Quality Assurance Project Plan

Volume I, Appendix C
Soil Gas Monitoring at Sites 2 and 12

Addendum No. 2
Soil Gas Plume Rebound Characterization
Jetty Street Study Area

Former Fort Ord, California

Prepared for:

U.S. Department of the Army
Fort Ord Base Realignment and Closure
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Task No. 6

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A Standard Operating Procedures

B Field Documentation Forms

Acronyms and Abbreviations

%	percent
µg/m^3	micrograms per cubic meter
Ahtna	Ahtna Global, LLC
APP	Accident Prevention Plan
Army	U.S. Department of the Army
bgs	below ground surface
CAS	Chemical Abstracts Service
CCRWQCB	California Regional Water Quality Control Board, Central Coast Region
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COC	chemical of concern
CPR	cardiopulmonary resuscitation
CQCR	Contractor Quality Control Report
CQM	Construction Quality Management
DL	detection limit
DoD	Department of Defense
DQO	data quality objective
DTSC	California Department of Toxic Substances Control
FSOP	field standard operating procedure
GC/MS	gas chromatography/mass spectrometry
GWTP	groundwater treatment plant
H&S	health and safety
HAZWOPER	Hazardous Waste Operations and Emergency Response
IDW	investigation derived waste
LOD	limit of detection
LOQ	limit of quantitation
MEC	munitions and explosives of concern
N/A	not applicable
OU2	Operable Unit 2
PCE	tetrachloroethene
PE	Professional Engineer
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Systems Manual
SGCL	soil gas cleanup level

Sites 2/12	Sites 2 and 12
SOP	standard operating procedure
SVE	soil vapor extraction
SVETS	soil vapor extraction and treatment system
SVTU	soil vapor treatment unit
TBD	to be determined
TCE	trichloroethene
THQ	target hazard quotients
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency

1.0 Introduction

Ahtna Global, LLC (Ahtna) prepared this *Quality Assurance Project Plan, Volume I, Appendix C, Soil Gas Monitoring at Sites 2 and 12, Addendum No. 2, Soil Gas Plume Characterization – Jetty Street Study Area* (QAPP Addendum) under U.S. Army Corps of Engineers (USACE) Contract No. W9123824D0003, Delivery Order No. W9123825FA005. This QAPP Addendum describes soil gas sampling to be performed at the former Fort Ord Sites 2 and 12 (Sites 2/12) in the Jetty Street area (Figure 1). This work is being conducted under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or "Superfund") to address historical releases of chemicals of concern (COCs) at the former Fort Ord. This QAPP Addendum details quality assurance (QA) and quality control (QC) procedures for soil gas sampling activities.

This document is an addendum to the *Quality Assurance Project Plan, Former Fort Ord, California, Volume I, Appendix C, Revision 10, Soil Gas Monitoring at Sites 2 and 12, Former Fort Ord, California* (Soil Gas QAPP; Ahtna, 2026). The Soil Gas QAPP will be referenced as appropriate in the worksheets contained herein. This Soil Gas QAPP Addendum specifically discusses soil gas sampling activities for characterizing the remaining soil gas plume in the Jetty Street area with respect to rebound of COC concentrations and corresponding potential vapor intrusion risk at structures in this area and therefore only includes Optimized Uniform Federal Policy (UFP)-QAPP Worksheets #1 & 2, #4, 7 & 8, #9, #11, #14 & 16, #15, #17, and #21 with additional information specifically applicable to this project. Other worksheets and information are available in the Soil Gas QAPP (Ahtna, 2026).

2.0 Worksheet #1 & 2: Title and Approval Page

Site Name/Project Name: Sites 2 and 12 (2/12)/Superfund Response Actions

Site Location: Former Fort Ord, California

Document Title: Quality Assurance Project Plan, Volume I, Appendix C, Soil Gas Monitoring at Sites 2 and 12, Addendum No. 2, Soil Gas Plume Rebound Characterization – Jetty Street Study Area

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Preparation Date: July 2026

Project Role	Name Organization	Signature	Date
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Investigative Organization's QC Manager	Steven Bennett Ahtna		
Lead Organization's Technical Lead	Erin Corr USACE		
Lead Organization's Project Chemist	April Martinez USACE		

Plans and reports from previous investigations relevant to this project:

Site Name/Project Name:	Former Fort Ord/Superfund Response Actions
Site Location:	Monterey County, California
Site Number/Code:	Not Applicable (N/A)
Operable Unit:	Sites 2/12
Contractor Name:	Ahtna Global, LLC
Contract Number:	W9123824D0003
Contract Title:	Operations and Maintenance at Fort Ord
Work Assignment Number:	N/A
Guidance used to prepare QAPP:	Uniform Federal Policy for Quality Assurance Project Plans, Optimized UFP-QAPP Worksheets, March 2012, Revision 1 Department of Defense (DoD) Quality Systems Manual (QSM) for Environmental Laboratories, Version 5.4, October 2021 DoD General Data Validation Guidelines, Environmental Data Quality Workgroup, Revision 1, September 2019 Data Validation Guidelines Module 1: Data Validation Procedure for Organic Analysis by GC/MS, May 2020 Data Validation Guidelines Module 1, 2, and 4 Revised Blank Qualification Table, May 2021
Regulatory Program:	CERCLA as amended by the Superfund Amendment and Reauthorization Act
Approval Entities:	U.S. Environmental Protection Agency (USEPA), California Department of Toxic Substance Control (DTSC), and Regional Water Quality Control Board, Central Coast Region (CCRWQCB)
Data Users:	U.S. Department of the Army (Army), USACE, USEPA, DTSC, CCRWQCB, Army/USACE contractors, citizen groups, and members of the public
Organizational partners (stakeholders) and connection with lead organization:	USACE, Army (lead agency/owner), USEPA (lead oversight agency), DTSC (support agency), and CCRWQCB (support agency)
The QAPP is (select one):	Generic:____ Project-Specific:_X_

Plans and reports from previous investigations relevant to this project:

Title	Approval Date
Quality Assurance Project Plan, Former Fort Ord, California, Volume I, Appendix C, Final Revision 10, Soil Gas Monitoring at Sites 2 and 12	March 2026
Quality Assurance Project Plan, Former Fort Ord, California, Volume I, Appendix C, Final Revision 9, Soil Gas Monitoring at Sites 2 and 12	December 2024
Quality Assurance Project Plan, Former Fort Ord, California, Volume I, Appendix C, Final Revision 8, Soil Gas Monitoring at Sites 2 and 12	August 2023
Quality Assurance Project Plan, Former Fort Ord, California, Volume I, Appendix C, Final Revision 7, Soil Gas Monitoring at Sites 2 and 12	June 2022
Quality Assurance Project Plan, Former Fort Ord, California, Volume I, Appendix C, Final Revision 6, Soil Gas Monitoring at Sites 2 and 12	September 2021
Quality Assurance Project Plan, Former Fort Ord, California, Volume I, Appendix C, Final Revision 5, Soil Gas Monitoring at Sites 2 and 12	August 2020
Quality Assurance Project Plan, Former Fort Ord, California, Volume I, Appendix C, Draft Addendum No. 1, Soil Gas Monitoring at Sites 2 and 12	November 2019
Quality Assurance Project Plan, Former Fort Ord, California, Volume I, Appendix C, Final Revision 4, Soil Gas Monitoring at Sites 2 and 12	February 2019
Quality Assurance Project Plan, Former Fort Ord, California, Volume I, Appendix C, Final Revision 3, Soil Gas Monitoring at Sites 2 and 12	January 2018
Quality Assurance Project Plan, Former Fort Ord, California, Volume I, Appendix C, Final Revision 2, Soil Gas Monitoring at Sites 2 and 12	May 2017
Quality Assurance Project Plan, Former Fort Ord, California, Volume I, Appendix C, Final Revision 1, Soil Gas Monitoring at Sites 2 and 12	March 2016
Quality Assurance Project Plan, Former Fort Ord, California, Volume I, Appendix C, Final Revision 0, Soil Gas Monitoring at Sites 2 and 12	March 2015
Final Quality Assurance Project Plan/Field Sampling Plan, Remedial Investigation/Feasibility Study Addendum at Sites 2 and 12, Former Fort Ord, California (Appendix A to the RI/FS Addendum Work Plan)	September 2013

3.0 Worksheet #4, 7 & 8: Personnel Qualifications and Sign-Off Sheet

Organization: Ahtna Global, LLC (Ahtna)

Name	Project Title/ Role	Education/ Experience	Specialized Training/ Certifications[1]	Signature[2]	Date
Derek Lieberman	Program Manager	Resume on file	First aid, CPR, MEC, H&S, HAZWOPER, CQM		
Eric Schmidt	Project Manager/ Chemist	Resume on file	First aid, CPR, MEC, HAZWOPER, CQM		
Shaelyn Hession	Assistant Project Manager	Resume on file	First aid, CPR, MEC, H&S, HAZWOPER		
Mark Fisler	Field Supervisor	Resume on file	First aid, CPR, MEC, HAZWOPER, CQM		
Andrew Mauck	Task Lead, Soil Gas Monitoring	Resume on file	First aid, CPR, MEC, HAZWOPER, CQM		
Steven Bennett	QC Manager	Resume on file	MEC, HAZWOPER, CQM		

Notes:

[1] Specialized Training/Certifications Key:

CPR: cardiopulmonary resuscitation

CQM: Construction Quality Management

H&S: health and safety training including, but not limited to: hazard communication, fire extinguisher use, defensive driving, behavior-based safety, confined spaces

HAZWOPER: 40-hour and current 8-hour annual refresher Hazardous Waste Operations and Emergency Response

MEC: munitions and explosives of concern recognition and safety training

PE: registered Professional Engineer

[2] Signatures indicate personnel have read and agree to implement this QAPP Addendum as written.

4.0 Worksheet #9: Project Planning Session Summary

Project Name: Soil Gas Plume Characterization – Jetty Street Study Area
Site Name: Sites 2 and 12
Site Location: Former Fort Ord, California
Start Date: August 7, 2025
Project Manager: Eric Schmidt, Ahtna
Date of Planning Session: August 7, 2025
Planning Session Purpose: Define data quality objectives (DQOs) and analytic approach criteria.

Name	Title/Role	Affiliation	Telephone	Email Address
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Planning Session Summary

Reviewed the existing soil gas probe cluster locations in the Jetty Street area. Sampling of the soil gas probe clusters in the Jetty Street area to recharacterize the soil gas plume was discussed. The approach for DQOs and analytical criteria was discussed.

Action Items

Based on this review, Ahtna will:

- Initiate the Soil Gas QAPP Addendum
- Keep soil vapor extraction (SVE) wells in the Jetty Street area offline during operation of the existing soil vapor extraction and treatment system (SVETS) to assess rebound as part of recharacterization of the soil gas plume in the Jetty Street area.
- Identify decision criteria for installing additional soil gas probe clusters and performing indoor air sampling in the Jetty Street area.
- Identify decision criteria for operation of the existing SVETS as part of the rebound study in the Jetty Street area.

