TETRA TECH

LUCAS STAMPS
PROJECT MANAGER

November 24, 2021

Mr. D. Erik Hardin, Remedial Project Manager
U.S. Environmental Protection Agency, Region 5
Superfund and Emergency Management Division
77 West Jackson Boulevard
Chicago, Illinois 60604

Subject: **Sampling and Analysis Plan – Revision 0**
Pike and Mulberry Streets PCE Plume Superfund Site
Martinsville, Morgan County, Indiana
EPA Contract No.: 68-HE-0519-D0005
Task Order No.: 68HE0521F0115
Document Tracking No.: 0833

Dear Mr. Hardin:

Tetra Tech, Inc. (Tetra Tech) is submitting the enclosed Sampling and Analysis Plan (SAP) – Revision 0 for the Pike and Mulberry Streets PCE Plume Superfund Site (the Site) for your review and approval. The SAP summarizes the sampling activities that will be conducted as part of an investigation at the Site.

If you have any questions regarding this plan, please contact me at (317) 419-5586 or via e-mail at lucas.stamps@tetratech.com.

Respectfully,

Lucas Stamps
Project Manager

Enclosure

cc: Chris Burns, Tetra Tech Program Manager
TO-TOLIN File

SAMPLING AND ANALYSIS PLAN

PIKE AND MULBERRY STREETS PCE PLUME SUPERFUND SITE
MARTINSVILLE, MORGAN COUNTY, INDIANA

REVISION 0

PREPARED FOR

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION 5
SUPERFUND AND EMERGENCY MANAGEMENT DIVISION
77 WEST JACKSON BOULEVARD
CHICAGO, ILLINOIS 60604

TASK ORDER NO.:	68HE0521F0115	
EPA OSC:	D. Erik Hardin	
SITE NAME:	Pike and Mulberry Streets PCE Plume Superfund Site	
SITE LOCATION:	Martinsville, Morgan County, Indiana	
SAMPLING ACTIVITIES:	Vapor Intrusion Assessment	
SAMPLING DATES:	January 2022	
SAP PREPARER:	Lucas Stamps	
SIGNATURE/DATE		11/24/2021
QC REVIEWER:	Heather Wood	
SIGNATURE/DATE:		11/24/2021
EPA OSC APPROVAL SIGNATURE/DATE:		
DOCUMENT TRACKING NO:	0833	

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1.0 INTRODUCTION

This Sampling and Analysis Plan (SAP) identifies the data collection activities and associated quality assurance/quality control (QA/QC) measures to be implemented for air and soil gas sampling at the Pike and Mulberry Streets PCE Plume Superfund Site (the Site) in Martinsville, Morgan County, Indiana (Appendix A, Figures 1 and 2). The U.S. Environmental Protection Agency (EPA) has identified conditions that could cause vapor intrusion at structures near a plume groundwater contaminated with tetrachloroethylene (PCE). The objectives of the sampling activities described in this SAP are: 1) to identify structures where vapor intrusion is occurring at concentrations above site-specific action levels and 2) to identify structures with contaminant concentrations in sub-slab soil gas that are above site-specific action levels and that could cause vapor intrusion at a later date.

This SAP is designed to provide defensible data for EPA Region 5 to assist with an ongoing vapor intrusion investigation at the Site. The site-specific sampling, analytical, and QA/QC procedures described in this SAP are designed to accommodate the project scope of work and requirements requested by the EPA.

2.0 SCOPE OF WORK

Under Contract Number 68-HE-0519-D0005, Task Order Number 68HE0521F0115, EPA Region 5 tasked the Tetra Tech, Inc. (Tetra Tech) Superfund Technical Assessment and Response Team (START) with collecting indoor and outdoor ambient air and sub-slab soil gas samples from up to 150 properties in Martinsville, Morgan County, Indiana. The overall goal of the sampling effort is to assess structures for ongoing or potential vapor intrusion.

The EPA remedial project manager (RPM) tasked START with the following objectives:

- Schedule a time with each consenting property owner to conduct vapor intrusion sampling
- Conduct a pre-screening inspection at each property within 48 hours prior to sampling to identify and remove potential point sources of indoor air contaminants that could interfere with samples
- Install sub-slab sampling ports where necessary or identify the location of an existing sub-slab sampling port
- Collect at least one indoor air sample and at least one sub-slab soil gas and/or crawlspace air sample from each property
- Collect up to 15 outdoor ambient air samples to rule out exterior air influences on indoor air samples
- Send samples to a laboratory for analysis of PCE, trichloroethylene (TCE), and vinyl chloride (VC)
- Conduct stage three data validation on analytical results and summarize the findings in a data validation report
- Summarize findings in a technical memorandum

- Send validated results for each property to the respective property owner in a letter written in consultation with EPA

Figures for this SAP are provided in Appendix A. Tetra Tech standard operating procedures (SOPs) that will be used by START are provided in Appendix B. Attachment 1 includes figures showing the distribution of PCE and its degradation products in groundwater and soil vapor, generated for previous EPA investigations.

3.0 PROJECT TEAM

The personnel listed in Table 1 below will be involved in planning or technical activities for the Site. The EPA RPM and each field team member will receive a copy of the SAP, and a copy will be retained in the Site file.

TABLE 1
PROJECT TEAM MEMBERS

Personnel	Title	Organization	Phone Number	Email
D. Erik Hardin	RPM	EPA	312-886-2402	hardin.erik@epa.gov
Chris Burns	Program Manager	START	312-201-7719	chris.burns@tetratech.com
Lucas Stamps	Project Manager	START	317-419-5586	lucas.stamps@tetratech.com
Kris Schnoes	QA Manager	START	312-201-7480	kris.schnoes@tetratech.com
Adam Peterca	Data Manager	START	312-201-7768	adam.peterca@tetratech.com
Joe Robert	Field Staff	START	317-847-5020	joe.robert@tetratech.com

Notes:
EPA = U.S. Environmental Protection Agency
QA = Quality assurance
RPM = Remedial project manager
START = Superfund Technical Assessment and Response Team

4.0 SITE LOCATION AND DESCRIPTION

The Site consists of a PCE groundwater plume in Martinsville, Morgan County, Indiana. The Site is in Section 33, Township 12 North, Range 1 East of the Martinsville, Indiana topographic quadrangle (Appendix A, Figure 1). The approximate center of the PCE groundwater plume lies at the intersection of Pike Street and Mulberry Street at 39.428834 degrees north latitude and 86.431452 degrees west longitude. Attachment 1 includes maps showing the distribution of PCE and its degradation products in groundwater and soil vapor that have been taken from the EPA record of decision (ROD) (EPA 2021a). The sampling events described in this plan will be conducted at up to 150 buildings in the area near the groundwater plume.

The study area is in a mixed commercial and residential area near the center of Martinsville, Indiana (Appendix A, Figure 2). The PCE groundwater plume extends downgradient northwest through the center

of Martinsville and terminates at the municipal wellfield and drinking water treatment plant (EPA 2021a). The White River lies 1.5 miles to the west-northwest of the center of the plume.

The Indiana Department of Environmental Management (IDEM) conducted a preliminary assessment and site inspection in 2003 and 2004, which identified elevated levels of PCE in the soil and groundwater near the former Master Wear, Inc. dry cleaning facility (IDEM 2004). IDEM also identified elevated PCE levels in the indoor air of nearby homes and businesses. An air sparge (AS)/soil vapor extraction (SVE) system was installed and operated near the source zone of the Site from 2005 to 2008 as part of a time-critical removal action (TCRA). Samples collected in 2008 by IDEM's consultant, Astbury Environmental Engineering, Inc. (AEE), showed that closure criteria for air, soil, and groundwater had been met (AEE 2008). IDEM conducted additional sampling in 2010, which identified PCE in exceedance of its EPA Maximum Contaminant Level (MCL) of 5 micrograms per liter (µg/L) upgradient and downgradient of the former Master Wear, Inc. facility (IDEM 2011). Groundwater PCE concentrations had also increased to 180 µg/L in the municipal wellfield since the shutdown of the AS/SVE system in 2008 (IDEM 2011). In 2013, the Site was listed on the National Priorities List, and EPA began a remedial investigation and feasibility study (RI/FS) at the Site in April 2015. The RI/FS was completed with the issuance of a ROD in March 2021 (EPA 2021a).

5.0 PROPOSED SCHEDULE

The first round of sampling activities under this task order is scheduled to take place in January 2022. A second round of sampling may take place at a later time, but the necessity and schedule have not yet been determined by EPA. The preliminary laboratory results are anticipated to be available approximately 2 weeks after the laboratory receives the samples. Laboratory results for PCE, TCE, and VC will be reviewed by a START data validator when the full laboratory data packages become available. The validated analytical results and other findings will be provided to EPA in a technical memorandum. The anticipated schedule is outlined in Table 2.

TABLE 2
PROPOSED SCHEDULE

Activities	Dates		Deliverables	Deliverable Due Date
	Anticipated Date(s) of Initiation	Anticipated Date of Completion		
Sampling and Analysis Plan Preparation	November 15, 2021	November 24, 2021	Sampling and Analysis Plan – Revision 0	November 24, 2021
Contact Residents for Scheduling	December 6, 2021	December 17, 2021	Sampling Schedule	December 24, 2021
Pre-Screening Inspection	January 2022	January 2022	Logbooks and Digital Field Forms	January 2022
Sample Collection	January 2022	January 2022	Logbooks and Digital Field Forms	January 2022
Laboratory Analysis	January 2022	February 2022	Preliminary Laboratory Results	February 2022
Data Validation	February 2022	February 2022	Data validation report	1 week after receipt of final laboratory data package
Reporting	February 2022	March 2022	Technical Memorandum	1 week after data validation report submittal
Drafting Letters to Residents	March 2022	March 2022	Results Letters	1 week after Technical Memorandum submittal

6.0 SAMPLE LOCATIONS AND COLLECTION PROCEDURES

START anticipates collecting samples in January 2022. The following sections provide details on sample types and collection methods. All samples will be collected and analyzed in accordance with the START Quality Assurance Project Plan (QAPP) (Tetra Tech 2020).

6.1 VAPOR INTRUSION INVESTIGATION

The sections below outline the procedures for pre-inspection screening and sampling indoor air, sub-slab soil gas, and outdoor ambient air. The number of samples and their locations may change based on conditions at the time of sampling.

6.1.1 Pre-Inspection Screening

Within 48 hours prior to sample collection, START will inspect the interior of the building to be sampled. START will collect photographic documentation of any potential issues and inform the EPA RPM. The areas where samples will be collected will then be screened with a photoionization detector (PID). Tetra Tech will also conduct a visual screening to identify any items that could affect air sample results such as paints, craft glue, dry cleaning, household cleaning materials, or automotive maintenance supplies. If materials are identified, they will be noted in field notes and placed in plastic totes and removed from the

home, if possible, prior to sample collection. Based on the professional opinions of the field team and EPA, sampling may be postponed for a day after materials have been removed from the sample area to prevent sample interference. Details about the building and the results of the pre-inspection screening will be recorded using digital field forms. Immediately following pre-inspection screening, START will install a sub-slab sampling port or identify a pre-installed sampling port. Details about the installation process are discussed below in Section 6.1.3.

6.1.2 Indoor Air and Crawlspace Air Sampling

One indoor air sample will be collected from near the center of the main floor at each building. Indoor air samples will be collected using individually-certified, stainless-steel 6-Liter (L) Summa canisters. The canisters will be equipped with 24-hour flow controllers at residential properties or 8-hour flow controllers at commercial properties. The canisters will be placed approximately 3 feet above the floor, in the breathing zone for a child. Once a canister is in the appropriate sampling location, the canister will be opened, the starting pressure and time will be recorded using a digital field form, and sample collection will begin. After the sample period has ended, or when the vacuum pressure reaches between 1- and 5-inches mercury, the canister valve will be closed, and the end time and pressure will be recorded using a digital field form. The samples will be submitted under a signed chain-of-custody form to ALS Environmental in Simi Valley, California, for low level analysis of PCE, TCE, and VC via EPA Method TO-15.

For structures with a crawlspace or basement with a dirt floor, an additional sample will be collected by placing a canister on the floor of the crawlspace or basement. If crawlspace vents are present and open, the sampling team will ask the property owner if they can be closed. If a crawlspace meets the criteria to be considered a confined space defined in Title 29 *Code of Federal Regulations* Standard 1910.146, the sampling team will place the canister in the most central location that is accessible without a confined-space permit. The sample will be collected, handled, and analyzed using the same process described above for indoor air samples.

6.1.3 Sub-Slab Soil Gas Sampling

One sub-slab soil gas sample will be collected from buildings with a slab foundation or a basement with a concrete floor. The sub-slab soil gas sample will be collected from a central area without a finished floor covering, when possible. Prior to collecting the sample, a vapor pin sub-slab sampling port will be installed following the manufacturer's SOPs. For slabs that that are at least 3 inches thick, the sampling port will be installed in a flush mount configuration with a stainless-steel cover. For slabs that are less than 3 inches thick, the sampling port will protrude slightly from the slab. In either case, a hole will be drilled through

the slab, and a stainless-steel sampling port surrounded by a single-use silicone sleeve will be inserted into the hole forming an air-tight seal. A batch-certified 6-L Summa canister fitted with a 24-hour or 8-hour flow controller (for residential or commercial structures, respectively) will be connected to the port. After connection, a leak test will be completed by moving air through the sample train while it is enclosed by a helium-filled shroud. The sample train will then be checked with a helium detector to verify an airtight sub-slab port and sample train. The canister will then be opened, the starting pressure and time will be recorded in a digital field form, and sample collection will begin. After the sample period has ended, or when the vacuum pressure reaches between 1- and 5-inches mercury, the canister valve will be closed, and the end time and pressure will be recorded using a digital field form. The samples will be submitted under a signed chain-of-custody form to ALS Environmental in Simi Valley, California, for analysis of PCE, TCE, and VC via EPA Method TO-15. The sub-slab soil gas samples will not have low-level analysis done because the reporting limits for standard EPA Method TO-15 are sufficient to compare the results to the site-specific screening levels discussed in Section 8.0.

