a tremie pipe. Grout for single cased wells will consist of bentonite-cement slurry mixed in the proportions 94 pounds (lbs) Type I Portland Cement, 6 gallons of potable water, and no more than 2 lbs bentonite powder to yield a grout slurry of at least 15 lbs/gal. Grout for the rock-well riser and surface casing-well riser annular space will consist of a high-solids bentonite grout slurry, mixed in accordance with the manufacturer's recommendations to yield a slurry of approximately 30% solids, and a minimum density of 10 lbs/gal. Bentonite grout will be capped with neat cement or concrete at the surface to provide for a weatherproof surface within the final well completion/manhole. Grout density will be verified using a grout scale during mixing of individual batches, and upon circulation from the borehole.

Monitoring wells will be completed with 2 foot by 2 foot by 6 inch thick concrete surface pad and a traffic-rated "flush-mount" manhole. The concrete pad will be flush with existing grade at the edges and tapered such that water will run off of the pad and mechanical equipment such as lawnmowers may be operated over the well without damage to the well or motorized equipment. The well cover or sealing cap will be fitted with a keyed padlock.

Development will be conducted by the driller not less than 24 hours after grout placement. Completed well development methodology will include mechanical surging and over pumping to produce well effluent of low turbidity and stable geochemical parameters including specific conductance, dissolved oxygen, pH, and oxidation reduction potential as determined via field instrumentation. Stabilization criteria described in EPA Region 4 Field Science and Ecosystem Support Division Operating Procedure: Groundwater Sampling *(SESDPROC-301-R3)* (EPA, 2013) will be applied to well development at relatively high flow rates to demonstrate that the well effluent is representative of formation water in preparation for later sampling events.

2.2 Direct Push Technology (DPT) Groundwater Sampling

The objective of this activity is to collect groundwater samples for VOC and 1,4-dioxane analysis at up to 22 locations to evaluate the extent of groundwater contamination and the potential for VOC migration into residential homes. A DPT rig will be used to drill to the water table where a temporary 1-inch diameter PVC well will be set in the borehole. Groundwater samples will be collected using a peristaltic pump and Teflon tubing. Prior to sample collection, groundwater will be pumped from the interval until field parameters stabilize and turbidity is reduced. The samples will be packaged and sent to the Contract Laboratory Program (CLP) laboratory for analysis with expedited turn around for the sample results.

Upon completion of groundwater sampling at each sampling location, the temporary well will be removed and the DPT borehole will be abandoned by grouting the boring bottom to top with cement/bentonite grout or bentonite pellets.

2.3 Soil Gas Sampling

The objective of this activity is to collect soil gas samples and analyze for VOCs to evaluate the potential for VOCs migrating upward into residential homes. Soil gas grab samples will be collected from up to 20 residential properties. The sampling event will take place approximately three to four weeks after the groundwater sampling event is completed. The properties to be sampled will be selected based on the results of the groundwater VOC analytical results. The data will be evaluated by Versar and EPA to determine which residential properties have a potential for vapor intrusion based on the VOC concentration in the groundwater. The soil gas samples will be collected in accordance with the procedures provided in FSP Addendum 4.

2.4 Vapor Intrusion – Crawl Space Air Sampling

The objective of this activity is to collect crawl space vapor intrusion air samples and analyze for VOCs to evaluate the potential for VOCs migrating upward into residential homes. Air grab samples will be collected from the crawl space of up to 20 residential properties. The sampling event will take place approximately two weeks after the soil gas sampling event is completed. The properties to be sampled will be selected

based on the results of the soil gas VOC analytical results. The data will be evaluated by Versar and EPA to determine which residential properties have a potential for vapor intrusion based on the VOC concentrations in the soil gas samples. The crawl space air samples will be collected at the residential properties using 6-liter passivated SUMMA sampling canisters with the appropriate calibrated metering valves to collect the samples over a period of 24 hours. The crawl space samples will be collected as close to the center of the structure as possible. The crawl space samples will be collected in accordance with the procedures provided in FSP Addendum 7.

2.5 Drilling Equipment Decontamination Procedures

Decontamination procedures will meet the requirements contained in Science and Ecosystem Support Division's (SESD's) *Operating Procedure for Field Equipment Cleaning and Decontamination (SESDPROC-205-R2)* (EPA, 2011).

Drilling equipment, including any portion of the drill rig that will be emplaced above the borehole will be decontaminated upon arrival at the site, between drilling activities at different boreholes, and at the conclusion of the project. The following is the standard procedure for field cleaning of drilling equipment, tools, and associated equipment.