5.0 Worksheet #11: Project/Data Quality Objectives

Project Quality Objectives for Sites 2/12 as a whole are identified in the Soil Gas QAPP (Ahtna, 2026). The text below focuses on recharacterization of the soil gas plume and soil gas rebound study to be completed in the Jetty Street study area (Figure 1).[1]

DQOs are qualitative and quantitative statements that outline the decision-making process and specify the data required to support corrective actions. DQOs specify the level of uncertainty that will be accepted in results derived from data. The DQO process used for developing data quality criteria and performance specifications for decision-making is consistent with the *Guidance on Systematic Planning Using the Data Quality Objectives Process*, EPA QA/G-4 (USEPA, 2006). The DQO process consists of the following seven steps:

Step 1: State the problem

Step 2: Identify the goals of the study

Step 3: Identify information inputs

Step 4: Define the boundaries of the study

Step 5: Develop the analytic approach

Step 6: Specify performance or acceptance criteria

Step 7: Develop the plan for obtaining data

The seven steps of the DQO process, as applied to this addendum, are described in the following sections.

5.1 Step 1: State the Problem

Historical activities at Sites 2/12, including disposal of solvents at Site 12, resulted in releases of volatile organic compounds, primarily tetrachloroethene (PCE) and trichloroethene (TCE), into soil. Soil gas was investigated at Site 12 in 2013 and distinct PCE and TCE plumes were identified in the vadose (or unsaturated) zone (AES, 2015). Follow-up investigations and operation of an SVE and air sparge pilot study treatment system in 2014 identified a TCE soil gas plume in the southern Site 12 area. The pilot study demonstrated that SVE is an effective technology for remediation of soil gas at Site 12 (AES, 2015). Accordingly, a full-scale SVETS was constructed per the *Final Remedial Action Work Plan Addendum, Sites 2 and 12 Groundwater Remediation, Former Fort Ord, California* (AEI, 2015).

The SVETS began operation in September 2015.[2] Based on the results of quarterly soil gas and groundwater monitoring, SVE wells were operated to optimize the removal of COCs from the vadose zone that might otherwise partition into groundwater. Operation of the SVETS reduced COC concentrations in soil gas to below the soil gas cleanup levels (SGCLs) described in the Explanation of

[1] "Rebound" typically refers to an increase in contaminant concentrations immediately following remedial treatment induced reductions in contaminant concentration.

[2] The Sites 2/12 SVETS is a component of the groundwater remedy and currently consists of the SVTU (the system controls and treatment equipment including the GAC vessels) and ten SVE wells located at Site 12. SVE wells VE-12-01, VE-12-02, VE-12-03, VE-12-04, and VE-12-05 were installed in 2014 and are in the Jetty Street Area (Figure 1).

Significant Differences (ESD) No. 1 (Army, 2016). However, development in the Jetty Street area on the south side of Site 12 has progressed since the soil gas plume in this area was initially delineated. A movie theater, commercial spaces, and mixed-use development including residential units have been constructed in the vicinity. Consistent with structures typical to the area, the building foundations are slab on grade, and the mixed-use development includes a vapor barrier below the foundation. Potential receptors are building occupants that may include patrons and employees of the commercial operations and residents in the mixed-use area.

The SVETS is an approved component of the selected remedy under ESD No. 1 (Army, 2016) and, as indicated in ESD No. 1, operation of the SVETS for achieving remedial action objectives with respect to groundwater is also intended to be protective with respect to potential vapor intrusion into buildings and subsequent potential impacts to indoor air should site conditions change. Figure 1 shows the existing soil gas probe locations and SVE well locations in this portion of Site 12. SVE wells in the Jetty Street area have not been operated since the Third Quarter of 2024 to facilitate assessment of rebound of COC concentrations in soil gas in this area.[3]

Due to the potential for rebound of COC concentrations in soil gas while the SVETS is offline, uncertainty exists regarding current soil gas COC concentrations and plume extent in the Jetty Street area. Further data collection is needed in the Jetty Street area to:

- Re-characterize the soil gas plume for COC rebound and plume extent.
- Determine intermediate actions with respect to further monitoring of the site based on updated plume shape and concentration kinetics.
- Evaluate the need for SVETS operation in this area based on COC rebound.
- Evaluate the performance of the SVETS with respect to COC mass removal from the vadose zone.
- Provide a data foundation to support site closure, including baseline data necessary for future rebound studies, long-term monitoring decisions, and SVETS operational decisions.

The project action limits to be used to support re-characterization of the plume in the area of Jetty Street are described in Worksheet #15.

5.2 Step 2: Identify the Goals of the Study

The general goal of the study is to provide additional data to evaluate rebound conditions and to support decisions regarding continued SVETS operation and overall remedy protectiveness in the Jetty Street area. The specific study goals for the re-characterization of the soil gas plume in the vicinity of Jetty Street are to:

- Assess rebound of soil gas COCs.
- Assess SVETS Mass Removal Capability: Generate baseline and operational data to evaluate COC mass removal by the existing SVETS based on rebound and plume characterization data.

[3] More recent operation of the SVETS has included only operation of SVE well VE-12-02 in the Jetty Street area. This SVE well was selected for operation only to optimize the operation of the SVETS and not due to any exceedance of soil gas cleanup levels (Army, 2015) in the Jetty Street area. Buildings in the Jetty Street area were present prior to initiation of the rebound study, including both occupied and unoccupied structures that represent current and potential receptors.

- Delineate Plume Extent: Determine if additional exterior soil gas probes are required to define the lateral and vertical soil gas COC plume extents relative to current building footprints per defined action levels (Worksheet #15).
- Evaluate Migration Pathways: Identify specific buildings or areas that may require sub-slab soil gas and concurrent indoor/ambient air sampling based on exterior soil gas concentrations exceeding relevant commercial or residential action levels (Worksheet #15).
- Account for Background Contributions: Conduct building surveys and chemical inventories in structures slated for indoor air sampling to differentiate potential soil gas sources from background/consumer product sources.
- Protect Perimeter Receptors: Define the outermost limits of the soil gas COC plume to ensure off-site or perimeter structures are not threatened by potential plume migration.

To meet these goals, soil gas monitoring in the Jetty Street study area at Site 12 will be conducted to determine:

- The stability of the soil gas COC plumes, including evaluating temporal and seasonal changes in concentrations by collecting data from existing soil gas probes for a minimum of four consecutive quarters.
- Whether concentrations of COCs in soil gas are detected at levels greater than or equal to action levels (Worksheet #15).
- The vertical and lateral extent of COC concentrations in soil gas as defined by the action levels (Worksheet #15) relative to existing building foundations.
- The vadose zone conditions relative to the stability of the COC plume and what trends and temporal changes in COC concentrations are taking place that may be indicative of rebound.

Alternative outcomes for the proposed study questions are identified in Step 5.

5.3 Step 3: Identify Information Inputs

Inputs or potential inputs to decisions are:

- COC concentrations in soil gas over time
- Derived risk-based action levels (Worksheet #15)
- Soil gas plume contours
- Vadose zone properties (e.g., stratigraphy, moisture, preferential pathways) that may influence soil gas COC plume behavior.
- COC concentrations in soil gas before and after SVETS operation
- Building locations and use (i.e., commercial or residential)
- Building surveys and chemical inventories
- Indoor air COC concentrations
- Sub-slab COC concentrations
- Ambient air COC concentrations

5.4 Step 4: Define the Boundaries of the Study

The Site 12 Jetty Street study area is defined by the development tracts in the vicinity of the intersection of Jetty Street and General Stilwell Drive (Figure 1). The Jetty Street study area is in the southern portion

of Site 12 where a trichloroethene (TCE) soil gas plume was previously identified (AES, 2015). Soil gas samples will be collected from six (6) existing soil gas probe clusters at 10-foot intervals from approximately 10 feet below ground surface (bgs) to 70 feet bgs (Worksheet #18). The six (6) existing soil gas probe locations and five (5) SVE well locations at the vicinity of Jetty Street are shown on Figure 1. The spatial boundaries encompass the soil gas plume in the vadose zone from 10 to 70 ft bgs. If triggered by the analytic approach described in Step 5, the study boundaries will expand vertically to include the sub-slab environment (0-12 inches beneath the foundation) and the indoor breathing zone (typically 3-5 feet above the floor).

Samples will be collected from existing soil gas probes quarterly for four consecutive quarters. Additional soil gas probe clusters and/or indoor air and sub-slab soil gas sampling may also be conducted in accordance with the analytic approach identified below. Once sampling for re-characterization of the soil gas plume is complete, soil gas probes will be sampled in compliance with the Soil Gas QAPP (Ahtna, 2026).

The five (5) existing SVE wells in the Jetty Street area (Figure 1) will be operated in accordance with the analytic approach described below during the re-characterization of the plume. Implementation of the analytic approach for the soil gas rebound study with respect to SVETS operation may continue after completion of the study, if appropriate. Sampling of the SVE wells and soil vapor treatment unit (SVTU) will be conducted in accordance with the Soil Gas QAPP (Ahtna, 2026).

5.5 Step 5: Develop the Analytic Approach

The actions assigned are no action, additional probe installation, indoor air and sub-slab soil gas sampling, and SVETS operation with the location of the detected concentration driving which land-use scenario and action levels are most pertinent. In other words, if the COC concentration at a soil gas probe cluster in close proximity to a commercial building exceeds the residential and commercial action levels, then the action will be taken for that location; however, if only the residential action level is exceeded, but pertinent land use has been determined to be commercial only, then no action will be required. Worksheet #15 shows the action level concentrations and their derivations for both commercial and residential land-use scenarios for TCE and PCE. After analytical data for quarterly soil gas monitoring event are received, COC plume isoconcentration contour maps for each 10-foot interval from 10 feet bgs to 70 feet in the Jetty Street study area will be generated. Contour lines will represent the action level concentrations presented in Worksheet #15.

For residential areas, the decision rules presented below shall apply to soil gas probe cluster SG-12-24, which is closest to the mixed-use residential/commercial buildings east of General Stilwell Drive and south of Jetty Street. For commercial areas, the decision rules presented below shall be implemented concurrently and apply to soil gas probe clusters SG-12-14, SG-12-15, SG-12-16, SG-12-17, SG-12-23, and SG-12-24 (SG-12-24 is also within 100 feet of two commercial buildings).

5.5.1 Soil Gas Rebound Study

Soil gas probes will be sampled for four consecutive quarters. At the end of this period, a determination will be made based on the data, in combination with historical data, whether COC concentrations are stable, increasing, or declining with the SVETS offline.

- If monitoring data show concentrations of COCs in a soil gas probe are less than or equal to the relevant commercial or residential action level (Worksheet #15), and it can be demonstrated COC concentrations will continue to be less than or equal to the relevant commercial or residential action level in the future, then rebound is not occurring in the soil gas probe under any of the following conditions:
    - If all COCs in the soil gas probe are ND, or a combination of ND sampling results and all detected COC concentrations are below the relevant commercial or residential action level, and sufficient data are available (i.e., a minimum of eight data points), then a statistical analysis of the data will be performed to confirm rebound is not occurring in the soil gas probe.
    - If monitoring data do not lend themselves to a statistical analysis (e.g., fewer than eight data points), then non-statistical review of the data set may be used.
    - If all COCs in the soil gas probe are less than or equal to the relevant commercial or residential action level, and a statistical analysis (i.e., trend analysis) demonstrates COCs will remain less than or equal to the relevant commercial or residential action level in the future (the trend line has a statistically significant zero [steady state] or negative [decreasing] slope, and the 95% upper confidence limit value is less than or equal to the applicable action level), then rebound is not occurring in the soil gas probe.
- If the statistical analysis or non-statistical review demonstrates COC rebound is not occurring in soil gas probe clusters SG-12-15, SG-12-16, SG-12-17, or SG-12-24, then the SVETS will remain offline.
- If the statistical analysis or non-statistical review indicates an increasing COC concentration trend (rebound) in soil gas probe clusters SG-12-14, SG-12-15, SG-12-16, SG-12-17, SG-12-23, or SG-12-24, then further monitoring may be conducted.
- If the statistical analysis or non-statistical review indicates an increasing COC concentration trend (rebound) that is projected to exceed the relevant commercial or residential action levels in soil gas probe clusters SG-12-15, SG-12-16, SG-12-17, or SG-12-24, then the SVETS may be operated.
- If soil gas COC concentrations increase (rebound) above the relevant commercial or residential action level in soil gas probe clusters SG-12-15, SG-12-16, SG-12-17, or SG-12-24, then the SVETS will be operated.
- The SVETS shall be operated for a minimum of 30 days and the affected soil gas probe clusters shall be resampled. If COC concentrations at soil gas probe clusters SG-12-15, SG-12-16, SG-12-17, or SG-12-24 remain above the relevant commercial or residential SVETS operation action level, then the SVETS shall continue to operate.
- If COC concentrations at soil gas probe clusters SG-12-15, SG-12-16, SG-12-17, or SG-12-24 have been reduced to below the relevant commercial or residential SVETS operation action level, then the reduction in COC concentrations will be determined by comparing pre- and post-SVETS operation COC concentrations to assess the effectiveness of the SVETS in removing COC mass from the vadose zone.