6.1.4 Outdoor Ambient Air Sampling

To confirm that no outdoor contamination sources exist near the sampled properties, one outdoor ambient air sample will be collected each day that indoor air samples are collected. Each ambient air sample will be collected using an individually-certified, stainless-steel 6-L Summa canister equipped with a 24-hour flow controller. The ambient air sample will be placed outside in an open, upwind area near the properties being sampled that day. Once placed in an appropriate sampling location, the canister will be opened, the starting pressure and time will be recorded on a digital field form, and sample collection will begin. After 24 hours, or when the vacuum pressure reaches between 1- and 5-inches mercury, the canister valve will be closed, and the end time and pressure will be recorded using a digital field form. The samples will be submitted under a signed chain-of-custody form to ALS Environmental in Simi Valley, California, for analysis of PCE, TCE, and VC via EPA Method TO-15 in Selective Ion Monitoring (SIM) mode.

6.2 SAMPLE NOMENCLATURE

Each sample will be labeled to identify its location. The samples will be labeled with the site name (Pike and Mulberry Streets PCE Plume Superfund Site [PMSS]), sample medium (ambient air [AA], indoor air [IA], crawlspace air [CA], basement air [BA], or sub-slab soil gas [SS]), randomly assigned property identifier (0001), and sampling date (MMDDYY). An example sample ID for an indoor air sample would be PMSS-IA0001-011422 for a Pike and Mulberry Streets PCE Plume Superfund Site sample of indoor air taken at property 0001 on January 14, 2022. Field duplicates will be submitted blind, and the relationship to the parent sample will be noted in the field logbook. Blind duplicates will be named consistently with

the field samples, but the sample description part of the ID will be "DU," the property identifier will be replaced with a two-digit sequential number, and the sample time will be marked as "0000." An example of a duplicate sample ID would be PMSS-DU01-011422 for the first Pike and Mulberry Streets PCE Plume Superfund Site duplicate sample taken on January 14, 2022.

6.3 SAMPLE AND ANALYTICAL METHODS SUMMARY

Table 3 summarizes the estimated total number of samples, including necessary QA/QC samples, for each sample medium and analysis. Table 4 provides a list of analytical methods that will be used by the laboratory, including the types of containers, preservation requirements, and holding times.

TABLE 3
SAMPLE SUMMARY

Analytical Parameter	Matrix	Number of Samples	Number of Field Duplicates	Number of MS/MSDs	Total Number of Samples to Laboratory
VOCs	Outdoor Air	Up to 15	0	0	Up to 15
VOCs	Indoor Air	Up to 150	1 per 10	0	Up to 165
VOCs	Sub-Slab Soil Gas	Up to 150	1 per 10	0	Up to 165

Notes:
MS/MSD = Matrix Spike/Matrix Spike Duplicate
VOC = Volatile organic compound

TABLE 4
ANALYTICAL METHODS

Matrix	Parameter	Analytical Method	Volumes and Containers	Preservation	Holding Time[1]
Indoor Air	VOCs	TO-15 SIM	One individually-certified 6-liter Summa canister	NA	30 days
Outdoor Ambient Air	Low-Level VOCs	TO-15	One individually-certified 6-liter Summa canister	NA	30 days
Sub-Slab Soil Gas	VOCs	TO-15	One batch-certified 6-liter Summa canister	NA	30 days

Notes:
[1] Holding time is measured from the time of sample collection to the time of sample extraction and analysis.
NA = Not applicable
VOC = Volatile organic compound

7.0 SAMPLE HANDLING

Sampling locations will be noted in the site logbook in accordance with Tetra Tech SOP No. 024, "Recording Notes in Field Logbooks" and using digital field forms (Appendix B). The collected samples will be labeled, packaged, and shipped in accordance with the procedures outlined in Tetra Tech SOP No. 019, "Packaging and Shipping Samples" (Appendix B).

8.0 DATA QUALITY OBJECTIVES

The purpose for collecting the samples described in this SAP is to identify buildings with a complete vapor intrusion pathway or sub-slab soil gas that presents a potential threat of vapor intrusion in the future. To accomplish this, sample results will be compared to EPA Vapor Intrusion Screening Levels (VISL) calculated using a hazard quotient of 1 and a target cancer risk of 10^{-5} (EPA 2021b). Indoor air sample results, including crawlspace and basement air sample results, will be compared to indoor air VISLs. Sub-slab sample results will be compared to sub-slab and exterior soil gas VISLs. Outdoor ambient air samples will be qualitatively evaluated to determine if ambient air could have impacted indoor air sample results. To ensure that data quality objectives are met, data generated during the investigation will be handled according to the site-specific Data Management Plan (Tetra Tech 2021).

9.0 QUALITY ASSURANCE/QUALITY CONTROL

QC samples will be collected to evaluate the field sampling methods and the overall reproducibility of the laboratory analytical results. Specifically, field duplicate samples will be collected at a frequency of one per 10 investigative samples (or one per sampling event, if fewer than 10 investigative samples are collected during the event). Each field duplicate sample will be collected from the same location from which START collected the initial investigative sample. The field duplicate samples will be processed, stored, packaged, and analyzed by the same methods as the investigative samples. Matrix Spike/Matrix Spike Duplicate (MS/MSD) samples are not collected with air samples analyzed via EPA Method TO-15 (Tetra Tech 2020). The sample nomenclature, specific to the QC samples, is described in Section 6.2 of this SAP.

START chemists will conduct stage three data validation laboratory results for PCE, TCE, and VC in accordance with the START QAPP (Tetra Tech 2020). Corrective actions may include resampling, reassessment of the laboratory's methods, or the addition of data qualifiers to the laboratory results.

The START project manager will be responsible for ensuring that sample quality and integrity are maintained, and that sample labeling and documentation procedures are in accordance with the START QAPP (Tetra Tech 2020).

10.0 DECONTAMINATION

START will use dedicated and disposable sampling equipment during the collection of the samples. The used disposable sampling equipment and personal protective equipment (PPE) will be double-bagged and disposed of as dry industrial waste.

11.0 REFERENCES

Astbury Environmental Engineering, Inc. (AEE). 2008. “Closure Report.” December.

Indiana Department of Environmental Management (IDEM). 2004. “Preliminary Assessment/Site Inspection Report, Master Wear.” September.

IDEM. 2011. Office of Land Quality, Site Investigation Section. “Reassessment Report.” January.

Tetra Tech, Inc. (Tetra Tech). 2020. “Quality Assurance Project Plan, Superfund Technical Assessment and Response Team (START V), Revision 2.” August.

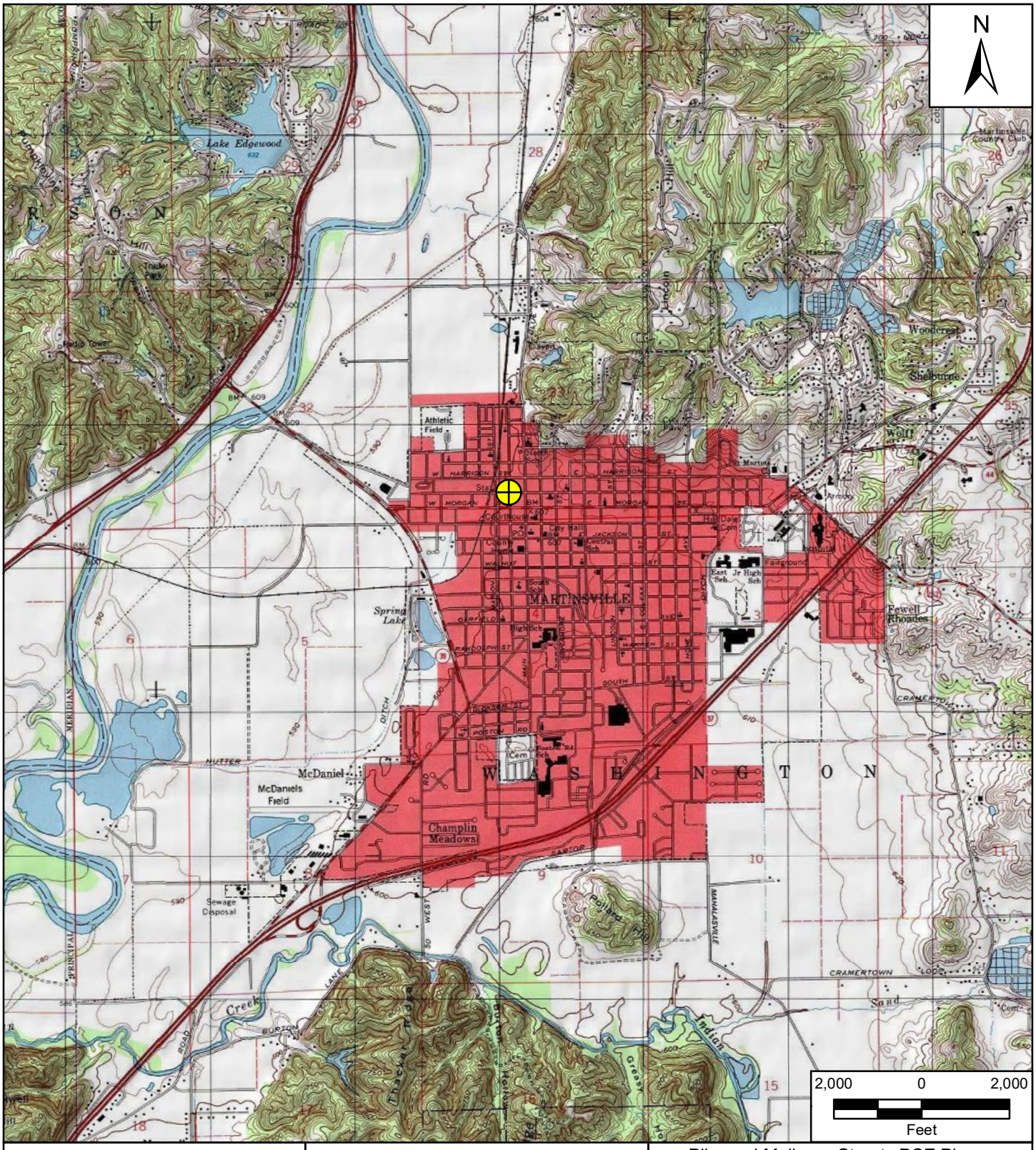
Tetra Tech. 2021. “Site-Specific Data Management Plan, Revision 0.” October 22.

U.S. Environmental Protection Agency (EPA). 2021a. “Record of Decision - Pike and Mulberry Streets PCE Plume Superfund Site.” March 11.

EPA. 2021b. “Vapor Intrusion Screening Level Calculator.” November 17.

APPENDIX A
FIGURES

Figure 1 – Site Location Map
Figure 2 – Site Layout Map



Reference Map

Legend

⊕ Approximate Site Center

Source: USGS 7.5-Minute Topographic Quadrangle Map: Martinsville Quadrangle 1991

Pike and Mulberry Streets PCE Plume
Superfund Site
Martinsville, Morgan County, Indiana

Figure 1
Site Location Map

TETRA TECH

Prepared For: USEPA	Prepared By: Tetra Tech Inc.

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Date Saved: 10/8/2021 EPA Contract No.: 68HE0519D0005 Task Order No.: 68HE0521F0115

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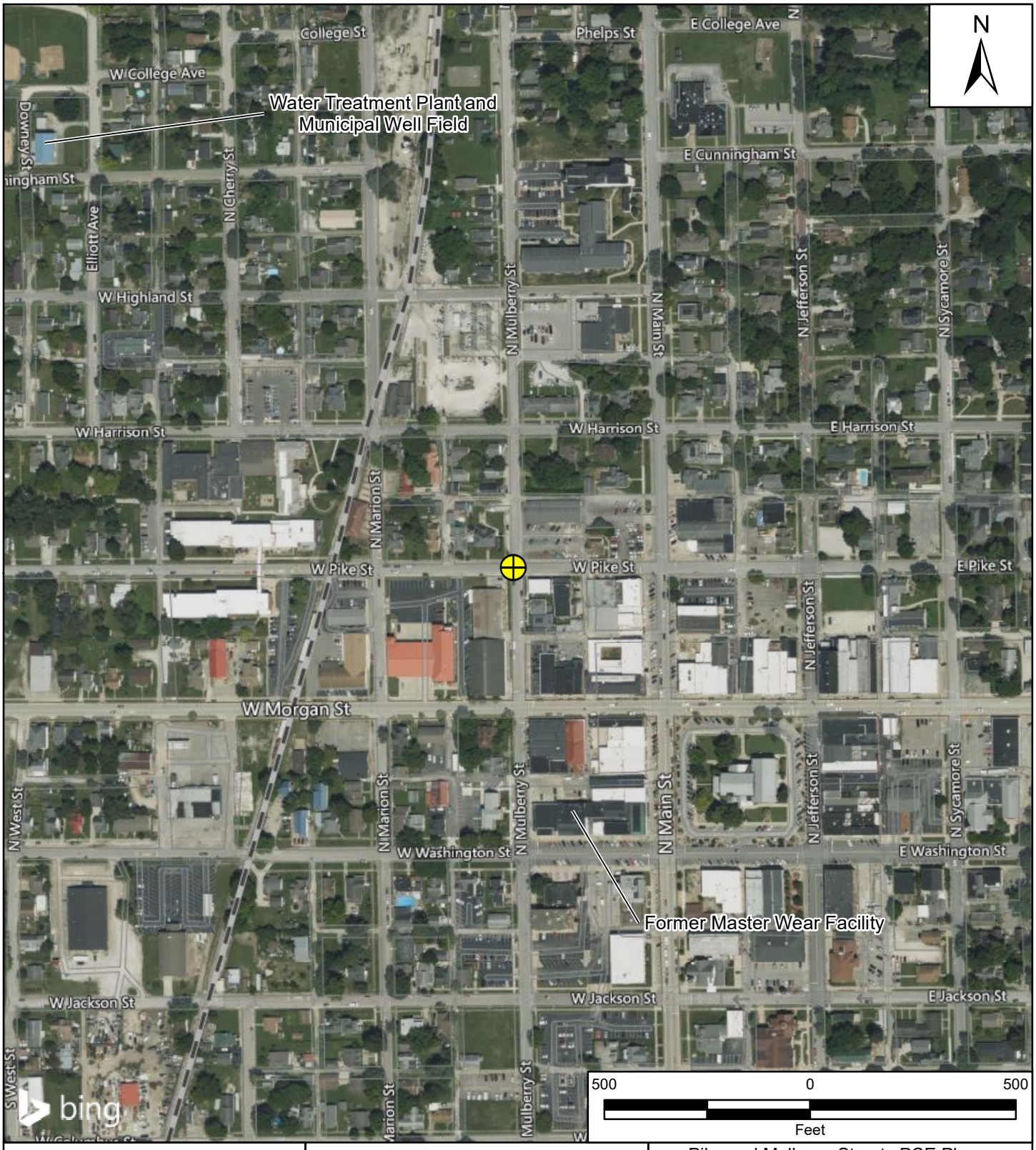


Reference Map

Legend

⊕ Approximate Site Center

Pike and Mulberry Streets PCE Plume
Superfund Site
Martinsville, Morgan County, Indiana

Figure 2
Site Layout Map

TETRA TECH

Prepared For: USEPA	Prepared By: Tetra Tech Inc.