1. Wash with tap water and soap, using a brush if necessary, to remove particulate matter and surface films. Steam cleaning (high pressure hot water with soap) may be necessary to remove matter that is difficult to remove with the brush. Drilling equipment that is steam cleaned should be placed on racks or saw horses above the floor of the decontamination pad.

2. Rinse thoroughly with tap water.

3. Allow to air dry. If stored overnight, cover or store in plastic sheeting.

2.6 Investigation-Derived Waste

Decontamination and drilling wastes will be containerized and securely stored an onsite staging area pending characterization and disposal. Drilling waste will be staged in a lined and covered roll-off dumpster (cuttings) or temporary storage tank (liquid waste) near the drilling site pending characterization and disposal.

Soil cuttings will be transported to a licensed storage and disposal facility as non-hazardous waste via licensed waste hauler, and disposed of at a licensed storage and disposal facility according to the waste profile established for earlier phases of fractured rock drilling work.

Well effluent will be analyzed for VOCs via subcontracted laboratory prior to demobilization from the drilling event, and a waste profile established based on the analytical results. Transportation of the waste to a licensed storage and disposal facility will be performed by licensed waste hauler.

Solid waste including nitrile gloves, paperwork debris, and sample container cardboard boxes will be generated. These types of Investigation-Derived Waste (IDW) are not expected to be contaminated with site related VOCs. However, if during site activities other potential hazardous materials are encountered and require disposal, then the IDW will be managed in accordance with the SESD *Operating Procedure for Management of Investigation-Derived Waste Operating Procedure (SESDPROC-202-R2)* (EPA, 2010)

2.7 Health and Safety

Based on the results of former investigation at the site, it is anticipated that all of the work performed under this addendum will be conducted in modified Level D protective equipment. Further discussion of the site-specific health and safety program is presented in the Health and Safety Plan (HASP). The minimum PPE will be standard work clothes, steel-toed work boots, hard hat, and safety glasses. Hearing protection will also be required as work conditions dictate.

Prior to conducting any subsurface exploration activities, the proposed locations will be checked for underground utilities using the One Call utility locating service and then each sample location will be hand augered to a depth of 4 feet bgs as an additional precaution.

All onsite personnel shall have completed 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training and a current (annual) 8-hour refresher, and be enrolled in an OSHA-compliant medical monitoring program for hazardous waste site workers prior to beginning the work.

All onsite personnel must attend a one-time, site-specific health and safety orientation conducted by the Versar onsite geologist. The Versar onsite geologist will also conduct daily “toolbox” health and safety meetings at the beginning of each work day. Attendance at both the initial orientation and daily health and safety meetings is mandatory.

2.8 Schedule

The field sampling is expected to begin on July 18, 2016 and continue through August 27, 2016.

3.0 REFERENCES

EPA, 2010. U.S. Environmental Protection Agency, Region 4, *Science and Ecosystem Support Division, Operating Procedure: Management of Investigation Derived Waste*, SESDPROC-202-R2, October 15, 2010.

EPA, 2011. U.S. Environmental Protection Agency, Region 4, *Science and Ecosystem Support Division, Operating Procedure: Field Equipment Cleaning and Decontamination*, SESDPROC-205-R2, December 20, 2010.

EPA, 2013. U.S. Environmental Protection Agency, Region 4, *Science and Ecosystem Support Division* Guidance: *Design and Installation of Monitoring Wells, SESDGUID-101-R, January 22, 2013*.

EPA, 2013b. U.S. Environmental Protection Agency, Region 4EPA Region 4 Field Science and Ecosystem Support Division Operating Procedure: Groundwater Sampling *(SESDPROC-301-R3)* (EPA, 2013).

J.M. Waller, 2014a. J.M Waller Associates Inc., *SAP Revision 2 (FSP Volume 1 and QAPP Volume 2) including approved Addendums 1-9,* January, 2014.

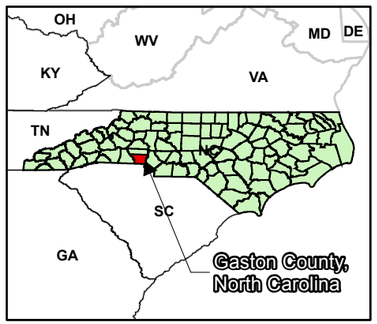
FIGURES

Legend

- Proposed DPT Groundwater Sample Location
- Proposed Shallow Monitoring Well Location
- Proposed Deep Monitoring Well Location
- Hemphill Site
- Parcels
- Streams

N

0 110 220 440
Feet
NAD 1983 North Carolina



Hemphill Road TCE Site
Gastonia, Gaston County
North Carolina

Figure 1
Proposed Monitoring Well and DPT Groundwater Sampling Locations

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