5.5.2 Soil Gas Plume Delineation

If it is determined additional data are needed to close data gaps or otherwise re-characterize the soil gas plume previously identified in the Jetty Street area, then up to three (3) additional soil gas probe clusters with up to seven (7) probes each may be installed in the Jetty Street study area. Three conditions must be met to trigger installation of additional soil gas probes:

- The average COC concentrations at all of the sampled probes in an existing soil gas probe cluster exceed the relevant action levels (Worksheet #15) for a minimum of three consecutive quarters.[4]
- The existing soil gas probe cluster is less than 100 feet away from an existing occupied building.
- There is an apparent data gap between the existing soil gas probe cluster and the existing building as demonstrated by quarterly COC plume isoconcentration contour maps and a COC plume isoconcentration contour map for COC concentrations averaged over a minimum of three quarters.

If agreed amongst the organizational partners (stakeholders) identified in Worksheet #1 & 2, the SVETS may be operated instead of installing additional soil gas probe clusters to address soil gas rebound in the Jetty Street area (see Section 5.5.1).

5.5.3 Sub-Slab Soil Gas and Indoor Air Sampling

Up to five (5) paired sub-slab soil gas and indoor air samples, with associated outdoor ambient air samples, may be collected in existing buildings in the Jetty Street study area. The following analytic approach will be applied to determine if sub-slab soil gas and indoor air sampling are needed:

- If quarterly COC plume isoconcentration contour maps and a COC plume isoconcentration contour map for COC concentrations averaged over a minimum of three quarters indicate COC concentrations exceed the relevant commercial or residential action levels (Worksheet #15) at 10 feet and/or 20 feet beneath an existing building, then paired sub-slab soil gas and indoor air samples and corresponding outdoor ambient air samples shall be collected. Analytical results from probes deeper than 20 feet would not be a trigger for sub-slab soil gas and indoor air sampling. Two rounds of sampling will be conducted to account for seasonality.
- If COC concentrations detected in 10-foot and/or 20-foot soil gas probes within 50 feet of an existing building and averaged over a minimum of three quarters indicate COC concentrations exceed the relevant commercial or residential action levels (Worksheet #15), then paired sub-slab soil gas and indoor air samples and corresponding outdoor ambient air samples shall be collected. Two rounds of sampling will be conducted to account for seasonality.
- If the COC concentrations for indoor air in a specific commercial or residential space exceed the relevant commercial or residential action level (Worksheet #15), and analytical results for the paired sub-slab samples and corresponding ambient air samples indicate vapor intrusion as the source, then the SVETS shall be activated to address potential vapor intrusion risk.
- The SVETS shall be operated for a minimum of 30 days and the affected commercial or residential space indoor air and sub-slab shall be resampled. If COC concentrations in indoor air

[4] The consecutive quarters may be applied retroactively to include data collected in the First Quarter 2025 and the Second Quarter 2025.

remain above the action level, and analytical results for the paired sub-slab samples and corresponding ambient air samples indicate vapor intrusion as the source, then the SVETS shall continue to operate and additional short-term and long-term measures will be evaluated (e.g., increasing ventilation, sealing potential conduits, treating indoor air, expansion of the existing SVETS).

If agreed amongst the organizational partners (stakeholders) identified in Worksheet #1 & 2, the SVETS may be operated instead of sub-slab soil gas and indoor air sampling to address soil gas rebound in the Jetty Street area (see Section 5.5.1).

5.6 Step 6: Specify Performance or Acceptance Criteria

See Soil Gas QAPP (Ahtna, 2026) Section 3.2.6.

5.7 Step 7: Develop the Plan for Obtaining Data

The sampling approach is non-random and based on professional judgment. To limit uncertainty in obtained environmental data, criteria for precision, accuracy, representativeness, completeness, comparability parameters, and reporting limits for the parameters have been developed and are presented in the Soil Gas QAPP (Ahtna, 2026). Measurement errors will be controlled by using the appropriate sampling and analytical methods, adhering to the requirements of QSM Version 5.4 (DoD, 2021), and data validation/review to verify laboratory processes and measurement quality objectives. The data that meet these criteria will be of definitive quality.

The optimum sampling design is derived for the Site 12 Jetty Street study area as a result of the DQO process. The overall sampling network design, including sample collection locations, rationales, and frequencies, was established to achieve DQOs (Worksheet #17 and Worksheet #18). The USEPA Method TO-15 analytical procedure for this project was selected to accurately quantify the chemicals of interest at the levels of concern. Soil Gas QAPP Worksheets #19 & 30, #20, and #24-#28 specify analysis design requirements for USEPA Method TO-15.

6.0 Worksheet #14 & 16: Project Tasks & Schedule

This section includes information specific to soil gas plume characterization in the Jetty Street study area. Additional project task information is found in Soil Gas QAPP Worksheet #14 & 16.

6.1 Project Tasks

Applicable standard operating procedures (SOPs) for the project tasks outlined in this Worksheet are listed in Worksheet #21 and provided in detail in Attachment A.

6.1.1 Soil Gas Sampling

Sampling is described in Worksheets #17 and #18. Existing soil gas probe clusters will be sampled for four consecutive quarters, starting in Third Quarter of 2025.

6.1.2 Soil Gas Probe Cluster Installation

This section will apply if it is determined that additional soil gas probe cluster(s) are required per the decision criteria identified in Worksheet #11.

Pre-Field Activities

Notification and Access

Property owners will be notified of fieldwork activities at least three days before the start of work. Site users will be coordinated with for site access, limited access to the project site during construction, and scheduling changes.

Permitting

Permits for soil gas probe installation will be obtained from the Monterey County Department of Health; however, no permit fees are required to be paid because the former Fort Ord is a CERCLA site.

Utility Clearance

A utility clearance will be performed at the proposed soil gas probe cluster location(s) before drilling activities commence to avoid encountering underground utilities and other potential obstructions. Clearance activities include notification of utility agencies and/or utility protection organizations, as appropriate, in addition to performing onsite surveys using the appropriate geophysical equipment. Locations of utilities will be marked on the ground surface with indications of the assumed type of utility. Prior to initiating intrusive activities, utility location information will be reviewed, including field markings and available drawings, to ensure the boring is a minimum of 3 feet away from a marked utility. The asphalt pavement will be cut with a cutting tool to access the boring location, which will be hand augured (or similar method) to a depth of 5 feet bgs.

Traffic Control Plan

If required, the proposed location for any new soil gas probe will be determined based on available data. The Jetty Street area is developed and includes parking lots and roadways with moderate to high public and/or property user traffic. Traffic control around the project site with proper safety delineators and protocol will be adhered to as described in the Accident Prevention Plan (APP; Ahtna, 2024).

Material Handling

Both hazardous and non-hazardous wastes may be generated during fieldwork activities. These wastes will be managed as described in Section 6.2. Chemicals brought onsite will be managed per the Hazard Communication Program in the APP (Ahtna, 2024).

Support Facilities

Support facilities include lockable containers, chemical toilets, portable containment tanks and bins with lids. Lockable support facilities will be secured when project personnel are not on site. Decontamination facilities will consist of portable secondary containment for personnel and an equipment decontamination pad. Decontamination water will be collected in portable tanks for disposal (see Section 6.2). It is anticipated most of the support facilities will be located in the vicinity of the Sites 2/12 groundwater treatment plant (GWTP).

Field Activities

Borehole Drilling and Logging

Up to three borings will be completed by a California-licensed contractor using a truck- or track-mounted hollow-stem auger drill rig. The work area footprint for these drill rigs, including support vehicles and drilling equipment, is expected to be approximately 25 feet by 50 feet or 1,250 square feet.

The borehole diameter will be sized to assure proper borehole sidewall clearance for soil gas probe cluster construction. The boring will be completed under the supervision of the Project Geologist/Engineer who will be responsible for oversight of borehole logging, probe installation, and surface completion. General procedures for borehole drilling and logging include:

- The soil gas probe cluster location will be verified and determined to be safe for construction operations from underground utilities and aboveground hazards.
- Drilling equipment will be staged to avoid disturbing the normal flow of traffic using safety delineators as needed.
- The pavement will be cut around the borehole location with a cutting tool.
- A hand auger will be used to advance the borehole from 0 to 5 feet bgs to ensure there are no underground utilities at the borehole location.
- Drilling will commence and removed soil will be classified in accordance with the Unified Soil Classification System.
- Soil cuttings or cores will be containerized for transport and disposal per Worksheet #14 & 16, Section 6.2. Other liquid and solid investigation derived waste (IDW) will be handled according to Section 6.2.
- The borehole is advanced by continuous flight augers with hollow stems that are driven by top head rotary machines. The soil cuttings are removed from the borehole via helical flights and placed in a bin adjacent to the borehole. The borehole will be logged from soil cuttings as they come off the augers. The augers keep the borehole open during drilling and allow for installation of the well casing through the stem while removing the augers once total depth is reached.

Drilling equipment brought to the site will be in operable condition and free of leaks in the hydraulic, lubrication, fuel, and other fluid systems. Downhole equipment and tools will be maintained in a clean condition throughout well installation activities.

Soil Gas Probe Cluster Construction

Seven nested permanent soil gas probes will be constructed in each of the proposed soil borings at approximately 10-foot intervals below ground surface. Probe depths may change based upon soil conditions and actual depth to groundwater. Soil gas probe cluster construction details will be recorded in the field using the forms in Attachment B.

Soil Gas Probe Cluster Construction Materials

Soil gas probe cluster construction materials will be in accordance with field standard operating procedure (FSOP)-607. Construction materials will be new, clean, and in good condition.

Environmental Protection Plan

Environmental protection is defined as maintaining the environment in its natural state, to the extent possible, during and after fieldwork activities and returning the disturbed site to conditions similar to those present prior to these activities. Environmental protection will consist of protecting air, water, and land.

Air Resources Protection

Fieldwork activities will be conducted to minimize the release of airborne particulates within and outside of the boundaries of the site. Dust and particulates will be controlled in accordance with the APP (Ahtna, 2024) to minimize contaminate dispersion and to protect human health and the environment. It is anticipated, based on the proposed activities, that significant dust will not be generated. Visual air monitoring will be conducted to verify the effectiveness of the program.

Land Resources Protection

The potential for impact to land resources will be minimal because the Jetty Street area is developed and the work area footprint will be minimized.