File Path: G:\G\G9031-START V\Indiana\Pike and Mulberry 2022\mxd\Fig2-SiteLayout.mxd

Date Saved: 11/23/2021 EPA Contract No.: 68HE0519D0005 Task Order No.: 68HE0521F0115

Coordinate System: GCS WGS 1984
Datum: WGS 1984
Units: Degree

APPENDIX B
STANDARD OPERATING PROCEDURES

Tetra Tech SOP 019-8: Packaging and Shipping Samples
Tetra Tech SOP 024-3: Recording Notes in Field Logbooks

SOP APPROVAL FORM

TETRA TECH, INC.

EMI OPERATING UNIT

ENVIRONMENTAL STANDARD OPERATING PROCEDURE

PACKAGING AND SHIPPING SAMPLES

SOP NO. 019

REVISION NO. 8

Last Reviewed: August 2020

Quality Assurance Approved

August 11, 2020

Date

1.0 BACKGROUND

In any sampling program, the integrity of a sample must be ensured from its point of collection to its final disposition. This standard operating procedure (SOP) describes procedures for packaging and shipping samples. Steps in the procedures should be followed to ensure sample integrity and to protect the welfare of persons involved in shipping and receiving samples.

1.1 PURPOSE

This SOP establishes the requirements and procedures for packaging and shipping nonhazardous environmental samples. It has been prepared in accordance with the U.S. Environmental Protection Agency (EPA) "Contract Laboratory Program Guidance for Field Samplers." Procedures described in this SOP should be followed for all routine sample packaging and shipping of nonhazardous samples. If procedures are to be modified for particular contract- or laboratory-specific requirements, modified procedures should be clearly described in site-specific plans such as work plans, field sampling plans (FSP), or quality assurance project plans (QAPP). Deviations from the procedures in this SOP must be documented in a field logbook. This SOP assumes that samples are already in the appropriate sample jars and that the sample jars are labeled.

This SOP does not cover the packaging and shipment of Dangerous Goods or Hazardous Materials. The shipment of Dangerous Goods (by air) and Hazardous Materials (by ground) requires specialized training. If you have NOT received this training in the last 2 years, you are NOT qualified to package or ship these materials and may be personally liable for any damages or fines. Contact one of Tetra Tech's shipping experts for assistance. Instructions to access the training course, shipping experts, and health and safety (H&S) contacts, and general information on packaging and shipping hazardous substances and dangerous goods can be obtained by checking the links provided in Section 1.4 (References) and communicating with appropriate Tetra Tech H&S contacts listed on the EMI Operating unit internal H&S web site.

1.2 SCOPE

This SOP applies to packaging and shipping of environmental and nonhazardous samples. This SOP does not address shipping dangerous goods or hazardous materials.

1.3 DEFINITIONS

Airbill: An airbill is a shipping form (such as a FedEx shipping form) acquired from the commercial shipper and is used to document shipment of the samples from the sampler to the designated analytical laboratory (see Figure 1).

Blank: A blank is any sample that is used to assess cross-contamination from sampling and sample management procedures. A typical blank sample will consist of distilled or deionized (DI) water (water sampling) or an air filter cartridge (air sampling) that is then analyzed by the laboratory to evaluate whether cross-contamination has been introduced. Each blank is assigned its own unique sample number. Blanks collected in the field include trip blanks, field blanks, and equipment blanks, all intended to assess potential cross-contamination. For example, a trip blank checks for contamination during sample handling, storage, and shipment from the field to the laboratory. Field blanks assess the contamination of water or soil from ambient air. Equipment blanks (also known as rinse blanks) assess contamination from incomplete decontamination procedures.

Chain-of-Custody form: A chain-of-custody form is used to document the transfer of custody of samples from the field to the designated analytical laboratory (see Figure 2). The chain-of-custody form is critical to the chain-of-custody process and is used to identify the samples in each shipping container to be shipped or delivered to the laboratory for chemical or physical (geotechnical) analysis. A copy of the chain-of-custody form is shipped with the samples and accompanies them from sampler to laboratory (see Figure 3).

Custody seal: A custody seal is a tape-like seal and is used to indicate that samples are intact and have not been disturbed during shipping or transport after the samples have been released from the sampler to the shipper (see Figure 4). The custody seal is part of the chain-of-custody process and is used to prevent tampering with samples after they have been packaged for shipping (see Figure 5).

Environmental samples: Environmental samples include drinking water, groundwater, surface water, soil, sediment, treated municipal and industrial wastewater effluent, indoor and ambient air, nonhazardous bulk materials, soil gas, dust, asbestos, and biological specimens. Environmental samples typically contain low concentrations of contaminants and, when handled, require only limited precautionary procedures.

Nonhazardous samples: Nonhazardous samples are those samples that do not meet the definition of a hazardous sample AND do not need to be packaged and shipped in accordance with the International Air Travel Association's (IATA) "Dangerous Goods Regulations" (DGR) or U.S. Department of Transportation's "Hazardous Materials Regulations" defined in Title 49 *Code of Federal Regulations* (CFR).

The following definitions are provided to further distinguish environmental and nonhazardous samples from dangerous goods and hazardous samples:

Dangerous goods: Dangerous goods are articles or substances that can pose a significant risk to health, safety, or property when transported by air; they are classified as defined in Section 3 of the DGR (IATA 2020).

Hazardous samples: Hazardous samples include dangerous goods and hazardous substances. Hazardous samples shipped by air should be packaged and labeled in accordance with procedures specified by the DGR; ground shipments should be packaged and labeled in accordance with the Hazardous Material Regulations.

Hazardous substance: A hazardous substance is any material, including its mixtures and solutions, that is listed in 49 CFR 172.101 and its quantity, in one package, equals or exceeds the reportable quantity listed in Table 1 to Appendix A of 49 CFR 172.101.

1.4 REFERENCES

General Awareness, H&S Contacts, and Course Training Information (Tetra Tech, Inc., EMI Operating Unit. Intranet) On-line address: https://int.tetratech.com/sites/EMI/hs/Pages/Dangerous-Goods-Shipping.aspx

International Air Transport Association (IATA). 2020. "Dangerous Goods Regulations. 2020." For sale at: https://www.iata.org/en/publications/dgr/. Updated annually, with new edition available late in year.

U.S. Environmental Protection Agency (EPA). 40 CFR, 763 Subpart F, Asbestos Hazards Emergency Response Act (AHERA).

EPA. 2014. "Contract Laboratory Program Guidance for Field Samplers." EPA 540-R-014-013. October. On-line address: https://www.epa.gov/sites/production/files/2015-03/documents/samplers_guide.pdf.

EPA. 2020. "Packing, Marking, Labeling and Shipping of Environmental and Waste Samples." EPA Region 4, LSASDPROC-209-R4. February 23. On-line address: https://www.epa.gov/sites/production/files/2015-06/documents/Shipping-Environmental-and-Waste-Samples.pdf

1.5 REQUIREMENTS AND RESOURCES

The procedures for packaging and shipping samples require the following:

- Coolers (insulated ice chest) or other shipping containers appropriate to sample type
- Ice
- Bubble wrap or similar cushioning material
- Chain-of-custody forms and seals
- Airbills

- Resealable plastic bags for sample jars and ice
- Tape (strapping and clear)
- Large plastic garbage bags for lining the cooler
- Temperature blank sample bottle filled with distilled water can be included in the cooler if appropriate to sample type
- Trip blank samples used to check for volatile contamination during sample handling in the field should accompany sample containers during shipment from laboratory to field (empty containers) and from field to laboratory (filled containers). It should remain in the cooler with sample containers during the sampling event. Trip blanks should be requested from the laboratory when containers are initially ordered.

2.0 PROCEDURES

The following procedures apply to packaging and shipping nonhazardous and environmental samples.

2.1 PACKAGING SAMPLES

After they have been appropriately containerized and labeled, environmental samples should be packaged as described in this section. This section covers procedures for packing samples for delivery by commercial carrier (air or ground) and hand delivery of environmental samples (by employee or courier), as well as shipping asbestos and air quality samples. Note that these instructions are general; samplers also should be aware of client-specific requirements concerning the placement of custody seals or other packaging provisions.

2.1.1 Packaging Samples for Delivery by Commercial Carrier (Air or Ground)

Samples shipped by commercial carriers should be packed for shipment using the following procedures and in compliance with all carrier requirements:

Preparing the sample:

1. Allow a small amount of headspace in all bottles, or as instructed by the laboratory (except volatile organic compound [VOC] containers with a septum seal) to compensate for any changes in pressure and temperature during transfer.
2. Be sure the lids on all bottles are tight (will not leak). Lids maybe taped or sealed with custody seals as added protection or as required. For any sample containers that are not marked with a tare weight by the laboratory, cover the completed sample label on the container with clear tape to protect the label.
3. Place sample containers in resealable plastic bags.

Preparing the cooler:

1. Secure and tape the drain plug of the cooler with fiber or duct tape.
2. Line the cooler with a large plastic garbage bag before samples, ice, and absorbent packing material are placed in the cooler.
3. Wrap the sample containers in bubble wrap or line the cooler (bottom and sides) with a cushioning material to prevent breakage of bottles or jars during shipment.
4. If required by the laboratory for the analytical method, add a sufficient quantity of ice to the cooler to cool samples to 4 °C (± 2 °C). Ice should be double bagged in resealable plastic bags to prevent the melted ice from leaking out. If required, include one temperature blank (a sample bottle filled with distilled water) per cooler.

5. For VOC samples only, include one trip blank for VOC analysis per shipment matrix in each cooler.

6. Fill all remaining space between the bottles or jars with bubble wrap.

7. As each container is placed in the cooler, verify the sample information on the chain-of-custody form. The samples listed on the chain-of-custody form must match exactly with the contents of the cooler.

8. Securely fasten the top of the large garbage bag with tape (preferably plastic electrical tape).

9. If more than one cooler is being shipped, mark each cooler as “1 of 2,” “2 of 2,” and so forth.

10. Place the chain-of-custody forms (see Figure 2) into a resealable plastic bag, and tape the bag to the inner side of the cooler lid (see Figure 3). If you are shipping more than one cooler, copy the chain-of-custody form so that there is one copy of all forms in each cooler. The samples listed on the chain-of-custody form must match exactly with the contents of the cooler. Tape any instructions for returning the cooler to the inside of the lid.

11. Close the lid of the cooler and tape it shut by wrapping strapping tape around both ends and hinges of the cooler at least once.

12. Place two signed custody seals (see Figure 4) on opposite sides of the cooler, ensuring that each one covers the cooler lid and side of the cooler (see Figure 5; note that in contrast to the figure, the seals should be placed on the opposite sides of the cooler and offset from each other, rather than directly across from each other as shown in Figure 5). Place clear plastic tape over the custody seals so that the cooler cannot be opened without breaking the seal.

13. Shipping containers should be marked "THIS END UP.” Arrow labels, which indicate the proper upward position of the container, may also be affixed to the container. As appropriate, the containers should also be labeled for Saturday delivery or other special requirements.

14. Ship samples overnight using a commercial carrier such as FedEx. As a best practice, electronic sample shipping labels should be prepared by the shipping agency’s employees, at the direction of Tetra Tech employees or sampling personnel. This allows the sampling personnel to confirm special shipping requirements, such as Saturday delivery, and verify that samples will be shipped that day (that is, the last shipment of the day has not already occurred). If this is not possible, the airbill can be prepared by hand (see Figure 1), but samples should still be handed over directly to shipping agency employees and shipping details should be verified. The shipping label should be placed on the outside of the container.

15. A copy of the receipt with sample tracking number should be retained by the sampling personnel and delivery should be verified the next day.

2.1.2 Hand Delivery of Environmental Samples (by Employee or Courier)

Samples hand-delivered to the laboratory should be packed for shipment using the following procedures:

Preparing the sample:

1. Bottles can be filled completely with sample (required for VOC containers with a septum seal).

2. Be sure the lids on all bottles are tight (will not leak).

Preparing the cooler:

1. Secure and tape the drain plug of the cooler with fiber or duct tape.

2. Wrap the sample containers in bubble wrap or line the cooler (bottom and sides) with a cushioning material to prevent breakage of bottles or jars during shipment.

3. As each container is placed in the cooler, verify the sample information on the chain-of-custody form. The samples listed on the chain-of-custody form must match exactly with the contents of the cooler.

4. If required for by the laboratory for the analytical method, add a sufficient quantity of ice to the cooler to cool samples to 4 °C. Ice should be double bagged in resealable plastic bags to prevent the melted ice from leaking out. If required, include one temperature blank (a sample bottle filled with distilled water) per cooler.

5. For VOC samples only, include one trip blank for VOC analysis per shipment matrix in each cooler.

6. If more than one cooler is being shipped, mark each cooler as "1 of 2," "2 of 2," and so forth.

7. Place the chain-of-custody form (see Figure 2) in a resealable plastic bag and tape to the inside of the cooler lid (see Figure 3), close the lid, and seal with custody seals (see Figure 5; note that in contrast to the figure, the seals should be placed on the opposite sides of the cooler and offset from each other, rather than directly across from each other as shown in Figure 5). Place clear plastic tape over the custody seals so that the cooler cannot be opened without breaking the seal. Transfer the cooler to the courier. When samples will be delivered directly to the laboratory, it is sufficient to close the cooler and hand-deliver it with the chain-of-custody form.

8. Include any instructions for returning the cooler to the inside of the lid.

9. If the cooler is being transferred to a courier, the shipping containers should be marked "THIS END UP," and arrow labels, which indicate the proper upward position of the container should be affixed to the container.

2.1.3 Shipping Asbestos Samples

Asbestos samples shipped by commercial carriers should be packed for shipment using the following procedures and in compliance with all carrier requirements:

1. Place each asbestos sample in a small resealable plastic bag or Whirl-pak sealable bag. Seal the bags carefully and place the sample bags in a larger resealable plastic bag.

2. Select a rigid shipping container and pack the samples upright in a noncontaminating, nonfibrous medium such as a bubble pack to minimize excessive movement during shipping.

3. Avoid using expanded polystyrene because of its static charge potential. Also avoid using particle-based packaging materials because of possible contamination.

4. Affix custody seals to the samples or outer sample bag so that the bags cannot be opened without breaking the seal.

5. Insert the chain-of-custody form in the box. Include a shipping bill and a detailed listing of samples shipped, their descriptions and all identifying numbers or marks, sampling data, shipper's name, and contact information.

6. Ship bulk samples in a separate container from air samples. Bulk samples and air samples delivered to the analytical laboratory in the same container will be rejected.

7. For each sample set, designate which are the ambient samples, which are the abatement area samples, which are the field blanks, and which is the sealed blank if sequential analysis is to be performed.

8. Hand-carry samples to the laboratory in an upright position if possible; otherwise, choose that mode of transportation least likely to shake the samples in transit.

9. Address the package to the laboratory sample coordinator by name when known and alert him or her of the package description, shipment mode, and anticipated arrival as part of the chain-of-custody and sample tracking procedures. This information will also help the laboratory schedule timely analysis for the samples when they are received.

2.1.4 Shipping Air Samples

Packaging and shipping requirements for air samples vary depending on the media used to collect the samples and the analyses required. Sampling media typically include Summa canisters and Tedlar bags for whole air samples, filters for metals and particulate matter, and sorbent tubes for organic contaminants. This section of the SOP provides general guidelines for packaging and shipping air samples collected using these media. The project FSP or QAPP should also be reviewed for any additional project-specific requirements or instructions.

Summa Canister Samples

1. Close the canister valve by tightening the knob clockwise or flipping the toggle switch. Replace the brass cap on the canister inlet.

2. If a flow controller was used to collect the air sample over a specified time interval, the flow controller should be removed before replacing the brass cap.

3. Fill out the sample tag on the canister with the sample number and the date and time of collection. Include the identification number of the flow controller on the sample tag if one was used. Make sure the information on the sample tag matches the chain-of-custody form.

4. Complete the chain-of-custody form. In addition to the information normally included, the form should include the following data: sample start and stop dates and times; initial and final Summa canister vacuum readings; Summa canister identification number; and flow controller identification number.

5. Package the Summa canister (and flow controller) in its original shipping box with the original packaging material. Tape the box shut and apply custody seals if required. Note: Summa canisters should never be packaged with ice.

6. Summa canister shipments typically include several canisters, and may include more than one shipping box. The chain-of-custody form for the shipment should be sealed within one of the shipping boxes. If more than one box is being shipped, mark each box as "1 of 2," "2 of 2," and so forth.

7. Ship the samples by a method that will meet the holding time. Summa canister samples should be analyzed within 30 days of sample collection.

Tedlar Bag Samples

1. Before removing it from the sample port, close the Tedlar bag by tightening the valve clockwise. The bag should only be approximately half-full to allow for pressure changes during shipping and handling of the sample. Keep the Tedlar bag out of direct sunlight to preserve the sample.

2. Fill out the label on the bag with the sample number and the date and time of sample collection. Make sure the information on the label matches the chain-of-custody form.

3. Complete the chain-of-custody form.

4. Package the Tedlar bag in a shipping box with appropriate packing material to prevent the bag from being punctured or damaged. Multiple bags can be packaged in the same box. Tape the box shut and apply custody seals if required. Note: Tedlar bag samples should not be cooled or packaged with ice, although they can be shipped in an ice chest to protect the samples.

5. Tedlar bag shipments may include more than one shipping box. The chain-of-custody form for the shipment should be sealed within one of the shipping boxes. If more than one box is being shipped, mark each box as "1 of 2," "2 of 2," and so forth.

6. Ship the samples using priority overnight delivery. Tedlar bag samples should be analyzed within 3 days of sample collection.

Filter Cassette Samples

1. Disconnect the filter cassette from the air sampling pump and replace the plastic caps on the inlet and outlet openings.

2. Attach a label to the sample that includes the sample number and the date and time of sample collection. Make sure the information on the label matches the chain-of-custody form.

3. Complete the chain-of-custody form. In addition to the information normally included, the form should include the following data: sample start and stop dates and times; initial and final air flow rates (or average flow rate); volume of air sampled; and sampling pump identification number.

4. Package the filter cassettes in a shipping box (such as a FedEx box). Use an appropriate packing material (such as bubble wrap) to separate the samples and prevent damage.

5. Place the chain-of-custody form within the box, seal the box, and apply custody seals if required. Filter cassette samples typically do not need to be cooled, but check the field sampling plan (FSP) or Quality Assurance Project Plan (QAPP) for project-specific requirements.

6. Ship the samples by a method that will meet the holding time.

Sorbent Tube Samples

1. Disconnect the sample tube from the air sampling pump and seal both ends of the tube with plastic caps.

2. Complete a sample label that includes the sample number and the date and time of sample collection. Make sure the information on the label matches the chain-of-custody form.

3. If the tube is small and the label cannot be attached to the tube, the tube can be placed in a small resealable plastic bag and the label can be attached to the bag or placed inside the bag with the tube.

4. Complete the chain-of-custody form. In addition to the information normally included, the form should include the following data: sample start and stop dates and times; initial and final air flow rates (or average flow rate); volume of air sampled; and sampling pump identification number.

5. Packaging requirements for the sample tubes will depend on the analysis required, and the sampler should check the FSP or QAPP for project-specific requirements (for example, tubes may need to be wrapped in aluminum foil to prevent exposure to light). Packaging containers and methods include (1) shipping boxes (as described under filter cassette samples), (2) small sample coolers filled with double-bagged ice, and (3) small sample coolers filled with blue (reusable) ice.

6. Place the chain-of-custody form within the box or container, seal the box or container, and apply a custody seal if required.

7. If coolers are used for shipping, tape instructions for returning the cooler to the inside of the lid.

8. Ship the samples by a method that will meet the holding time.

Polyurethane Foam (PUF) Tube Samples

1. Disconnect the PUF tube from the air sampling pump and wrap the tube in aluminum foil.

2. Attach a label to the wrapped sample tube that includes the sample number and the date and time of sample collection. Make sure the information on the label matches the chain-of-custody form.

3. Wrap the PUF tube in bubble wrap and place the tube in a glass shipping jar.

4. Complete the chain-of-custody form. In addition to the information normally included, the form should include the following data: sample start and stop dates and times; initial and final air flow rates (or average flow rate); volume of air sampled; and sampling pump identification number.

5. Package the PUF tube jars in a cooler that is filled with double-bagged ice. Use bubble wrap or other cushioning material to separate the samples and prevent breakage.

6. Place the chain-of-custody form within the cooler, seal the cooler, and apply a custody seal if required.

7. If coolers are used for shipping, tape instructions for returning the cooler to the inside of the lid.

8. Ship the samples by a method that will meet the holding time. Samples collected in PUF tubes typically must be extracted within 7 days of collection.

2.2 SHIPPING DOCUMENTATION FOR SAMPLES

Airbills, chain-of-custody forms, and custody seals must be completed for each shipment of nonhazardous environmental samples.

Field staff collecting samples should also review their field work plans to confirm what documentation must be completed during each sampling event, including client-specific requirements. For example, some EPA programs have a specific requirement to use Scribe software, an environmental data management system, to create sample documentation, electronically input information into Traffic Report or chain-of-custody forms, and enter other data.

- The Scribe software can be accessed from the EPA Environmental Response Team (ERT) at the following address: http://www.ertsupport.org/scribe_home.htm
- The ERT User Manual for Scribe, reference, and training materials can be accessed from the Scribe Support Web site at the following address: http://www.epaosc.org/scribe

Note that some laboratories must routinely return sample shipping coolers within 14 calendar days after the shipment has been received. Therefore, the sampler should also include instructions for returning the cooler with each shipment, when possible. The sampler (not the laboratory) is responsible for paying for return of the cooler and should include shipping airbills bearing the sampler's shipping account number, as well as a return address to allow for return of the cooler. Samplers should use the least expensive option possible for returning coolers.

2.3 SHIPMENT DELIVERY AND NOTIFICATION

A member of the field sampling team must contact the laboratory to confirm it accepts deliveries on any given day, especially Saturdays. In addition, samplers should ensure the laboratory has been notified in advance of the pending shipment and notify any additional parties as required. The sampler needs to know the laboratory's contact name, address, and telephone number and be aware of the laboratory's requirements for receiving samples.

In addition, samplers should be aware of the sample holding times, shipping company's hours of operation, shipping schedule, and pick-up and drop-off requirements to avoid delays in analytical testing.

Priority Overnight Delivery

Priority overnight delivery is typically the best method for shipment. Delays caused by longer shipment times may cause the sample temperature to rise above the acceptable range of 4° C (± 2 ° C) and technical holding time may expire, which in turn may compromise sample integrity and require recollection of

samples. If sample delivery procedures are to be modified for particular contract- or laboratory-specific requirements, the procedures should be clearly described in site-specific plans such as work plans, FSPs, or QAPPs.

Saturday Delivery

If planning to ship samples for Saturday delivery, the laboratory must be contacted in advance to confirm it will accept deliveries on Saturdays or arrange for them to be accepted. In addition, samplers should ensure the laboratory has been notified in advance of the pending shipment and notify any additional parties as required.

2.4 HEALTH AND SAFETY CONSIDERATIONS

In addition to the procedures outlined in this SOP, all field staff must be aware of and follow the health and safety practices that result from the Activity Hazard Analyses (AHA) for the project. The AHAs include critical safety procedures, required controls, and minimum personal protective equipment necessary to address potential hazards. The hazards specific to project tasks must be identified and controlled to the extent practicable and communicated to all project personnel via the approved, project-specific health and safety plan (HASP).

3.0 POTENTIAL PROBLEMS

The following potential problems may occur during sample shipment:

- Leaking package. If a package leaks (either from broken sample containers or melting ice), the carrier may open the package and return the package. Special care should be taken during sample packaging to minimize potential leaks.

- Improper labeling and marking of package. If mistakes are made in labeling and marking the package, the carrier will most likely notice the mistakes and return the package to the shipper, thus delaying sample shipment. A good practice is to have labels, forms, and container markings double checked by a member of the field team.

- Bulk samples and air samples delivered to the analytical laboratory in the same container. If samples are combined in this way, they will be rejected. Always ship bulk samples in separate containers from air samples.

- Issues in packing asbestos samples. When asbestos samples are shipped, avoid using expanded polystyrene because of its static charge potential. Also avoid using particle-based packaging materials with asbestos samples because of possible contamination.

- Improper, misspelled, or missing information on the shipper's declaration. The carrier will most likely notice these errors as well and return the package to the shipper. A good practice is to have another field team member double check this information.

- Missed drop off time or wrong location. Missing the drop off time or having the wrong location identified for drop off will delay delivery to the laboratory and may cause technical holding times to expire. Establish the time requirements in advance of completing the field effort and be sure and provide some contingency time for potential delays such as traffic or checking and redoing paperwork.

- Incorrectly packaging samples for analysis at multiple laboratories. For example, inorganic samples may be shipped to one laboratory for analysis, while organic samples may need to be shipped to another laboratory. All field staff should be aware which samples are to be shipped to which laboratory when they package samples for multiple types of analysis.

- Holidays or weather-related delays. Be aware of holidays and weather forecasts that could cause delays in delivery. Delays caused by longer shipping times may cause technical holding times to expire, which in turn may compromise sample integrity or require recollection of samples.

- Not noting field variances in field logbook. Field variances should be noted in the field logbook and the project manager notified. Common field variances include:

    - Less sample volume collected than planned. Notify appropriate staff and the laboratory to ensure there is an adequate amount for analysis.

    - Sample collected into incorrect jar because of broken or missing bottle-ware. Notify appropriate laboratory staff to ensure there is no confusion regarding the analysis of the sample.

FIGURE 1

EXAMPLE OF A FEDEX US AIRBILL FOR LOW-LEVEL ENVIRONMENTAL SAMPLES

Filling Out the FedEx US Airbill

- The sender *must complete* the following fields on the pre-printed airbill:
  - Section 1: Date
  - Section 1: Sender's FedEx Account Number (available from your office administrator)
  - Section 1: Sender's Name, Company, Address, and Phone Number
  - Section 2: Internal Billing Reference (Project Number) (this field may not be present on newer airbills)
  - Section 3: Recipient's Name, Company, Address, and Phone Number
  - Section 4: Express Package or Freight Services (Priority Overnight)
  - Section 5: Packaging (usually "Other," your own packaging)
  - Section 6: Special Handling (Saturday delivery if prearranged with receiving laboratory; "No" dangerous goods contained in shipment)
  - Section 7: Payment ("Bill to Sender")
  - Section 7: Total Number of Packages
  - Section 7: Total Weight (completed by FedEx employee)
  - Section 8: Delivery Signature Options ("No Signature Required")

Completing a Sample Chain-of-Custody Form (See Also Section 2.2 on SCRIBE for Forms)

After samples have been collected, they will be maintained under chain-of-custody procedures. These procedures are used to document the transfer of custody of the samples from the field to the designated

analytical laboratory. The same chain-of-custody procedures will be used for the transfer of samples from one laboratory to another, if required.