Water Resources Protection

The potential for impact to surface water resources is minimal because there is no surface water drainage or storm drains that lead to surface water within the project site. Equipment maintenance and fueling will be conducted away from open storm drain inlets.

Post-Field Activities

Surveying

Following soil gas probe cluster installation, the location will be surveyed by a professional California-licensed land surveyor for northing and easting coordinates. Surveying will be conducted using North American 1983 Datum, California State Plane Zone 4 horizontal and North American Vertical Datum of 1988.

6.1.3 Sub-Slab Soil Gas, Indoor Air, and Ambient Air Sampling

This section will apply if it is determined that sub-slab soil gas, indoor air, and ambient air samples are required per decision criteria identified in Worksheet #11.

Pre-Field Activities

Notification and Access

Property owners will be notified of fieldwork activities at least three days before the start of fieldwork. Site users will be coordinated with for site access, limited access to the project site during construction, and scheduling changes.

Building Survey

Document building details, such as foundation/slab condition and type, ventilation, and HVAC. Identify potential indoor sources of vapor-forming chemicals and note potential outdoor sources in the surrounding area. Identify potential vapor entry points.

Utility Clearance

A utility clearance will be performed at the proposed sub-slab location(s) before drilling activities commence to avoid encountering utilities and other potential obstructions, including tension cables that may be present within the slab. Prior to initiating intrusive activities, utility location information will be reviewed.

Material Handling

Both hazardous and non-hazardous wastes may be generated during fieldwork activities. These wastes will be managed as described below in Section 6.2. Chemicals brought onsite will be managed per the Hazard Communication Program in the APP (Ahtna, 2024).

Support Facilities

Support facilities include lockable containers, chemical toilets, portable containment tanks, and bins with lids. Lockable support facilities will be secured when project personnel are not on site. Decontamination facilities will consist of portable secondary containment for personnel and an equipment decontamination pad. Decontamination water will be collected in portable tanks for disposal (see Section 6.2). It is anticipated most of the support facilities will be located in the vicinity of the Sites 2/12 GWTP.

Field Activities

Sub-slab soil gas, indoor air, and ambient air sampling will follow FSOP-413. Sub-slab soil gas probes will be decommissioned following sampling efforts. Indoor and sub-slab samples will be paired.

Sub-Slab Soil Gas Probe Installation

Installation and sample collection will be conducted by a competent technician under the supervision of the Field Supervisor. The work area will be limited to a reasonably small area. Special consideration will be given to slabs with moisture barriers and/or tension cables. General procedures for sub-slab probe installation include:

- The location will be verified and determined to be safe for construction operations from utilities and hazards.
- The work space will be prepared and care taken to minimize the work area footprint.

- A small diameter hole (typically 1.0 to 1.25 inches in diameter) will be drilled through the concrete of the foundation slab. The boring will be advanced three to four inches into the engineering fill below the slab.
- Drill cuttings will be removed from the borehole.
- Sampling probe constructed.

Equipment brought to the site will be in operable condition and in good repair. Equipment and tools will be maintained in a clean condition throughout sub-slab soil gas probe installation activities.

Air Resources Protection

Fieldwork activities will be conducted to minimize the release of airborne particulates. Dust and particulates will be controlled in accordance with the APP (Ahtna, 2024) to minimize contaminant dispersion and to protect human health and the environment. It is anticipated, based on the proposed activities, that significant dust will not be generated. Visual air monitoring will be conducted to verify the effectiveness of the program.

6.2 Investigation-Derived Waste Management and Equipment Decontamination

IDW generated during field activities will be managed per the applicable provision in FSOP-802.00 (Attachment A). Equipment decontamination will be conducted in accordance with FSOP-801.01 (Attachment A).

Investigation-Derived Waste – Liquid

Liquid IDW will be contained in labeled drums or tanks and will be treated at the Sites 2/12 GWTP or Operable Unit 2 (OU2) GWTP. The OU2 and Sites 2/12 groundwater remedy consists of a groundwater pump and treatment system designed to remediate water containing COCs by pumping it through liquid-phase granular activated carbon. Accumulated sediment from equipment decontamination activities will be disposed of at the Fort Ord Landfills.

Investigation-Derived Waste – Soil

Soil IDW will be contained in drums or bins onsite. One representative composite sample of borehole cuttings (soil IDW) will be collected from each soil gas probe cluster drilling location and analyzed for Sites 2/12 soil gas COCs by USEPA Method 8260D. Soil IDW will be disposed of at the Fort Ord Landfills, consistent with the *Record of Decision, Basewide Remedial Investigation Sites* (Army, 1997b) in conjunction with the *Explanation of Significant Differences, Consolidation of Remediation Waste in a Corrective Action Management Unit (CAMU), Operable Unit 2 Landfill* (Army, 1997a) and the *Explanation of Significant Differences, No Further Action for Munitions and Explosives of Concern, Landfill Gas Control, Reuse of Treated Groundwater, Designation of Corrective Action Management Unit (CAMU) Requirements as Applicable or Relevant and Appropriate Requirements (ARARs), Operable Unit 2, Fort Ord Landfills* (Army, 2006), which designates CAMU regulations as ARARs for the Fort Ord Landfills (Title 22 California Code of Regulations, Section 66264.552).

Investigation-Derived Waste – Solid Waste

Solid non-hazardous waste, such as disposable personal protective equipment and non-reusable sampling equipment, will be disposed of in a waste receptacle located at the OU2 GWTP at 11000 Engineering Equipment Road, Marina, California.

6.3 Quality Control Tasks

FSOPs will be implemented and field QC samples, consisting of field duplicate samples will be collected at the frequency of 10 percent (%) the number of project samples with a minimum of 1 per sampling event. Samples will be analyzed by the laboratory in accordance with this QAPP Addendum, the Soil Gas QAPP (Ahtna, 2026), DoD QSM, and the stated method. For items related to QC, see Worksheets #11 and #15 and Soil Gas QAPP (Ahtna, 2026) Worksheets #12, #22, #24, #25, #27, and #28.

6.4 Project Schedule

The project schedule below is subject to change based on QAPP Addendum document review and approval, subcontractor availability, and field conditions. After this QAPP Addendum is finalized, the updated schedule will be maintained, discussed with appropriate parties, and made available upon request.

Activity	Responsible Party	Planned Start Date	Planned Completion Date	Deliverable(s)	Deliverable Due Date
Soil gas monitoring of existing probes (quarterly for four quarters)	Ahtna	Aug 2025	Jun 2026	Soil Gas Confirmation Sampling Report	July 2027
Installation of additional soil gas probe clusters	Ahtna/ Driller	TBD*	TBD*	Soil Gas Confirmation Sampling Report	July 2027
Sub-Slab Soil Gas, Indoor Air, and Ambient Air Sampling (two events)	Ahtna	TBD*	TBD*	Soil Gas Confirmation Sampling Report	July 2027

Notes:
*To be determined (TBD) if activity occurs per the decision criteria identified in Worksheets #11 and #15.

7.0 Worksheet #15: Project Action Limits and Laboratory-Specific Detection/Quantitation Limits

7.1 Project Action Limits

Action	Commercial		Residential	
	TCE (µg/m³)	PCE (µg/m³)	TCE (µg/m³)	PCE (µg/m³)
Soil Gas				
No Action[1]	≤100	≤1570	≤16	≤360
Additional Probe Cluster Installation[1]	>100	>1570	>16	>360
Sub-Slab Soil Gas, Indoor Air, and Ambient Air Sampling	≥300[2]	N/A[4]	≥69[2]	≥1395[5]
SVETS Operation	≥800[3]	≥1800[6]	≥200[3]	≥1800[6]
Indoor Air				
SVETS Operation	≥24[7]	≥526[8]	≥6[7]	≥125[8]

Notes:

µg/m³ = micrograms per cubic meter

[1] The "no action" and "additional probe cluster installation" concentration levels for TCE and PCE were calculated from the USEPA VISL cancer endpoint (ELCR= 1E-6) for the indicated land-use scenario (sub-slab attenuation factor = 0.03).

[2] The indoor air sampling action level for TCE was derived from the USEPA's accelerated response action level (THQ = 1 for the indicated land-use scenario, attenuation factor = 0.03).

[3] SVETS operation action level for TCE in soil gas derived from the USEPA's urgent response action level (THQ = 3 for the indicated land-use scenario, attenuation factor = 0.03).

[4] There is no commercial indoor air sampling action level for PCE because the action level for SVETS operation due to COC concentrations in soil gas is significantly lower than the value calculated using THQ of 1 and an attenuation factor of 0.03 (5,844 µg/m³).

[5] The residential indoor air sampling action level for PCE was calculated using THQ of 1 and an attenuation factor of 0.03.

[6] SVETS operation action level for PCE in soil gas is the PCE SGCL for both commercial and residential because this action level is significantly lower than the values calculated using THQ of 3 and an attenuation factor of 0.03 (17,532 µg/m³ commercial and 4,186 µg/m³ residential).

[7] SVETS operation action level for TCE in indoor air is the USEPA's urgent response action level (THQ = 3 for the indicated land-use scenario, attenuation factor = 0.03).

[8] SVETS operation action level for PCE in indoor air was calculated using THQ of 3, the indicated land-use scenario, and an attenuation factor of 0.03.

7.2 Laboratory-Specific Detection/Quantitation Limits

Matrix: Soil Gas, Indoor Air, Ambient Air
Analytical Method: TO-15 Low-Level[1]
Laboratory: Eurofins[2]

Analyte (CAS #)	Laboratory Limits[3]		
	DL ($\mu g/m^3$)	LOD[4] ($\mu g/m^3$)	LOQ ($\mu g/m^3$)
Tetrachloroethene (127-18-4)	0.21	0.54	0.68
Trichloroethene (79-01-6)	0.15	0.43	0.54

Matrix: Soil Gas, Indoor Air, Ambient Air
Analytical Method: TO-15 PPTV[5]
Laboratory: Eurofins[2]

Analyte (CAS #)	Laboratory Limits[3]		
	DL ($\mu g/m^3$)	LOD[4] ($\mu g/m^3$)	LOQ ($\mu g/m^3$)
Tetrachloroethene (127-18-4)	0.0339	0.0678	0.678
Trichloroethene (79-01-6)	0.0269	0.0537	0.537

Matrix: Soil Gas
Analytical Method: ASTM D1946
Laboratory: Eurofins[2]

Analyte (CAS #)	Laboratory Limits[3]		
	DL (%)	LOD (%)	LOQ (%)
Helium (7440-59-7)	0.0012	0.0031	0.050

Notes:
$\mu g/m^3$ = micrograms per cubic meter
CAS #: Chemical Abstracts Service Number
DL = detection limit
LOD = limit of detection
LOQ = limit of quantitation
[1] See Soil Gas QAPP (Ahtna, 2026) Worksheet #19 & 30 for descriptions of modified TO-15 methods.
[2] Laboratories used for sample analysis maintain DoD Environmental Laboratory Accreditation Program certification (provided in Attachment D of the Soil Gas QAPP (Ahtna, 2026)).
[3] Laboratory limits listed are base values. The final laboratory limits are determined by applying a dilution factor calculated from the SUMMA® canister pressurization measured upon receipt by the laboratory (see Attachment A, SOP 1 of the Soil Gas QAPP (Ahtna, 2026)).
[4] The LODs listed are Eurofins instrument specific.
[5] TO-15 PPTV replaces TO-15 Low-Level as of Second Quarter 2026.