The field sampling personnel will complete a Chain-of-Custody and Request for Analysis (CC/RA) form for each separate container of samples to be shipped or delivered to the laboratory for chemical or physical (geotechnical) analysis. These forms are often triplicate, carbonless forms. Care should be taken when completing the form that all copies are legible—PRESS FIRMLY WHEN WRITING. Information on the form will include:

1. Project identification (ID) (for example, contract and task order number);
2. Project Contract Task Order (CTO) number;
3. Laboratory Project Order (PO) number;
4. Tetra Tech Technical Contact;
5. Tetra Tech Project Manager;
6. Laboratory name;
7. Field sampler names;
8. Field sampler signature;
9. Sample ID;
10. Date and time of sampling;
11. Sample matrix type;
12. Sample preservation method; note “NONE” if no preservatives;
13. Number and types of containers per sample;
14. Sample hazards (if any);
15. Requested analysis;
16. Requested sample turnaround time or any special remarks (for example, possible presence of free product or high screening concentrations);
17. Page __ of __;
18. Method of shipment;
19. Carrier/waybill number (if any);
20. Signature, name, and company of the person relinquishing the samples and the person receiving the samples when custody is transferred;

21. Date and time of sample custody transfer;

22. Condition of samples when they are received by the laboratory.

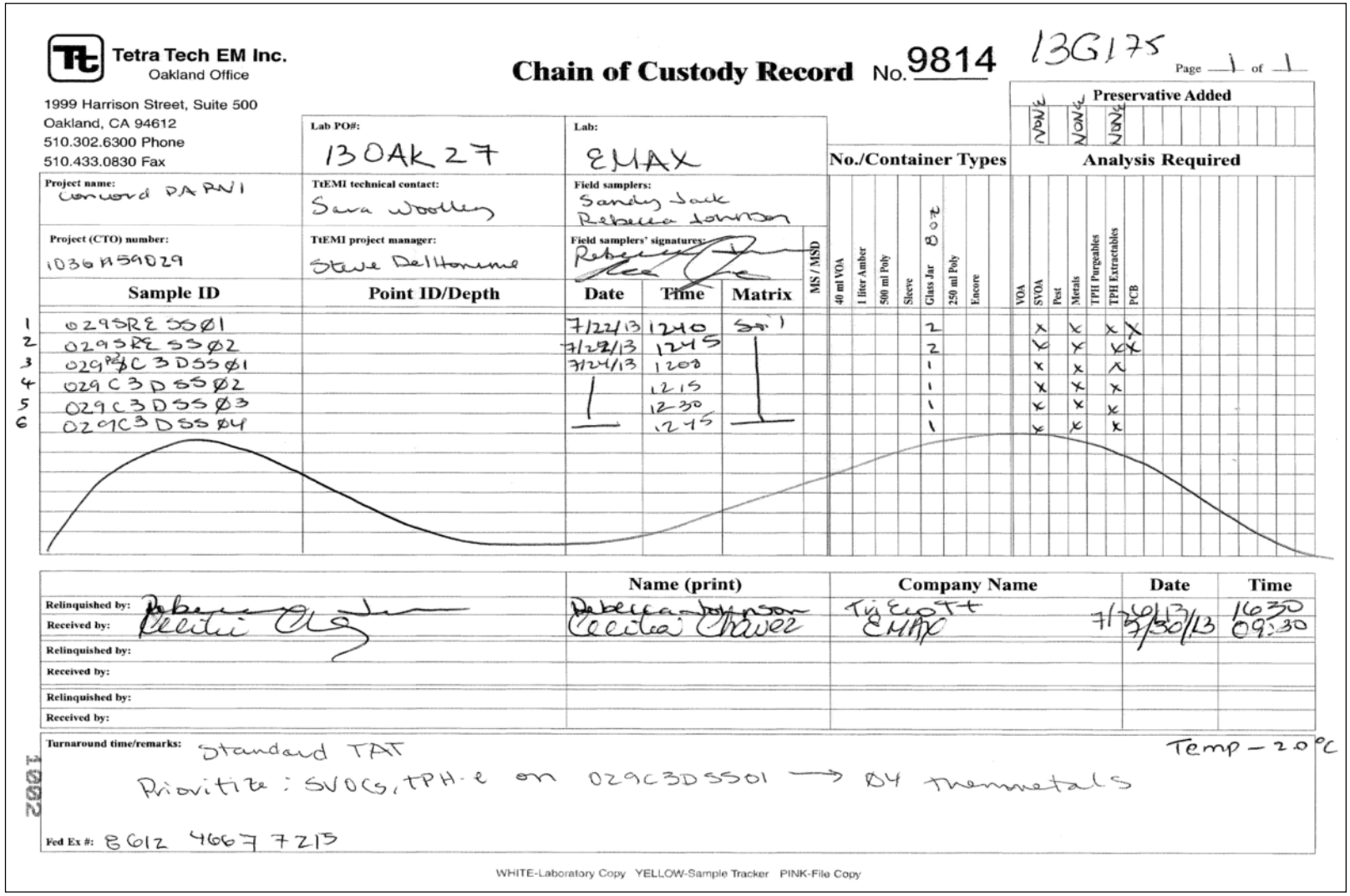
The sample collector will cross out any blank space on the CC/RA form below the last sample number listed on the part of the form where samples are listed.

The sampling personnel whose signature appears on the CC/RA form is responsible for the custody of a sample from time the sample is collected until the custody of the sample is transferred to a designated laboratory, a courier, or to another Tetra Tech employee for transporting a sample to the designated laboratory. A sample is considered to be in custody when the custodian: (1) has direct possession of it; (2) has plain view of it; or (3) has securely locked it in a restricted access area.

Custody is transferred when both parties to the transfer complete the portion of the CC/RA form under "Relinquished by" and "Received by" or a sample is left at a FedEx facility pending shipment. Signatures, printed names, company names, and date and time of custody transfer are required. When custody is transferred, the Tetra Tech sampling personnel who relinquished the samples will retain the third sheet (pink copy) of the CC/RA form. When the samples are shipped by a common carrier, a Bill of Lading supplied by the carrier will be used to document the sample custody, and its identification number will be entered on the CC/RA form. Receipts of Bills of Lading will be retained as part of the permanent documentation in the Tetra Tech project file.

FIGURE 2

EXAMPLE OF A CHAIN-OF-CUSTODY FORM (WHITE COPY)



Tetra Tech EM Inc.
Oakland Office
1999 Harrison Street, Suite 500
Oakland, CA 94612
510.302.6300 Phone
510.433.0830 Fax

Chain of Custody Record No. 9814 13G175 Page 1 of 1

Lab PO#: 130Ak27 | Lab: EMAX

Project name: Concord PA PN1 | TtEMI technical contact: Sara Woolley | Field samplers: Sandy Jack, Rebecca Johnson

Project (CTO) number: 103G159029 | TtEMI project manager: Steve DeHoratius | Field samplers' signatures:

	Sample ID	Point ID/Depth	Date	Time	Matrix	MS / MSD	No./Container Types: 40 ml VOA	1 liter Amber	500 ml Poly	Sleeve	Glass Jar 8 oz	250 ml Poly	Encore	Preservative Added: NONE	NONE	NONE	Analysis Required: VOA	SVOA	Pest	Metals	TPH Purgeables	TPH Extractables	PCB
1	029SRE SS01		7/22/13	1240	Soil						2						X	X	X		X	X	
2	029SRE SS02		7/22/13	1245							2						X	X	X		X	X	
3	029PBC 3D SS01		7/24/13	1200							1						X	X	X		X		
4	029 C 3D SS02			1215							1						X	X	X		X		
5	029C3D SS03			1230							1						X	X	X		X		
6	029C3D SS04			1245							1						X	X	X		X		

	Name (print)	Company Name	Date	Time
Relinquished by:	Rebecca Johnson	TtEMI	7/26/13	1630
Received by:	Cecilia Chavez	EMAX	7/30/13	09:30
Relinquished by:				
Received by:				
Relinquished by:				
Received by:				

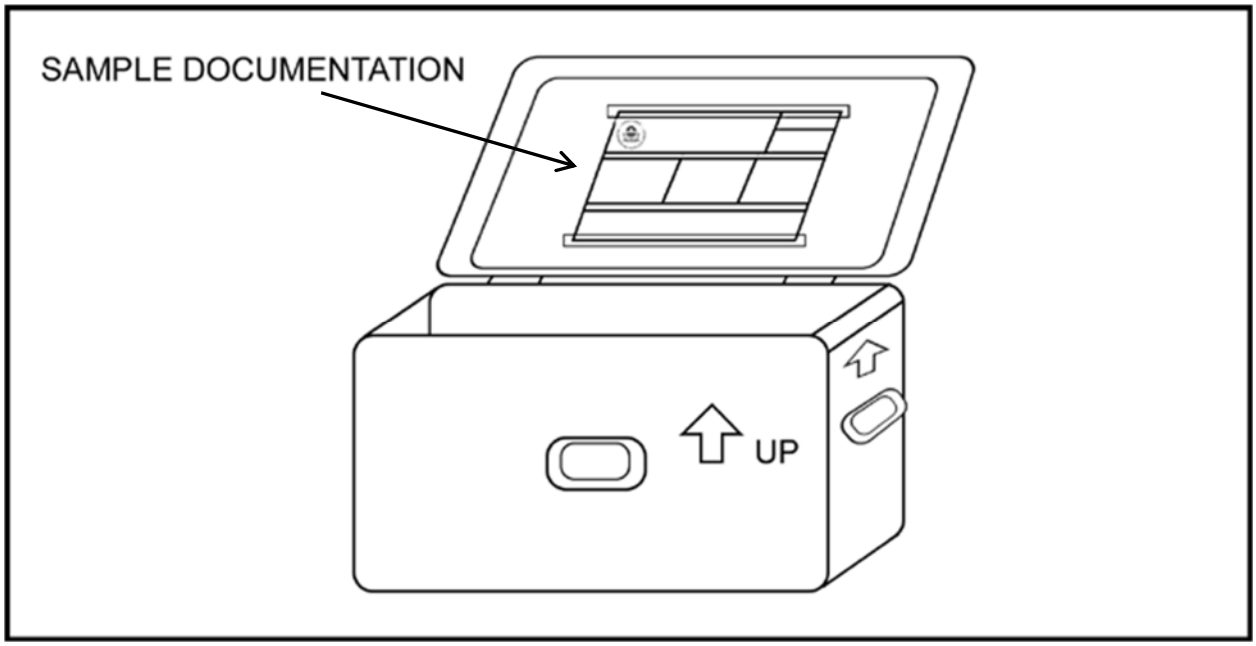
Turnaround time/remarks: Standard TAT Temp – 20°C
Prioritize: SVOCs, TPH-e on 029C3DSS01 → 04 thenmetals

Fed Ex #: 8612 4667 7215

WHITE-Laboratory Copy YELLOW-Sample Tracker PINK-File Copy

FIGURE 3

EXAMPLE OF A SAMPLE COOLER WITH ATTACHED DOCUMENTATION



Source: U.S. Environmental Protection Agency. 2014.

Place the necessary paperwork (chain-of-custody form, cooler return instructions, and associated paperwork) in the shipping cooler or acceptable container. All paperwork must be placed in a plastic bag or pouch and then secured to the underside of the shipping container lid.

FIGURE 4

EXAMPLE OF A CUSTODY SEAL

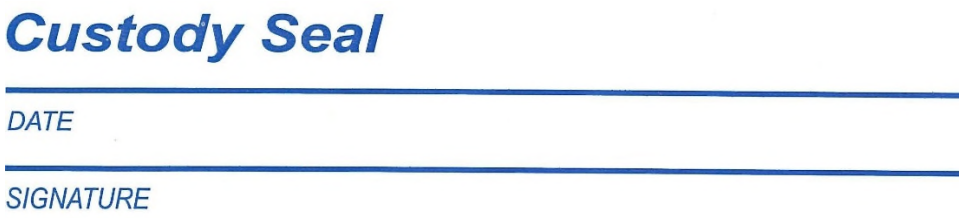
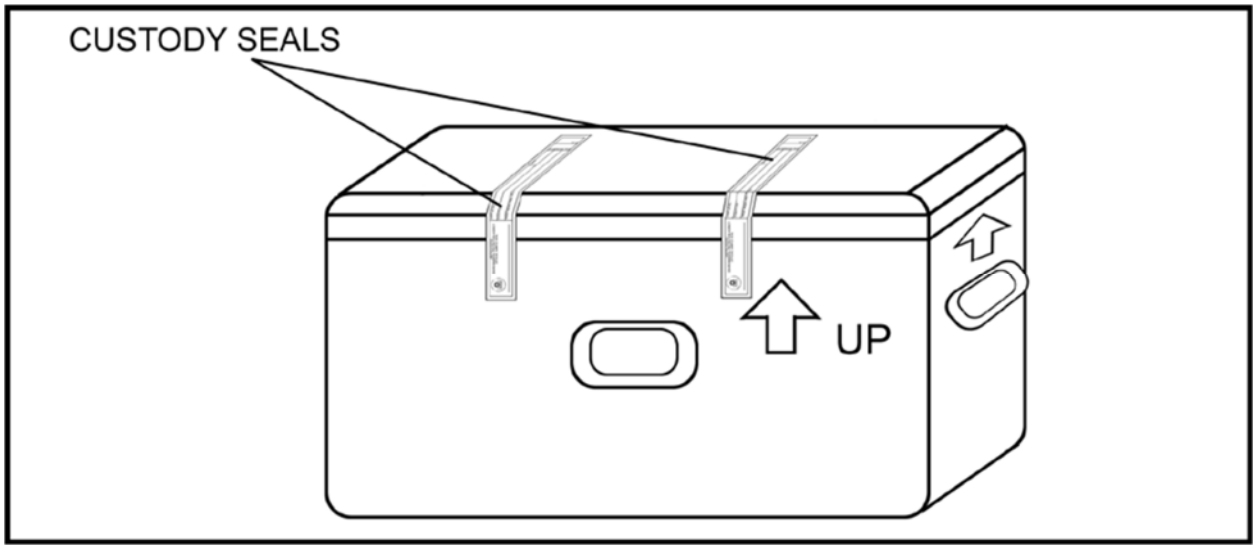


FIGURE 5

EXAMPLE OF SHIPPING COOLER WITH CUSTODY SEALS



Source: U.S. Environmental Protection Agency. 2014.