8.0 Worksheet #17: Sampling Design and Rationale

8.1 Existing Soil Gas Probes and SVETS

A complete description of the soil gas probes installed at Site 12, the sample design, and rationale is included in the Soil Gas QAPP (Ahtna, 2026). Six (6) permanent soil gas probe clusters are present in the Site 12 Jetty Street study area (Figure 1). Each soil gas probe cluster includes seven nested probes installed at approximately 10-foot intervals from 10 feet bgs to a depth of approximately 70 feet bgs (Worksheet #18).

Probe ID	Location	Rationale
SG-12-14	Parking lot area north of Jetty Street and west of General Stilwell Drive, approximately 158 feet west of Blaze Pizza.	Delineate vertical and horizontal extent of soil gas plume at location where historical detections of TCE in soil gas exceeded screening levels.
SG-12-15	Walkway area adjacent to Blaze Pizza, approximately 30 feet west of the building.	
SG-12-16	Approximately 95 feet north of the Brass Tap	
SG-12-17	In roadway, approximately 60 feet from the northeast corner of Cinemark.	
SG-12-23	Approximately 120 feet north of Cinemark	Delineate vertical and horizontal extent of soil gas plume in recently developed area.
SG-12-24	Parking area adjacent to new mixed-use development. Approximately 35 feet from the new commercial building.	

A full description of the SVETS, including the SVTU and SVE wells is contained in the Soil Gas QAPP (Ahtna, 2026). Five (5) permanent SVE wells are present in the Jetty Street study area (Figure 1). Samples will be collected from the SVETS based on the decision rules identified in Soil Gas QAPP (Ahtna, 2026) Worksheet #11.

Samples will be analyzed for TCE and PCE by USEPA Method TO-15 Low-Level or TO-15 PPTV (Worksheet #15). The sample analytical results will be assessed via the analytic approach in Worksheet #11 to determine the lateral and vertical soil gas plume extent

8.2 Additional Soil Gas Probe Clusters

Up to three additional soil gas probe clusters may be installed in the Jetty Street study area per decision criteria identified in Worksheet #11. If installed, these additional soil gas probe clusters will be constructed in a similar manner to the existing soil gas probe clusters.

If required, samples from the newly installed soil gas probe clusters will be collected and analyzed following installation per the Soil Gas QAPP (Ahtna, 2026). Samples will be analyzed for TCE and PCE by

USEPA Method TO-15 Low-Level or TO-15 PPTV (Worksheet #15). The sample analytical results will be assessed via the analytic approach in Worksheet #11 to determine the lateral and vertical soil gas plume extent

8.3 Sub-Slab Soil Gas, Indoor Air, and Ambient Air

The following sections present the sampling approach if it is determined that indoor air sampling is required per the decision criteria identified in Worksheets #11 and #15. Sampling locations will be determined based on available soil gas data.

If required, paired sub-slab soil gas and indoor air samples will be collected from commercial and/or residential structures. Sub-slab soil gas and indoor air sample pairs will be collected as close together in time as possible. Two rounds of sampling shall be completed to account for seasonality. Outdoor, ambient air samples will also be collected. The general depth/height and the analytical method are identified in the table below.

Activity	Depth/Height	Analytical Method	Container
Indoor Air	3-5 feet above ground	TO-15 Low-Level or TO-15 PPTV	6-Liter SUMMA
Sub-Slab Soil Gas	3-4 inches below foundation	TO-15 Low-Level or TO-15 PPTV	1-Liter SUMMA
Ambient Air	6 feet above ground	TO-15 Low-Level or TO-15 PPTV	6-Liter SUMMA

Prior to sampling, a building survey will be conducted. During the survey, potential indoor vapor sources will be identified. To the extent possible, indoor sources will be removed 24 to 72 hours prior to sampling. Any nearby outdoor sources will also be documented.

8.4 Deliverables and Reporting

Field daily reports will be presented weekly in Contractor Quality Control Reports during field activities.

Electronic data deliverables will be provided by the laboratory performing analyses in accordance with the Soil Gas QAPP (Ahtna, 2026). Preliminary and validated sample analytical results will be presented at project meetings and in the appropriate Sites 2/12 quarterly and annual reports.

A Completion Report will be prepared following completion of field activities. The Completion Report will describe soil gas probe installation and sampling activities and present geologic logs, soil gas probe completion diagrams, and sample analytical results.

Information will also be presented in the Sites 2/12 quarterly and annual groundwater and soil gas monitoring reports.

9.0 Worksheet #18: Sampling Locations and Methods

9.1 Existing Soil Gas Probe Clusters and Vapor Extraction Wells

Sample Location ID	Soil Gas Probe ID	Analytical Method for PCE & TCE	Sampling Methods/SOPs*
SG-12-14	SG-12-14-10	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
	SG-12-14-20	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
	SG-12-14-30	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
	SG-12-14-40	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
	SG-12-14-50	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
	SG-12-14-60	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
	SG-12-14-70	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
SG-12-15	SG-12-15-10	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
	SG-12-15-20	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
	SG-12-15-30	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
	SG-12-15-40	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
	SG-12-15-50	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
	SG-12-15-60	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
	SG-12-15-70	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
SG-12-16	SG-12-16-10	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
	SG-12-16-20	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
	SG-12-16-30	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802

Sample Location ID	Soil Gas Probe ID	Analytical Method for PCE & TCE	Sampling Methods/SOPs*
	SG-12-16-40	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
	SG-12-16-50	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
	SG-12-16-60	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
	SG-12-16-70	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
SG-12-17	SG-12-17-10	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
	SG-12-17-20	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
	SG-12-17-30	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
	SG-12-17-40	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
	SG-12-17-50	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
	SG-12-17-60	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
	SG-12-17-75	N/A	See note **
SG-12-23	SG-12-23-10	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
	SG-12-23-20	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
	SG-12-23-30	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
	SG-12-23-40	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
	SG-12-23-50	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
	SG-12-23-60	N/A	See note **
	SG-12-23-70	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
SG-12-24	SG-12-24-10	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
	SG-12-24-20	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802

Sample Location ID	Soil Gas Probe ID	Analytical Method for PCE & TCE	Sampling Methods/SOPs*
	SG-12-24-30	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
	SG-12-24-40	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
	SG-12-24-50	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
	SG-12-24-60	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
	SG-12-24-70	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 2, 4; FSOPs -001, -002, -408, -802
VE-12-01	N/A	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 3, 4; FSOPs -001, -002, -802
VE-12-02	N/A	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 3, 4; FSOPs -001, -002, -802
VE-12-03	N/A	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 3, 4; FSOPs -001, -002, -802
VE-12-04	N/A	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 3, 4; FSOPs -001, -002, -802
VE-12-05	N/A	TO-15 Low-Level or TO-15 PPTV	SUMMA®/SOPs 1, 3, 4; FSOPs -001, -002, -802

Notes:
* SOPs and purge volumes, rates, and times are included in the Soil Gas QAPP (Ahtna, 2026)
** No longer functional and cannot be sampled.
FSOP = field standard operating procedure
SG = soil gas [probe]
SOP = standard operating procedure
VE = vapor extraction [well]
N/A = not applicable

9.2 Additional Soil Gas Probe Clusters

If additional soil gas probe clusters are required per the decision criteria identified in Worksheet #11, the location of additional probe clusters will be determined based on available soil gas data. Soil gas probes in each additional probe cluster will be sampled and analyzed for PCE and TCE using USEPA Method TO-15 Low-Level or TO-15 PPVT. Sampling methods and SOPs will be consistent with the existing probes and will include SUMMA®/SOPs 1, 3, 4; FSOPs -001, -002, -802.

9.3 Sub-Slab Soil Gas, Indoor Air, and Ambient Air

If sub-slab soil gas, indoor air, and ambient air sampling is required per the decision criteria identified in Worksheet #11, the location of the sampling will be determined based on available soil gas data and building survey information. Sub-slab soil gas, indoor air, and ambient air samples will be analyzed for

PCE and TCE using USEPA Method TO-15 Low-Level or TO-15 PPVT. Sampling methods will be consistent with FSOP-413.00 (Attachment A).

10.0 Worksheet #21: Field SOPs/Methods

SOPs associated with project sampling are listed. Sampling SOPs are numbered in the "Reference Number" column. The Reference Number is used throughout the QAPP to refer to a specific SOP.

SOP Reference Number	Title, Revision Date and/or Number	Originating Organization of Sampling SOP	Equipment/Sample Type	Modified for Project Work? Yes/No	Comments
1	Guide to Air Sampling, June 27, 2014	Eurofins	Soil Gas	No	See Soil Gas QAPP (Ahtna, 2026)
2	Helium Shroud Spec Sheet, September 30, 2014	Eurofins	Soil Gas	No	See Soil Gas QAPP (Ahtna, 2026)
3	SVE Treatment System Sampling, September 25, 2015	Ahtna	Soil Gas	No	See Soil Gas QAPP (Ahtna, 2026)
4	DoD Environmental Field Sampling Handbook, Revision 1.0, April 2013, Chapter 3. "Common Sampling Procedures"	USACE	All	No	See Soil Gas QAPP (Ahtna, 2026)
5	SVE Treatment System Flow Meter Use	Ahtna	Flow Meter	No	See Soil Gas QAPP (Ahtna, 2026)
FSOP-001	Fieldwork Documentation	Ahtna	NA	No	See Soil Gas QAPP (Ahtna, 2026)
FSOP-002	Sample Management	Ahtna	NA	No	See Soil Gas QAPP (Ahtna, 2026)
FSOP-408	Soil Vapor Sampling	Ahtna	Soil Gas	No	See Soil Gas QAPP (Ahtna, 2026)

SOP Reference Number	Title, Revision Date and/or Number	Originating Organization of Sampling SOP	Equipment/Sample Type	Modified for Project Work? Yes/No	Comments
FSOP-802	Investigation-Derived Waste Management	Ahtna	N/A	No	See Soil Gas QAPP (Ahtna, 2026)
FSOP-413	Sub-Slab Soil Gas, Indoor Air, and Ambient Air Sampling	Ahtna	Sub-Slab Soil Gas, Indoor Air, and Ambient Air Sampling	No	Attachment A*
FSOP-607	Nested Soil Gas Probe Installation	Ahtna	N/A	No	Attachment A*
N/A	Key Instruments 2500 Series Flowmeters; installation and operation manual	Key Instruments	Flow Meter	No	See Soil Gas QAPP (Ahtna, 2026)
N/A	Oil-Less Diaphragm Vacuum Pump & Compressors Operation & Maintenance Manual	Gast Manufacturing	Vacuum Pump	No	See Soil Gas QAPP (Ahtna, 2026)
N/A	Trimble Catalyst DA2	Trimble	GPS	No	See Soil Gas QAPP (Ahtna, 2026)

Notes:
N/A = not applicable
GPS = global positioning system
*Signed final SOPs will be included in the final version of this QAPP.

11.0 References[5]

Ahtna Environmental, Inc. (AEI), 2015. *Final Remedial Action Work Plan Addendum, Sites 2 and 12 Groundwater Remediation, Former Fort Ord, California*. July 10. BW-2738B.

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Ahtna, 2026. *Quality Assurance Project Plan, Former Fort Ord, California, Volume I, Appendix C, Revision 10, Soil Gas Monitoring at Sites 2 and 12, Former Fort Ord, California* (Soil Gas QAPP). October. BW-2792BB.