Please note that the two seals typically are affixed to opposite sides of the cooler and offset from each other, although the offset is not depicted on the EPA figure above.

SOP APPROVAL FORM

TETRA TECH, INC.

EMI OPERATING UNIT

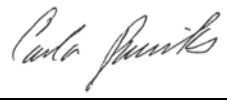
ENVIRONMENTAL STANDARD OPERATING PROCEDURE

RECORDING NOTES IN FIELD LOGBOOKS

SOP NO. 024

REVISION NO. 3

Last Reviewed: July 2020



Quality Assurance Approved

July 2, 2020

Date

1.0 BACKGROUND

Complete and accurate field documentation is critical to a successful project and the field logbook is an important tool to support field documentation needs. The field logbook should include detailed records of all field activities, document interviews with people, and record observations of conditions at a site. Entries should be described in a level of detail to allow personnel to reconstruct, after the fact, activities and events that occurred during their field assignments. Furthermore, entries should be limited to facts. Avoid speculation related to field events and do not record hearsay or unfounded information that may be presented by other parties during field activities. For example, do not record theories regarding the presence or absence of contamination when you are collecting field screening data or speculation regarding the reasons for a property owner's refusal to grant access for sampling.

Field logbooks are considered accountable documents in enforcement proceedings and may be subject to review. Therefore, the entries in the logbook must be accurate and detailed, but should not contain speculative information that could conflict with information presented in subsequent project deliverables and correspondence. Also be aware that the field logbooks for a site may be a primary source of information for depositions and other legal proceedings that may occur months or years after field work is complete and long after our memories have faded. The accuracy, neatness, and completeness of field logbooks are essential for recreating a meaningful account of events.

Field notes may also be recorded digitally, using a variety of software programs. The requirements and use of digital recording programs is not addressed in this standard operating procedure (SOP) because many items are unique to the selected software system. However, many of the principles discussed in this SOP will apply to the digital recording of field notes.

1.1 PURPOSE

The purpose of this SOP is to provide guidance to ensure that field logbook documentation collected during field activities meets all requirements for its later use. Among other things, field logbooks may be used for:

- Identifying, locating, labeling, and tracking samples
- Recording site activities and the whereabouts of field personnel throughout the day
- Documenting any deviations from the project approach, work plans, quality assurance project plans, health and safety plans, sampling plans, and any changes in project personnel
- Recording arrival and departure times for field personnel each morning and evening and weather conditions each day

- Describing photographs taken during the project.

In addition, the data recorded in the field logbook may later assist in the interpretation of analytical results. A complete and accurate logbook also aids in maintaining quality control, because it can verify adherence to project scope and requirements.

1.2 SCOPE

This SOP establishes the general requirements and procedures for documenting site activities in the field logbook.

1.3 DEFINITIONS

None.

1.4 REFERENCES

Compton, R.R. 1985. *Geology in the Field*. John Wiley and Sons. New York, NY.

1.5 REQUIREMENTS AND RESOURCES

The following items are required for field notation:

- Bound (sewn) notebooks
- Ballpoint pens or Sharpies with permanent waterproof ink
- 6-inch ruler (optional)

Field logbooks should be bound (sewn) with water-resistant and acid-proof covers, and each page should have preprinted lines or grids and numbered pages. They should be approximately $7^1/_2$ by $4^1/_2$ inches or $8^1/_2$ by 11 inches in size. Loose-leaf sheets are not acceptable for use as a field logbook, although logs and field forms used to record field measurements and data are acceptable as loose-leaf sheets maintained in a three-ring binder with numbered pages, as a supplement to the logbook. If notes are written on loose paper, they must be transcribed as soon as possible into a bound field logbook by the same person who recorded the notes originally.

Ideally, distribution of logbooks should be controlled by a designated person in each office. This person assigns a document control number to each logbook, and records the assignment of each logbook distributed (name of person, date distributed, and project number). The purpose of this procedure is to ensure the integrity of the logbook before its use in the field, and to document each logbook assigned to a

project. In the event that more than one logbook is assigned to a project, this process will ensure that all logbooks are accounted for at project closeout.

2.0 PROCEDURES

The following subsections provide general guidelines and formatting requirements for field logbooks, and detailed procedures for completing field logbooks.

2.1 GENERAL GUIDELINES

- A separate field logbook must be maintained for each project. If a site consists of multiple subsites (or operable units), designate a separate field logbook for each subsite. Similarly, if multiple activities are occurring simultaneously requiring more than one task leader (for example, well installation, private well sampling, or geophysical survey), each task leader should maintain a separate field logbook to ensure that each activity is documented in sufficient detail.

- At larger sites, a general field log may be kept at the site trailer or designated field office to track site visitors, document daily safety meetings, and record overall site issues or occurrences.

- Data from multiple subsites may be entered into one logbook that contains only one type of information for special tasks, such as periodic well water-level measurements.

- All logbooks must be bound and contain consecutively numbered pages. If the pages are not pre-numbered, the sequential page number should be written at the top of each page.

- No pages can be removed from the logbook for any purpose.

- All information must be entered using permanent, waterproof ink, either a traditional ballpoint pen or a permanent marker. Do not use pens with water-based ink (typically identified as rollerball or gel ink pens) because the ink may wash out if the paper gets wet. Pencils are not permissible for field notes because information can be erased. The entries should be written dark enough so that the logbook can be easily photocopied.

- Be sure that all entries are legible. Use print rather than cursive writing and keep the logbook pages free of dirt and moisture to the extent possible.

- Set apart critical information such as sample numbers by circling or drawing a box around the critical data.

- Do not enter information in the logbook that is not related to the project. The language used in the logbook should be factual and objective. Avoid speculation that could conflict with information presented in subsequent project deliverables and correspondence (see Section 1.0 above).

- Use military time, unless otherwise specified by the client. If a logbook entry is not related to a specific event, set it aside with the identification as a “NOTE.”

- Include site sketches, as appropriate.

- Begin a new page for each day’s notes.

- Include the date, project number, and location (if the project has multiple locations) at the top of each page.

- At the end of a day, draw a single diagonal line through any unused lines on the page, and sign at the bottom of the page. Note and implement any client-specific requirements (for example, some clients require each logbook page to be signed).

- Write notes on every line of the logbook. Do not skip any pages or parts of pages unless a day's activity ends in the middle of a page.

- If a line is left blank for some reason, cross it out (with a single line) and initial to prevent unauthorized entries.

- Cross out (with a single line) and initial any edits to the logbook entries. Note and implement any client-specific requirements (for example, some clients also require that edits be dated). Edits should only be made if the initial entry is illegible or erroneous. Do not make corrections for grammar or style.

2.2 LOGBOOK FORMAT

The layout and organization of each field logbook should be consistent and generally follow the format guidelines presented below. Some clients or contracts may have specific formatting guidelines that differ somewhat from this SOP; review client requirements at the start of the project to help ensure any client-specific guidelines are integrated.

2.2.1 Logbook Cover

Spaces are usually provided on the inside front cover (or the opening page in some logbooks) for the company name, address, contact names, and telephone numbers. If preprinted spaces for this information are not provided in the logbook, write the information on the first available page. Information to be included on the inside front cover or first page includes:

- Logbook document control number (assigned by issuer)
- "Book # of #" (determined by the project manager if there is more than one logbook for the project)
- Contract and task order numbers
- Name of the site and site location (city and state)
- Name of subsite (or operable unit), if applicable
- Type of activity, if the logbook is for a specific activity, such as well installation or indoor air sampling
- Beginning and ending dates of activities entered into the logbook

2.2.2 Inside Cover or First Page

Spaces are usually provided on the inside front cover (or the opening page in some logbooks) for the company name, address, contact names, and telephone numbers. If preprinted spaces for this information are not provided in the logbook, write the information on the first available page. Information to be included on the inside front cover or first page includes:

- Tetra Tech project manager and site manager names and telephone numbers
- Tetra Tech office address
- Client contact and telephone number
- Site safety officer and telephone number
- Emergency contact telephone number (911, if applicable, or nearest hospital)
- Subcontractor contacts and telephone numbers
- Site property owner or property manager contact information

Note—some clients prohibit the inclusion of personally identifiable information such as personal mobile telephone numbers on official project records.

2.3 ENTERING INFORMATION IN THE LOGBOOK

The following lists provide guidance on the types of information to be included in a typical field logbook. This guidance is general and is not intended to be all-inclusive. Certain projects or clients may specify logbook requirements that are beyond the elements presented in this SOP.

2.3.1 General Daily Entries

- Document what time field personnel depart the Tetra Tech office and arrive at the hotel or site. If permitted by the client to charge travel time for site work, document what time personnel leave and arrive at the hotel each day. (This information may be needed at remote sites where hotel accommodations are not near the site.)
- Indicate when all subcontractors arrive and depart the site.
- Note weather conditions at the time of arrival on site and any changes to the weather that might affect completion of project tasks during the day.
- Include the date and project number at the top of each page.
- Document that a site safety meeting was held and include the basic contents of the meeting.
- List the level of personal protection to be used for health and safety.

- Summarize the day's planned activities.
- Summarize which activities each field team member will be doing.

2.3.2 Field Activity Entries

- Refer to field data collection forms for details about field data collection activities (for example time, date, depth of samples, and field measurements). If separate field sampling sheets are not used, see Section 2.3.3 regarding logbook entries for sampling activities.
- Refer to well purge forms, well construction logs, and other activity-specific forms as applicable rather than including this type of information in the field logbook. These other forms allow the information to be more accessible at a later date.
- List any air monitoring instrumentation used, with readings and locations.
- Refer to instrument field logs for equipment calibration information.
- Summarize pertinent conversations with site visitors (agency representatives, property owners, client contacts, and local citizens).
- Summarize any problems or deviations from the quality assurance project plan (QAPP) or field sampling plan.
- Document the activities and whereabouts of each team member. (As indicated in Section 2.1, multiple logbooks may be required to ensure sufficient detail for contemporaneous activities).
- Indicate when utility clearances are completed, including which companies participated.
- Indicate when verbal access to a property is obtained.
- Include names, addresses, and telephone numbers of any pertinent site contacts, property owners, and any other relevant personnel.
- Document when lunch breaks or other work stoppages occur.
- Include approximate scale for all diagrams. If a scale is not available, write "not to scale" on the diagram. Indicate the north direction on all maps and cross-sections, and label features on each diagram.

2.3.3 Sampling Activity Entries

The following information should typically be on a sample collection log and referenced in the logbook. If the project does not use sample sheets as a result of project-specific requirements, this information should be included in the logbook.

- Location description
- Names of samplers
- Collection time

- Designation of sample as a grab or composite sample
- Identification of blind duplicates or split samples
- Type of sample (water, sediment, soil gas, or other medium)
- On-site measurement data (such as pH, temperature, and specific conductivity)
- Field observations (odors, colors, weather)
- Preliminary sample description
- Type of preservative used
- Instrument readings, if applicable

2.3.4 Closing Daily Entries

- Describe decontamination procedures (personnel and equipment).
- Describe handling and disposition of any investigation-derived wastes.
- Summarize which planned activities were completed and which ones were not.
- Note the times that personnel depart the site for the day.
- Summarize any activities conducted after departing the site (paperwork, sample packaging, etc.). This may be required to document billable time incurred after field activities were completed for the day.

2.3.5 Photographic Log Entries

- Before using a digital camera, ensure that the system date and time are correct. Verify whether the timestamp is being recorded on the image, if required.
- Indicate in the text that photographs were taken and the location where the photographs can be found (for example, in the project file) and identify the photographer.
- Begin a new photolog page for each new field day.
- Record the time of photograph so that the image can be generally identified when reviewing the digital files.
- Note the direction in which the photograph was taken, along with any relevant details that might not be understood when looking at the photograph.
- In the event that a film camera is used, the sequential number of the image should also be recorded, and the time from the logbook will be the recorded time for the photograph.

2.4 LOGBOOK STORAGE

Custody of logbooks must be maintained at all times. During field activities, field personnel must keep the logbooks in a secure place (locked car, trailer, or field office) when the logbook is not in personal possession. When the field work is over, the logbook should be included in the project file, which should be in a secured file cabinet; in addition, if directed by the project manager, scan logbook pages for electronic file management upon returning to the office. The logbook may be referenced in preparing subsequent reports and scanned logbook pages may be included as an appendix to a report. However, it is advisable to obtain direction directly from the client before including the logbook as a report appendix, because its inclusion may not be appropriate in all cases.