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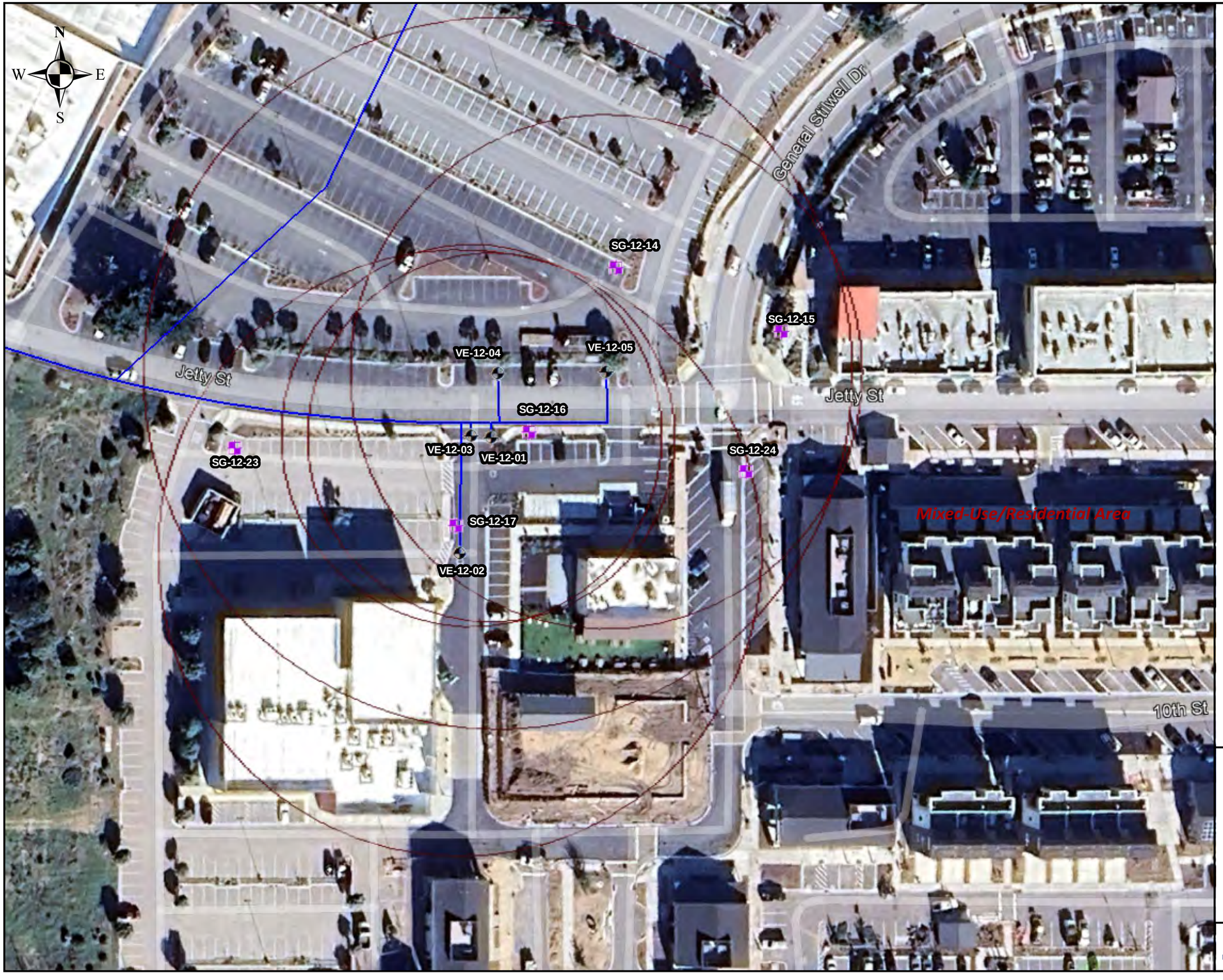
Army, 2016. *Explanation of Significant Differences No. 1, Basewide Remedial Investigation Sites 2 and 12, Former Fort Ord, California*. BW-2794.

U.S. Environmental Protection Agency (USEPA), 2006. "EPA/240/B-06/001, Guidance on Systematic Planning using the Data Quality Objectives Process, EPA QA/G-4." February.

[5] At the end of references included in the Fort Ord Document Library are the Record Numbers (e.g., BW-1234). To find the referenced document, this number may be typed into the Online Search tool at: http://www.fortordcleanup.com/documents/search/. Please note the referenced documents were available in the Fort Ord Document Library at the time this document was issued; however, some may have been superseded by more current versions and were subsequently withdrawn.

Figures



EXPLANATION

- Existing Soil Gas Probes in the Jetty Street Area
- Existing Soil Vapor Extraction Well in the Jetty Street Area
- Site12 SVE Wells ROI (varies from 145 -270 ft)
- Site 12 Soil Vapor Extraction Pipeline

Site 12
Soil Gas Probes and
Soil Vapor Extraction Wells Jetty Street Study Area

Quality Assurance Project Plan
Volume I, Appendix C, Soil Gas Sampling at Sites 2 and 12
Addendum No. 2, Jetty Street Study Area
Former Fort Ord, California

Ahtna	Date: 10/20/2025	Figure: 1

Attachments

Attachment A
Standard Operating Procedures (SOPs)

Sub-Slab Soil Gas, Indoor Air, and Ambient Air Sampling

Document Number	SWE-FSOP-413
Revision	0
Department	Southwest Operations
Previous Document Number	Original Document
Originally Released	January 26, 2026
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Approvals

Christopher Ohland
SWE Quality Assurance Manager

Date

Steve Korbay
SWE Field Quality Control Manager

Date

Project-Specific Modification[1]

[1] Document project-specific modifications in this section. No other modification to the standard operating procedure (SOP) is authorized.

Revision History

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1.0 Introduction

1.1 Purpose

This standard operating procedure (SOP) directs field staff in the proper techniques and documentation requirements to conduct sub-slab soil gas, indoor air, and ambient air sampling.

1.2 Scope

The scope of this SOP applies to field staff conducting sub-slab soil gas, indoor air, and ambient air sampling. The SOP includes guidance for the performance, management, and completion of sampling activities, including a description of staff responsibilities, relevant documentation, equipment, procedures, and quality control. Project-specific accident prevention plans (APP) and Site Safety and Health Plans address potential hazards related to these activities.

Per- and polyfluoroalkyl substances (PFAS)-friendly procedures are also provided in this SOP. When required by the project, use the PFAS-free equipment, materials, and procedures recommended in this SOP indicated by [PFAS Projects].

1.3 Responsibilities

Field Team. A field team is one or more individuals working together. The team is responsible for overseeing and/or collecting transect observations as specified in this SOP.

Field Team Lead (FTL). The FTL reviews project work plan to understand the health and safety needs, procedural specifications, and field documentation requirements. The FTL also reviews and confirms the adequacy of the fieldwork documentation.

Project Manager (PM). The PM or designated Assistant PM is responsible for providing adequate resources to the field staff and ensuring the field team has sufficient experience and training to comply with the SOP successfully. The PM is responsible for approving and documenting techniques not described in this SOP but considered the best methods for the current project.

Safety Representative. The Safety Representative meets the experience and training requirements of USACE EM-385-1-1 (USACE, 2024). The Safety Representative oversees site-specific health and safety activities and ensures compliance with the project requirements. The Safety Representative notifies the FTL of safety deficiencies, incidents, and actions to correct those. If the circumstance warrants, the FTL approves those actions or notifies the PM and the project Site Safety and Health Officer for their approval.

Quality Control Lead (QC Lead). The QC Lead ensures work is performed using the 3-Phases of Quality Control method described in the project work plan. The QC Lead notifies the PM of quality deficiencies and actions to correct them. The PM approves those actions or notifies the SWE Field QC Manager for their approval if the circumstance warrants involvement.

1.4 Definitions

Borehole. Any hole drilled into the sub-slab soil to identify lithology and install sub-slab soil gas probes.

Cuttings. Pieces of sub-slab material cut by a bit while drilling boreholes.

Filter Pack. Granular filter material (sand) placed in the annular space between the soil gas probe's permeable tip and the borehole to increase the effective diameter of the probe and prevent fine-grained material from entering the probe.

Grout. For this SOP, the term "grout" means a neat cement grout generally containing three to five percent bentonite powder to water by weight. The grout is emplaced as a slurry.

2.0 Relevant Documents

This SOP focuses on sub-slab soil gas, indoor air, and ambient air sampling activities and should be used in conjunction with the Department of Defense (DoD) Vapor Intrusion Handbook (TSERAWG, 2009) and associated DoD fact sheets and other applicable SOPs, including the following:

DoD Vapor Intrusion Handbook Fact Sheet Updates

- Fact Sheet Update No: 001, Passive Sampling for Vapor Intrusion Assessment (TSERAWG, 2017a)
- Fact Sheet Update No: 004, Use of Building Pressure Cycling in Vapor Intrusion Assessment (TSERAWG, 2017b)
- Fact Sheet Update No: 006, Determining the Influence of Background Sources on Indoor Air Concentrations in Vapor Intrusion Assessment (TSERAWG, 2017c)
- Fact Sheet Update No: 007, Matrix for Selecting Vapor Intrusion Investigation Technologies (TSERAWG, 2019)

Standard Operating Procedures

- SWE-FSOP-001 Field Documentation
- SWE-FSOP-801 Equipment Decontamination
- SWE-FSOP-802 Investigation-Derived Waste Management
- Guide to Whole Air Sampling – Canisters and Bags (Eurofins, 2014)

Field Forms

- SWE-FFRM-401, Well Construction
- SWE-FFRM-004, Daily PFAS Sampling Checklist [PFAS Projects]

3.0 Equipment and Materials List

Equipment/Supplies

- Camera
- Field forms
- Field logbook
- Health and safety equipment, including safety glasses and nitrile/latex exam gloves as specified in the project Health and Safety Plan
- Measuring tape
- Waterproof, indelible pens/markers in black or blue ink

The list below identifies equipment expected to be used by staff while conducting sub-slab soil gas, indoor air, and ambient air sampling activities.

- A bound, waterproof field logbook (FLB; e.g., Rite in the Rain™ or similar) with pre-numbered consecutive pages for field documentation
  [PFAS Project]: Field logbook made of standard/loose plain paper (non-weatherproof), held together by an aluminum or Masonite field clipboard. Alternatively, a spiral-bound notebook with non-weatherproof paper and/or cover can be used.
- Waterproof, indelible pens/markers in black or blue ink
  [PFAS Project]: Use ball-point pens. Do not use markers, felt pens, or pens with water resistant ink.
- Digital camera/video, cell phone, or other devices capable of digital imagery
- Appropriate personal protective equipment (PPE)

The following materials are usually required for sub-slab soil gas, indoor air, and ambient air sampling. Review project work plan for specific or unique materials or installation procedures.

- Flush mount probe box (optional)
- ⅛-inch or ¼-inch tubing (metal, Nylaflow®, polyetheretherketone [PEEK], Teflon®)
  [PFAS Project]: Do not use Teflon or polyethylene tubing
- Permeable probe tips
- Measuring tape
- Plastic sheeting to protect decontaminated materials
  [PFAS Project]: Clean, dry materials should be stored within a protective medium (e.g., HDPE bag) or staged in a clean area for future use.
- Gas-tight caps
- Deionized water
  [PFAS Project]: use lab-certified PFAS-free water
- Silica sand (sized based on the formation material)
- Bentonite pellets or chips (for seal or borehole fill according to project requirements)
- Pure bentonite powder and cement (for grout; confirm the type of each and mixture specifications)
- Granular bentonite (for dry bentonite transition between filter pack and seal)
- Helium shroud
- Helium detector
- Helium
- Vacuum pump
- SUMMA canister
- Flow regulator
- Pressure gauge

4.0 Pre-Field Planning

It is essential to be thoroughly familiar and compliant with state, county, or local installation standards, codes, etc. They may contain requirements that must be used in conjunction with procedures presented in this SOP.

Site-specific factors must be considered in the selection of installation and completion materials, specification of designs, and drilling methods. The design and other specifications are incorporated into the project work plan or as the FTL/PM directs.

4.1 Clearances

Before breaking ground, confirm that drilling locations have been appropriately cleared of potential overhead, surface, and subsurface hazards per the project work plan. This should include a utility locating subcontractor to identify subsurface infrastructure and anomalies.

Review available forms and diagrams that document the selected location of the drilling location relative to underground utility lines, surface structures, or buried objects.

Copies of the site clearance documents should be kept onsite.

4.2 Building Survey

The contribution of background sources of chemicals to measured concentrations of indoor air must be accounted for in any sampling program. Background indoor air contamination is everything unrelated to the subsurface vapors that migrate into a structure. Background contamination may result from either indoor or outdoor sources and is an important component of the chemicals measured during indoor air sampling.

Prior to sampling, a building survey will be conducted. During the survey, potential indoor vapor sources will be identified. Background indoor air sources of volatile chemicals in residential structures include consumer products, supplies used for personal hobbies, household cleaners, paints, and building supplies. Common products that can cause measurable levels of volatile chemicals in indoor air include, but are not necessarily limited to:

- Adhesives (automotive, household, craft, plumbing)
- Household cleaners
- Lubricants
- Building materials
- Bonders
- Adhesive removers
- Anti-static aerosols
- Automotive parts cleaners
- Paint strippers
- “Spot removers” for fabrics
- Jewelry polish
- Water repellants
- Spray paints
- Dry-cleaned materials (e.g., clothing containing residual dry-cleaning solvents)
- Caulks and sealants
- Cosmetics including hair spray, nail polish and nail polish remover, perfume, cologne
- Air fresheners and odor eliminators
- Insect repellants

To the extent possible, indoor sources will be removed 24 to 72 hours prior to sampling. It should be noted that some materials (e.g., carpeting, drapes, upholstery) may absorb and retain volatile organic compounds (VOCs), slowly releasing them to the indoor environment over a long period of time (weeks or more).

Any nearby outdoor sources, such as those related to automotive exhaust, smoking (e.g., benzene) and commonly emitted solvents, will also be documented. Outdoor sources may include gas stations, industrial facilities,

agricultural activities, and roadways (along with widespread regional sources such as power plants or refineries). The building details, such as foundation/slab condition and type, ventilation, and heating, ventilation, and air conditioning (HVAC) will be recorded. Potential vapor entry points, such as where utilities penetrate the foundation/slab (typically kitchens and bathrooms) will also be noted.

4.3 Health and Safety

- Hold Tailgate Safety Meetings in the manner and frequency stated in the APP.
- Personnel at the site should have appropriate training and qualifications as per the APP.
- Hearing protection is especially critical when drilling, as high noise levels may occur when drilling into and through the sub-slab.
- Establishing clear communication signals with the drilling crew is mandatory because verbal signals may not be heard during the drilling process. The entire crew should be made aware to inform the driller of any unforeseen hazard.

4.4 Site Conditions and Drilling Logistics

Prepare the site per the project work plan. Before mobilizing, determine the logistics of drilling, logging, sampling, cuttings containment, and construction. The FTL should assess the drilling site with the driller. This assessment should identify potential hazards (i.e., slip/trip/fall, utility lines) and determine how drilling operations may impact the environment (i.e., dust, debris, noise). As per the project work plan, potential hazards should be evaluated and corrected, or the borehole location changed or shifted.

- Drill site space requirements commonly include sufficient area for installation/sampling personnel, materials, and equipment.
- The FTL should inform the driller of the appropriate equipment (e.g., cookie-cutter) to penetrate the surface cover (e.g., asphalt, concrete, cement).
- The drilling method will be an electric hammer drill or concrete corer with a 1-inch to 1.25-inch diameter bit.

5.0 Sub-Slab Soil Gas Probe

5.1 Drilling

The following procedures assume that the drilling of the borehole occurred per the project work plan.

During fieldwork, the FTL will generally:

- Observe and monitor operations
- Conduct health and safety monitoring and sampling, and supervise health and safety compliance

After removal of the floor covering, a small-diameter hole will be drilled through the foundation slab. Typically, holes are 1.0 to 1.25 inches in diameter. Either an electric hammer drill or concrete corer is used to drill the hole. Sub-slab utilities, such as water, sewer, and electrical, should be located and clearly marked on the slab prior to drilling. Sub-slab holes should be advanced three to four inches into the engineered fill below the slab. Drill cuttings should be removed from the borehole.

5.2 Sub-Slab Probe Installation

The sampling probe should be constructed with the following specifications:

- Vapor probes are typically constructed of ⅛-inch or ¼-inch diameter tubing with a permeable probe tip.
- Depending on the type of sub-slab probe construction, install a sand pack to minimize disruption of airflow to the sampling tip. Place the probe tip midway in the sand pack, as shown on Figure 1.
- A Teflon™ sealing disk should be placed, as needed, between the probe tip and the blank pipe to prevent the downward migration of wet bentonite into the sand pack.
- Dry granular bentonite should be used to fill the borehole annular space to above the base of the concrete foundation.
- Hydrated bentonite should then be placed above the dry granular bentonite. The bentonite for this portion of probe construction should be hydrated at the surface to ensure proper sealing. Care should be used in placement of the bentonite to prevent post-emplacement expansion which might compromise both the probe and cement seal.
- The remainder of the hole should be filled with bentonite-cement grout if the probe is permanent or with hydrated bentonite if the probe is semi-permanent. Prior to the introduction of this material, the concrete surfaces in the borehole should be cleaned with a damp towel to increase the potential of a good seal.
- Water used in the construction of the probe should be deionized, the cement should be contaminant-free and quick drying, and metal probe components should be thoroughly cleaned to remove manufacturer-applied cutting oils.
- If permanent, each probe should be constructed with a gas-tight fitting and flush-mounted well box so that the probe completion is not a tripping hazard.
- Prior to sampling, at least two hours of time should elapse following installation of a probe to allow the construction materials to cure and allow for the subsurface to equilibrate.

Sub-slab probes should be installed in inconspicuous areas, such as utility closets or beneath stairs. Sub-slab probes should not be installed near the edges of the foundation due to the effects of wind on the representativeness of contaminant concentrations.

Figure 1

Sub-Slab Soil Gas Probe Typical Diagram

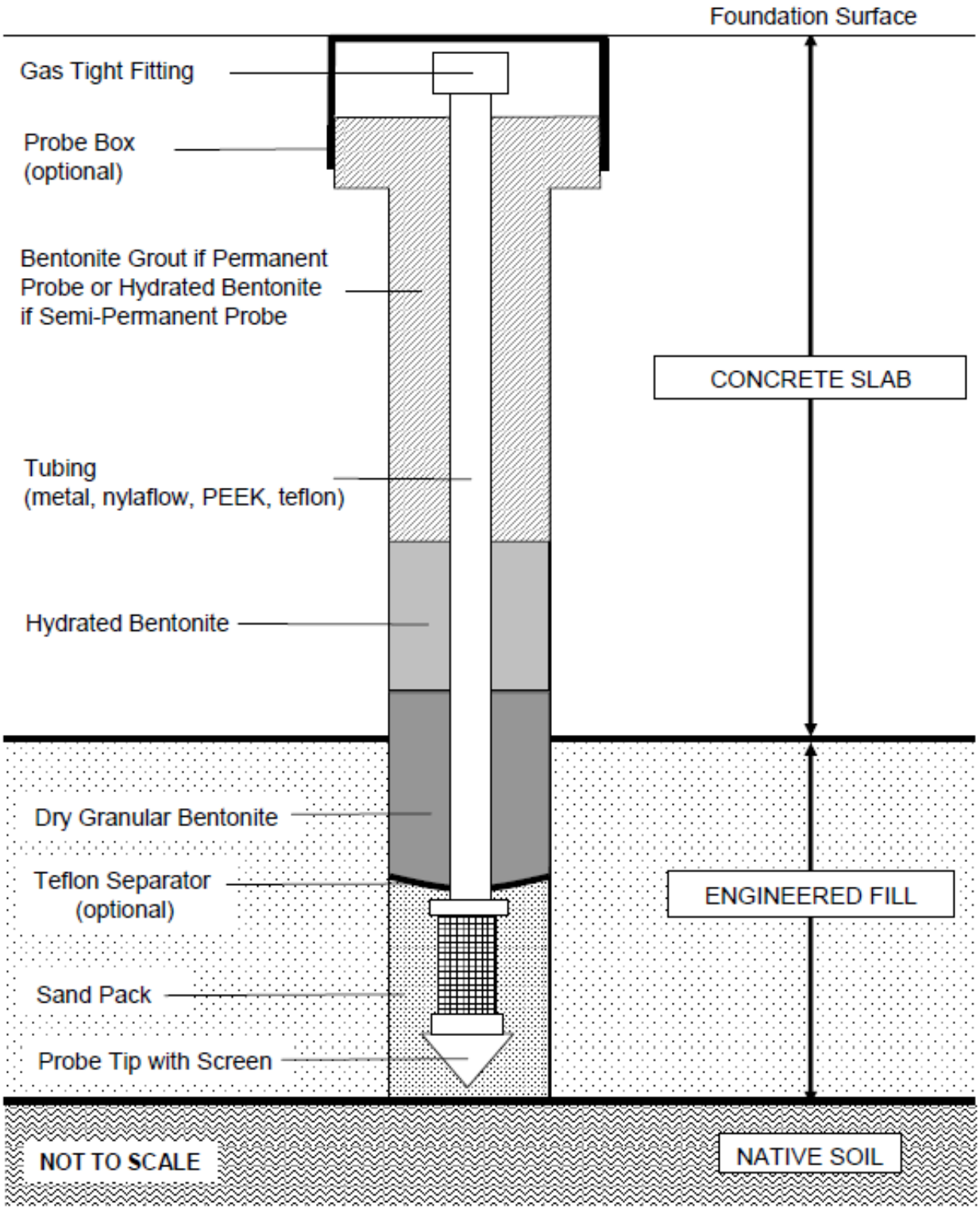

Figure 1 Source: *Advisory – Active Soil Gas Investigations* (CalEPA, 2015)

5.3 Sub-Slab Soil Gas Sampling

The collection of sub-slab samples should include purge volume testing, leak testing, and shut-in testing. Purging and sampling rates should not exceed 200 milliliters per minute.

To avoid air breakthrough from nearby foundation cracks within the slab, sample containers with volumes of less than or equal to one liter should be used. If using passivated metal canisters, the canisters should be returned to the laboratory slightly depressurized.

5.4 Decommissioning

Upon completion of sampling, the sub-slab probes should be properly decommissioned. The probe tip, probe tubing, bentonite, and grout should be removed by over-drilling. The borehole should be filled with grout and concrete patch material. Surface restoration should include a follow-up visit for final sanding and finish work to restore the floor slab and associated floor coverings to their original condition.

6.0 Indoor Air Sampling

Indoor air sampling should be conducted under conservative conditions. In general, the windows of the building should be closed. However, certain exceptions may be necessary if sampling is done in the summer in a building that is not air conditioned. Likewise, ingress and egress activities should be minimized. HVAC systems should be operated normally for the season and time of day. During colder months, heating systems should be operating for at least 24 hours prior to the scheduled sampling event to maintain normal indoor temperatures before and during sampling.