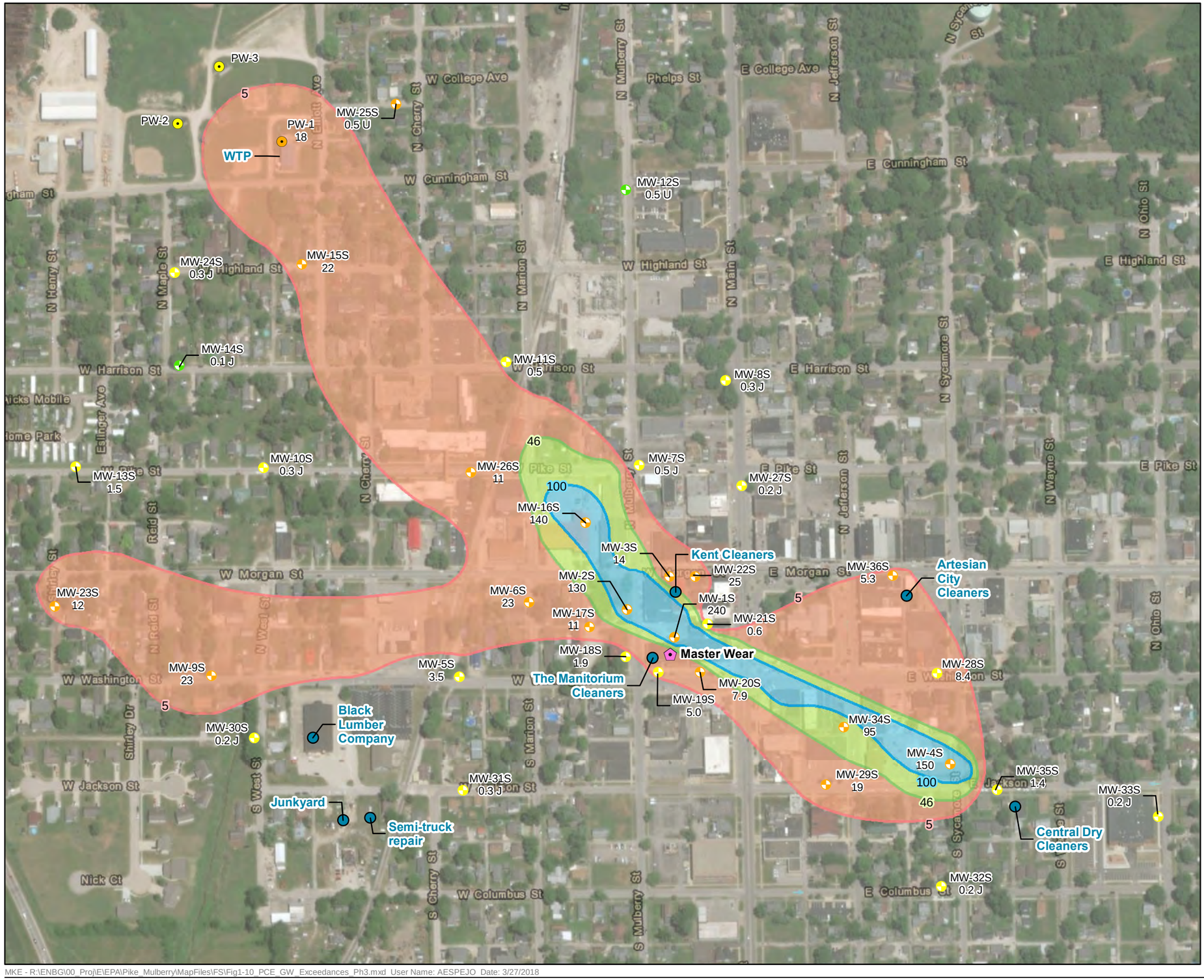
2.5 HEALTH AND SAFETY CONSIDERATIONS

In addition to the procedures outlined in this SOP, all field staff must be aware of and follow the health and safety practices that result from the Activity Hazard Analyses (AHA) for a project. The AHAs include critical safety procedures, required controls, and minimum personal protective equipment necessary to address potential hazards. The hazards specific to project tasks must be identified and controlled to the extent practicable and communicated to all project personnel via the approved, project-specific health and safety plan.

ATTACHMENT 1
GROUNDWATER AND SOIL VAPOR MAPS

From the U.S. Environmental Protection Agency 2021 Record of Decision

Figure 2 – PCE Exceedances in Shallow Groundwater – Phase 3
Figure 3 – PCE Soil Vapor Results and Property Type Designations (Phases 2 through 5)
Figure 4 – TCE Soil Vapor Results and Property Type Designations (Phases 2 through 5)
Figure 6 – Conceptual Site Model - PCE in Groundwater and Soil Vapor
Figure 7 – Conceptual Site Model - TCE in Groundwater and Soil Vapor
Figure 8 – Conceptual Site Model - PCE and TCE in Soil



LEGEND

- Potential Past PCE User
- Former Master Wear Facility

Monitoring Well

- Detected Above MCL
- Detected Below MCL
- Not Detected

Municipal Wells (PW)

- Detected Above MCL
- Detected Below MCL
- Not Detected

Groundwater Contour Concentrations (µg/L)

- 100
- 46
- 5

Notes:

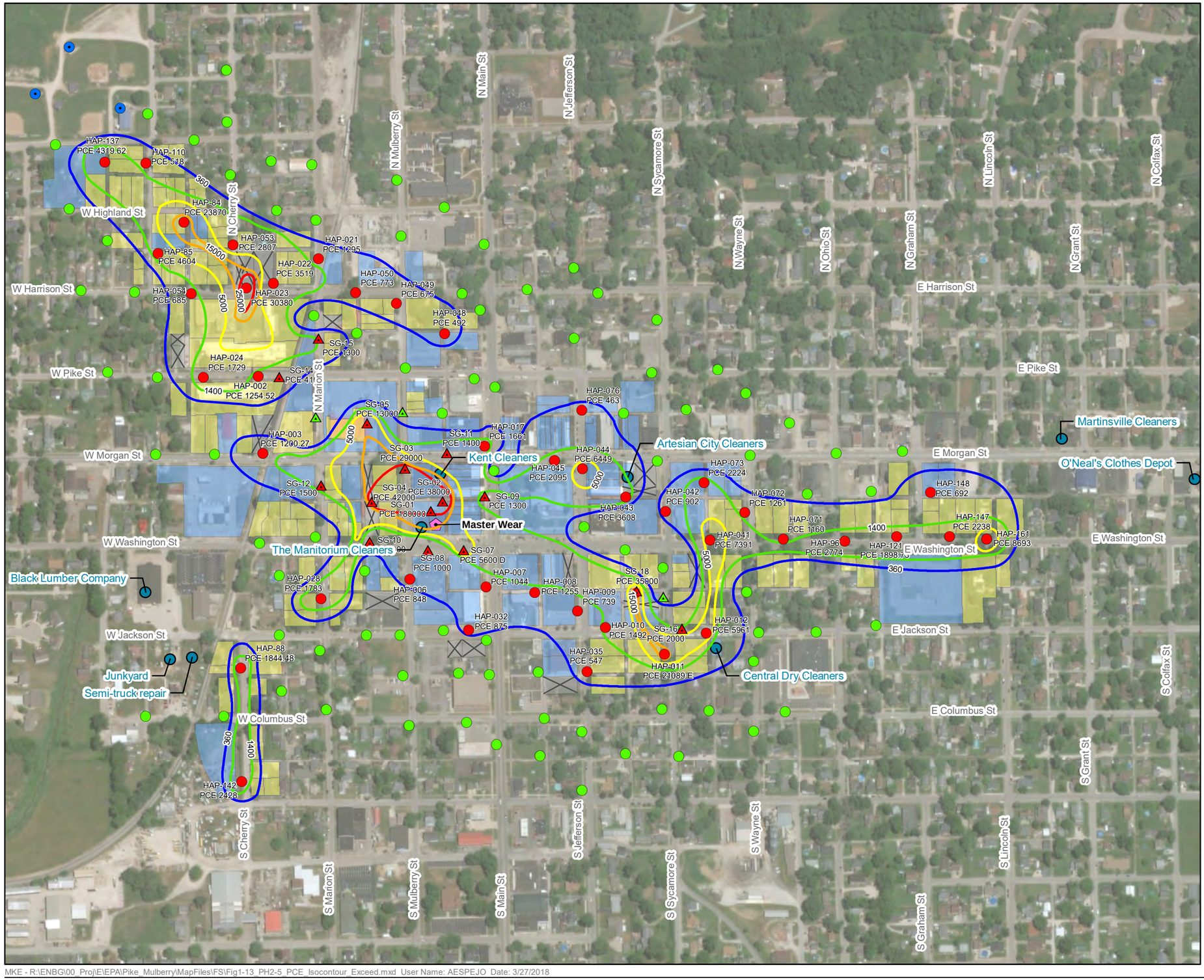
1. EPA = U.S. Environmental Protection Agency
2. G = indicates groundwater grab sample collected from soil boring at approximately 10 ft. below ground surface
3. J = Estimated detection
4. MCL = Maximum Contaminant Level
5. PCE = tetrachloroethene
6. U = Result not detected
7. UJ = Estimated result not detected
8. µg/L = micrograms per liter
9. Dashed lines indicate where plume is inferred or estimated
10. PCE screening level (SL) = 5 µg/L
11. PCE in intermediate well MW-7M was 24 µg/L

N

0 162.5 325

Feet

Figure 2
PCE Exceedances in Shallow Groundwater - Phase 3
Pike and Mulberry Streets PCE Plume Site
Martinsville, Indiana



LEGEND

- Potential Past PCE User
- Former Master Wear Facility
- Municipal Well
- Residential (129.5)
- Commercial/Industrial (90.5)
- No Sampling (park or parking lot) (18)

PCE Isocontours

Value

- 360
- 1400
- 5000
- 15000
- 25000

PCE Concentrations

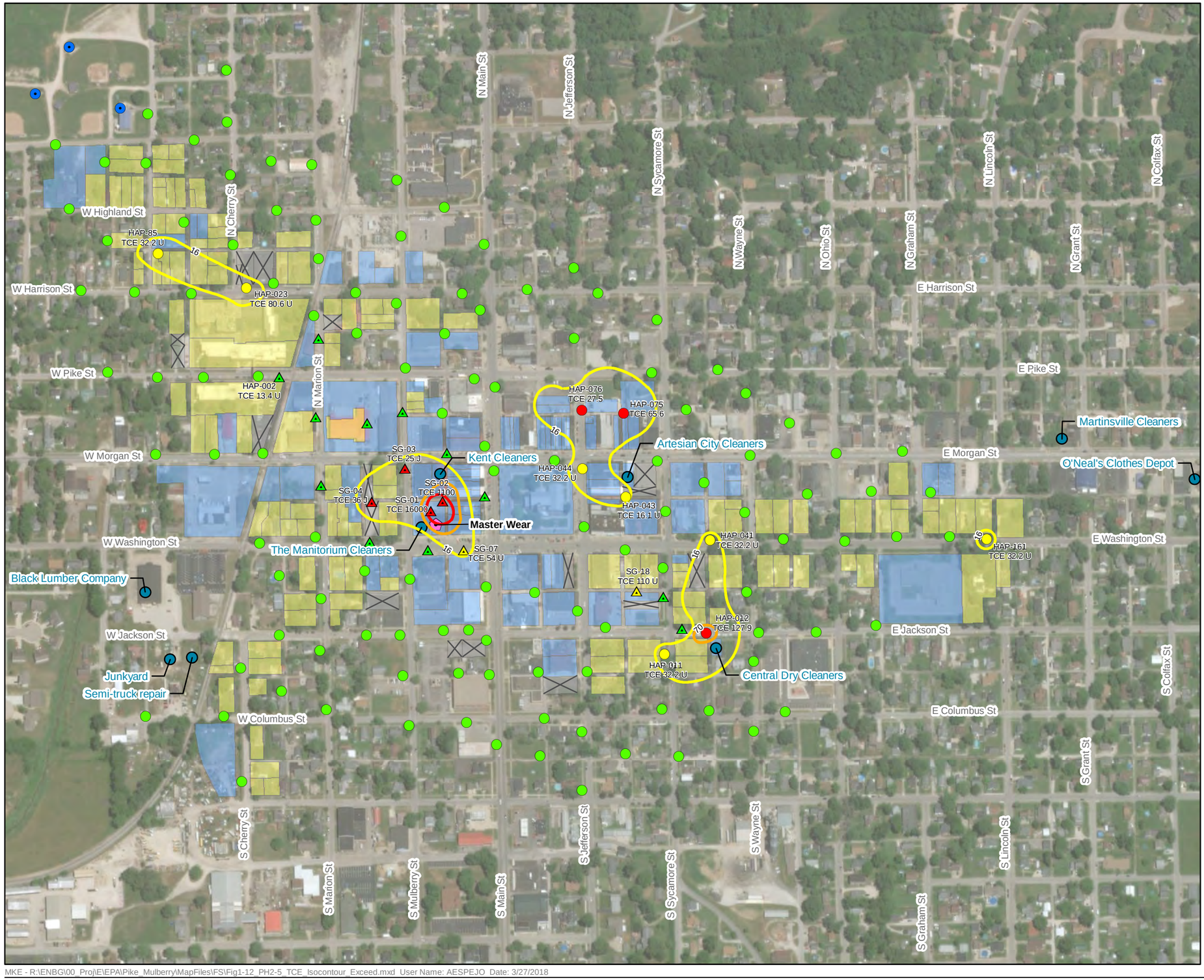
- Permanent Soil Vapor Probe with results of PCE greater than the VISL
- Permanent Soil Vapor Probe with results of PCE below the VISL
- Temporary Soil Vapor Point with HAPSITE results of PCE greater than the VISL
- Temporary Soil Vapor Point with HAPSITE results of PCE below the VISL

Notes:
1. All units are in µg/m³
2. PCE VISL is 360 µg/m³
3. VISLs are based on EPA VISL Calculator Version 3.5.1 (EPA 2016) with May 2016 RSLs, a residential exposure scenario, target Excess Lifetime Cancer Risk (ELCR) of 1x10-6, and a Hazard Index of 1
4. The 1400 contour line represents the ELCR of 1x10-5
5. U = HAPSITE result is non-detect
6. E = HAPSITE result exceeds calibration range and result is Estimated
7. PCE = tetrachloroethene
8. VISL = Vapor Intrusion Screening Level

All permanent soil vapor probe locations had soil vapor results that exceeded the PCE VISLs in August and October 2015 except for SG-6, SG-13, and SG-17.

Figure 3
PCE Soil Vapor Results (Phases 2 through 5) and Property Type Designations
Pike and Mulberry Streets PCE Plume Site
Martinsville, Indiana

ch2m



LEGEND

- Potential Past PCE User
- Former Master Wear Facility
- Municipal Well
- Residential (129.5)
- Commercial/Industrial (90.5)
- No Sampling (park or parking lot) (18)

TCE Isocontours

- 16
- 70
- 1000

TCE Concentrations

- Permanent Soil Vapor Probe with results of TCE greater than the VISL
- Permanent Soil Vapor Probe with Detection Limit greater than the VISL
- Permanent Soil Vapor Probe with results of TCE below the VISL
- Temporary Soil Vapor Point with HAPSITE results of TCE greater than the VISL
- Temporary Soil Vapor Probe with Detection Limit greater than the VISL
- Temporary Soil Vapor Point with HAPSITE results of TCE below the VISL

Notes:
1. All units are in µg/m³
2. TCE VISL is 16 µg/m³
3. VISLs are based on EPA VISL Calculator Version 3.5.1 (EPA 2016) with May 2016 RSLs, a residential exposure scenario, target Excess Lifetime Cancer Risk (ELCR) of 1x10-6, and a Hazard Index of 1
4. The 70 contour line represents the ELCR of 1x10-5
5. U = HAPSITE result is non-detect
6. E = HAPSITE result exceeds calibration range and result is Estimated
7. TCE = trichloroethene
8. VISL = Vapor Intrusion Screening Level

All permanent soil vapor probe locations had soil vapor results that exceeded the TCE VISLs in August and October 2015 except for SG-6, SG-13, and SG-17.

N

0 200 400
Feet

Figure 4
TCE Soil Vapor Results (Phases 2 through 5) and Property Type Designations
Pike and Mulberry Streets PCE Plume Site
Martinsville, Indiana

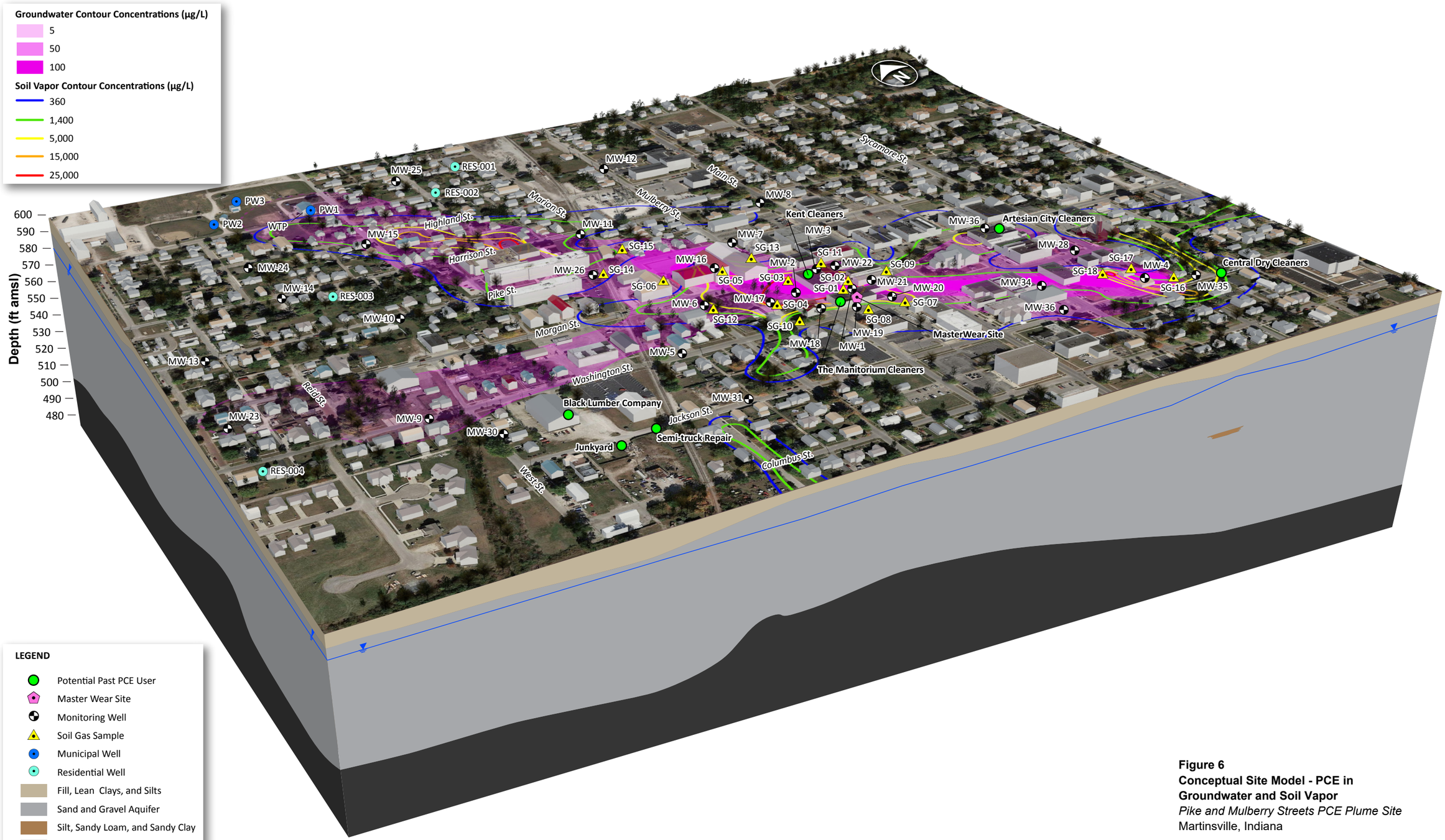


Figure 6
Conceptual Site Model - PCE in Groundwater and Soil Vapor
Pike and Mulberry Streets PCE Plume Site
Martinsville, Indiana

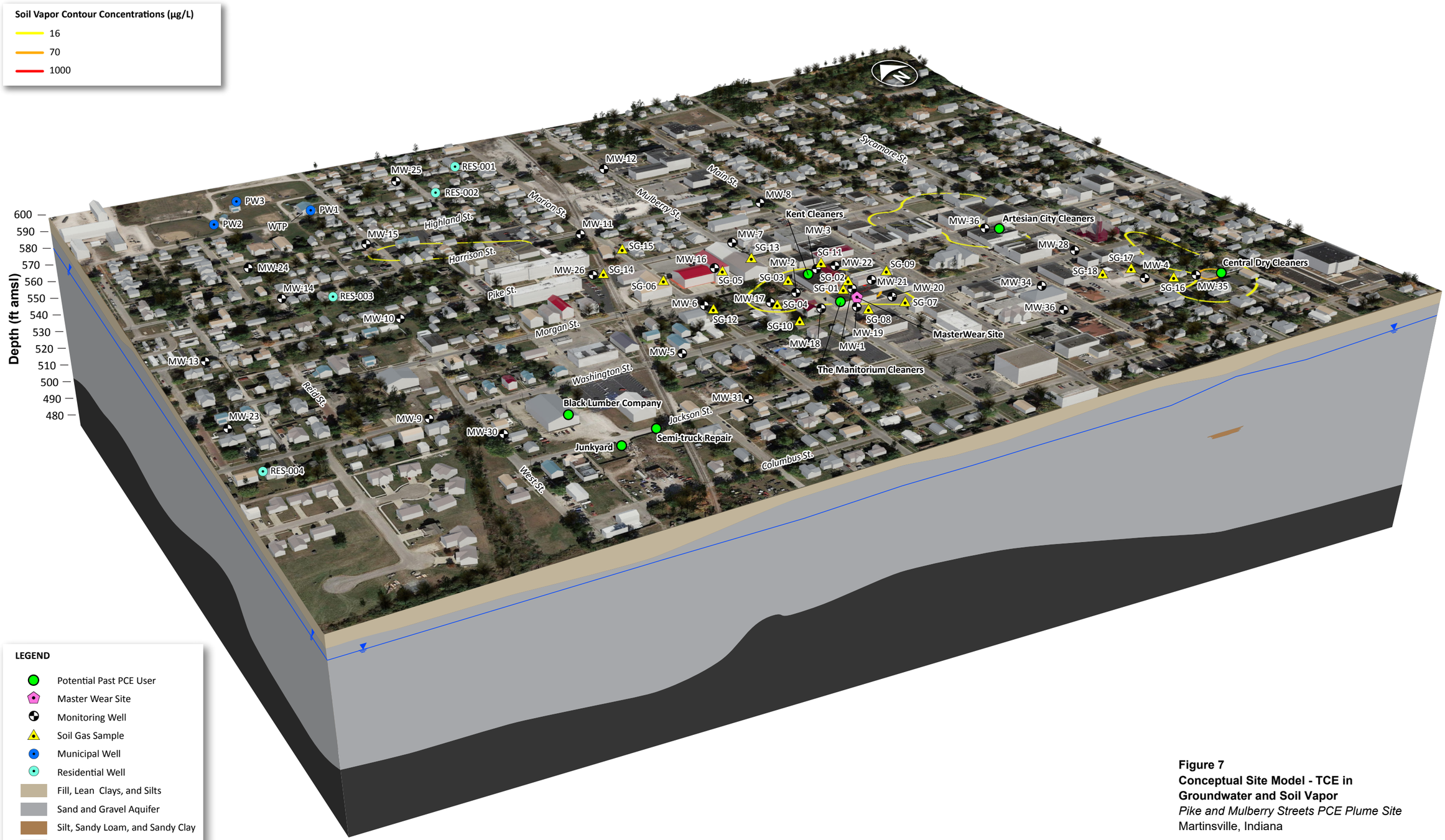


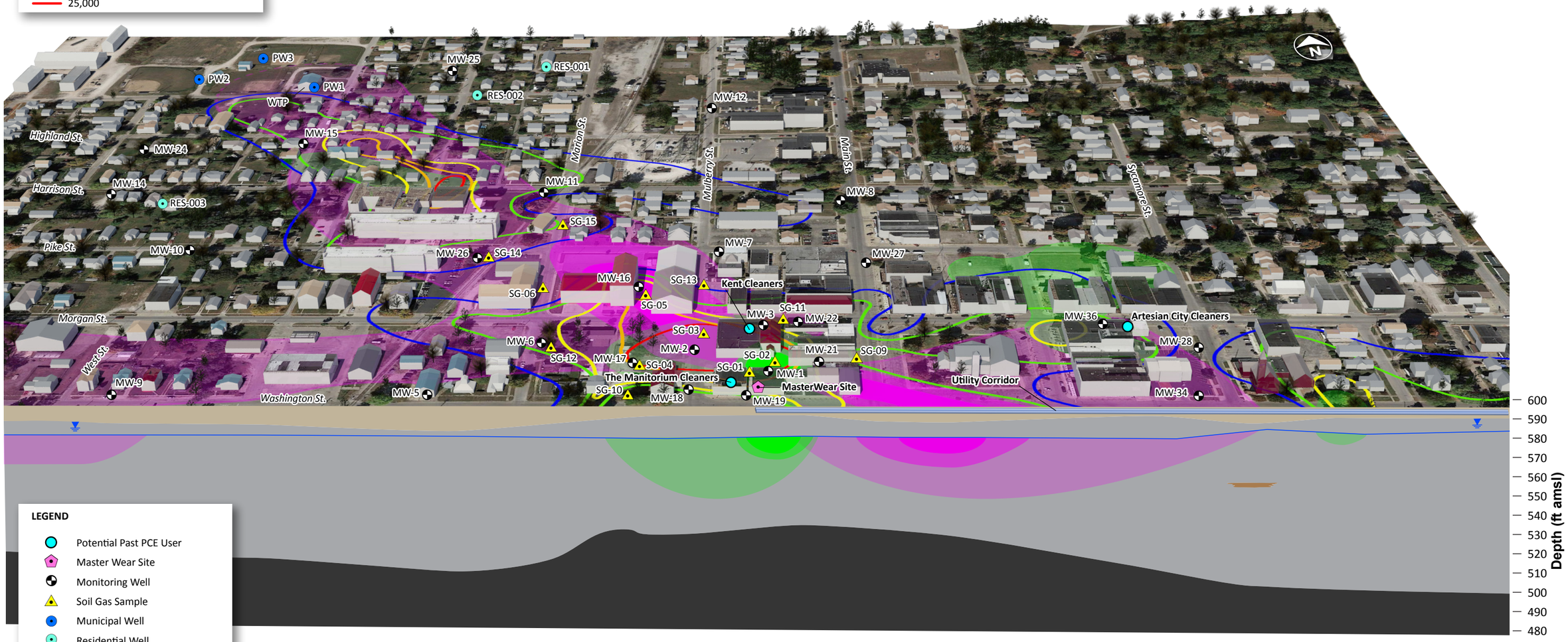
Figure 7
Conceptual Site Model - TCE in Groundwater and Soil Vapor
Pike and Mulberry Streets PCE Plume Site
Martinsville, Indiana

PCE Groundwater Contour Concentrations (µg/L)
- 5
- 50
- 100

PCE Soil Vapor Contour Concentrations (µg/L)
- 360
- 1,400
- 5,000
- 15,000
- 25,000

TCE Groundwater Contour Concentrations (µg/L)
- 16
- 70
- 1000

Screening Levels
- PCE – 8,100 µg/kg
- TCE – 410 µg/kg



LEGEND
- Potential Past PCE User
- Master Wear Site
- Monitoring Well
- Soil Gas Sample
- Municipal Well
- Residential Well
- Fill, Lean Clays, and Silts
- Sand and Gravel Aquifer
- Silt, Sandy Loam, and Sandy Clay
- Bedrock
- Groundwater Level

Figure 8
Conceptual Site Model - PCE and TCE in Soil
Pike and Mulberry Streets PCE Plume Site
Martinsville, Indiana