It is generally desirable to conduct concurrent sampling of other media, such as sub-slab soil gas, when sampling indoor air. Sampling media concurrently will give a more accurate representation of contaminant migration and reduce the uncertainty associated with the temporal variability in contaminant concentration data.

6.1 Sampling Duration

For the first sampling event, indoor air samples should be collected over a 24-hour period to ensure diurnal fluctuations in vapor intrusion and indoor air concentrations are included in the sampling period. After vapor intrusion is confirmed, sampling events should be conducted to produce representative concentrations of the monitored compounds over the anticipated daily exposure period for building occupants. Hence, air samples should be collected over a 24-hour period for residential structures, over an 8-hour period for non-residential structures, and over a typical school day for students. When feasible, 24-hour and 8-hour sampling may be conducted during the same sampling event. In some cases, indoor air samples may be collected with passive samplers for longer sampling periods.

6.2 Number of Samples and Locations

All floors of a residential structure potentially subject to vapor intrusion should be sampled for indoor air quality. Occupied areas, as well as basements, should be sampled. Sampling devices should be located in the breathing zone, approximately 3 to 5 feet off the ground for adults and at lower sampling heights if the receptors of concern are children as in a daycare center or school. Samples should be collected in the center of the room, away from doors. At a minimum, it is recommended that sampling points include the primary living area and likely locations for subsurface vapor entry (typically the bathroom or kitchen). In office buildings, samples should be collected

from primary work areas and near the points of vapor entry (such as sumps, elevator shafts or floor drains) to help define the potential routes of entry.

6.3 Sampling Equipment

When sampling indoor air with evacuated canisters, extra canisters, pressure gauges, and flow regulators should be taken into the field in case the integrity of some of the canisters is compromised or if some flow regulators and pressure gauges malfunction. Each sampling canister should have a dedicated vacuum gauge. The gauge is needed to verify the canister is properly evacuated prior to initiation of sampling and to demonstrate that the canister is slightly depressurized upon completion of the sampling. Likewise, the gauge will indicate whether the canister's flow regulator is functioning properly during sample collection. Flow regulators should be configured to produce a constant sampling rate. Sampling canisters, along with flow regulators and pressure gauges, should be certified clean to the laboratory's method reporting limit.

7.0 Ambient Air Sampling

Site-specific ambient (outdoor) air samples should be collected when indoor air sampling is conducted, with the realization that indoor and outdoor air samples will always have detectable concentrations of common air pollutants. Ambient air samples should be collected at locations that are not influenced by subsurface contamination. Therefore, ambient air samplers should be located upwind of subsurface plumes. In addition, information on the types of industry in the neighborhood should be used when selecting ambient sample locations and interpreting the air data. The ambient air data can be used as a qualitative tool to provide information regarding outside influences on indoor air quality.

The following should be considered when collecting ambient air samples:

- Sampling devices should be located approximately six feet off the ground.
- Ambient sampling should be conducted concurrent with the indoor air sampling.
- Ambient samples should be collected in upwind locations.
- Ambient samples should be located away from gasoline stations, automobiles, gasoline powered engines, fuel and oil storage tanks, chemical storage areas, and dry cleaners.
- Sampling devices should be placed at least 10 feet beyond a tree's drip line.
- Ambient air samples should be collected on the upwind side of a building at a distance equal to twice the height of the building.
- Three ambient samples, at a minimum, should be collected with each indoor air sampling event

8.0 Demobilization/Site Restoration

Debris generated by the drilling operation/sub-slab soil gas probe construction/decommissioning should be disposed of appropriately. The site should be cleaned and the site conditions restored as per the project work plan. Any hazards remaining due to drilling activities should be identified and appropriate barriers and markers should be put in place per the APP. Soil cuttings and fluids should be adequately contained, clearly labeled, and maintained to comply with the project work plan.

9.0 Document Control

Field forms should be completed in their entirety. If an entry is not applicable, indicate "n/a" or line out the entry.

After a task or project, field documentation, including the field logbook and field forms, will be scanned and placed on the server in the appropriate folder, along with photographs and GPS data. Original documents will be submitted to the PM/Assistant PM and kept in the project file. See FSOP-001 (Field Documentation).

10.0 Quality Assurance/Quality Control

Conduct the 3-Phases of Quality Control Method described in the project work plan.

Quality Assurance (QA) and Quality Control (QC) procedures for sub-slab soil gas, indoor air, and ambient air sampling field documentation review will be performed by the FTL or PM to confirm that procedures and documentation content and level of detail comply with this SOP. If a deficiency or a variance is identified, the PM should document the deficiency/variance and determine the need for corrective action in coordination with the QA Manager.

11.0 Documentation Review

The FTL is responsible for the daily review of the fieldwork documentation for legibility and compliance with requirements identified in Sections 4.0, 5.0, 6.0, and 7.0. Errors and omissions should be explained, and revisions to an entry should be signed and dated by the FTL.

The PM is responsible for the review and signoff of final approved documents stored in the project file.

12.0 References

California Environmental Protection Agency (CalEPA), 2015. *Advisory – Active Soil Gas Investigations*. July. Available from: https://dtsc.ca.gov/wp-content/uploads/sites/31/2021/11/VI_ActiveSoilGasAdvisory_FINAL_a.pdf

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Nested Soil Gas Probe Installation

Document Number	SWE-FSOP-607
Revision	0
Department	Southwest Operations
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Approvals

Christopher Ohland
SWE Quality Assurance Manager

Date

Steve Korbay
SWE Field Quality Control Manager

Date

Project-Specific Modification[1]

[1] Document project-specific modifications in this section. No other modification to the standard operating procedure (SOP) is authorized.

Revision History

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1.0 Introduction

1.1 Purpose

This standard operating procedure (SOP) directs field staff in the proper techniques and documentation requirements to install nested soil gas probes.

1.2 Scope

The scope of this SOP applies to field staff conducting nested soil gas probe installation oversight. The SOP includes guidance for the performance, management, and completion of installation activities, including a description of staff responsibilities, relevant documentation, equipment, procedures, and quality control. Project-specific accident prevention plans (APP) and Site Safety and Health Plans address potential hazards related to nested soil gas probe installation.

Per- and polyfluoroalkyl substances (PFAS)-friendly procedures are also provided in this SOP. When required by the project, use the PFAS-free equipment, materials, and procedures recommended in this SOP indicated by [PFAS Projects].

1.3 Responsibilities

Field Team. A field team is one or more individuals working together. The team is responsible for overseeing and/or collecting transect observations as specified in this SOP.

Field Team Lead (FTL). The FTL reviews project work plan to understand the health and safety needs, procedural specifications, and field documentation requirements. The FTL also reviews and confirms the adequacy of the fieldwork documentation.

Project Manager (PM). The PM or designated Assistant PM is responsible for providing adequate resources to the field staff and ensuring the field team has sufficient experience and training to comply with the SOP successfully. The PM is responsible for approving and documenting techniques not described in this SOP but considered the best methods for the current project.

Safety Representative. The Safety Representative meets the experience and training requirements of USACE EM-385-1-1 (USACE, 2024). The Safety Representative oversees site-specific health and safety activities and ensures compliance with the project requirements. The Safety Representative notifies the FTL of safety deficiencies, incidents, and actions to correct those. If the circumstance warrants, the FTL approves those actions or notifies the PM and the project Site Safety and Health Officer for their approval.

Quality Control Lead (QC Lead). The QC Lead ensures work is performed using the 3-Phases of Quality Control method described in the project work plan. The QC Lead notifies the PM of quality deficiencies and actions to correct them. The PM approves those actions or notifies the SWE Field QC Manager for their approval if the circumstance warrants involvement.

1.4 Definitions

Borehole. Any hole drilled into the subsurface to identify lithology, collect soil samples, and install soil gas probes.

Cuttings. Pieces of soil, sediment, or rock cut by a bit while drilling boreholes.

Filter Pack. Granular filter material (sand, gravel, etc.) placed in the annular space between the soil gas probe's permeable tip and the borehole to increase the effective diameter of the probe and prevent fine-grained material from entering the probe.

Grout. For this SOP, the term "grout" consists of a neat cement grout generally containing three to five percent bentonite powder to water by weight. The grout is emplaced as a slurry.

Hollow-Stem Auger Drilling. A drilling method using augers with open centers. The augers are advanced with a screwing or rotating motion into the ground. Cuttings are brought to the surface by the rotating action of the augers, thereby clearing the borehole.

Tremie. A tubular device or pipe used to place grout, bentonite, or filter pack in the annular space. Material should be placed in the borehole with a tremie pipe at depths below 15 feet below ground surface.

2.0 Relevant Documents

This SOP focuses on the oversight and documentation of nested soil gas probe installation activities and should be used in conjunction with the Department of Defense (DoD) Vapor Intrusion Handbook (TSERAWG, 2009) and other applicable SOPs, including the following:

Standard Operating Procedures

- SWE-FSOP-001 Field Documentation
- SWE-FSOP-300 Series (various drilling methods)
- SWE-FSOP-801 Equipment Decontamination
- SWE-FSOP-802 Investigation-Derived Waste Management

Field Forms

- SWE-FFRM-401, Well Construction
- SWE-FFRM-004, Daily PFAS Sampling Checklist [PFAS Projects]

3.0 Equipment and Materials List

Equipment/Supplies

- Camera
- Field forms
- Field logbook
- Health and safety equipment, including safety glasses and nitrile/latex exam gloves as specified in the project Health and Safety Plan
- Measuring tape
- Waterproof, indelible pens/markers in black or blue ink

The list below identifies equipment expected to be used by staff while supervising nested soil gas probe installation activities.

- A bound, waterproof field logbook (FLB; e.g., Rite in the Rain™ or similar) with pre-numbered consecutive pages for field documentation

[PFAS Project]: Field logbook made of standard/loose plain paper (non-weatherproof), held together by an aluminum or Masonite field clipboard. Alternatively, a spiral-bound notebook with non-weatherproof paper and/or cover can be used.

- Waterproof, indelible pens/markers in black or blue ink

  [PFAS Project]: Use ball-point pens. Do not use markers, felt pens, or pens with water resistant ink.
- Digital camera/video, cell phone, or other devices capable of digital imagery
- Appropriate personal protective equipment (PPE)

The following materials are usually required for nested soil gas probe installation. Review project-specific work plan for specific or unique materials or installation procedures.

- Steel protective locking cover or flush-mount well box and locking cap
- ⅛-inch or ¼-inch tubing (metal, Nylaflow®, polyetheretherketone [PEEK], Teflon®)

  [PFAS Project]: Do not use Teflon or polyethylene tubing
- Permeable probe tips
- Measuring tape
- Plastic sheeting to protect decontaminated materials

  [PFAS Project]: Clean, dry materials should be stored within a protective medium (e.g., HDPE bag) or staged in a clean area for future use.
- Downhole support rod (small diameter PVC or metal pipe, capped on both ends) for probes greater than 15 feet below ground surface
- Gas-tight caps
- Centralizers to keep the downhole rod centered in the borehole
- Silica sand (sized based on the formation material)
- Bentonite pellets or chips (for seal or borehole fill according to project requirements)
- Pure bentonite powder and cement (for grout; confirm the type of each and mixture specifications)
- Granular bentonite (for dry bentonite transition between filter pack and seal)
- Tremie pipe

4.0 Pre-Field Planning

It is essential to be thoroughly familiar and compliant with state, county, or local installation standards, codes, etc. They may contain requirements that must be used in conjunction with procedures presented in this SOP.

Site-specific factors must be considered in the selection of installation and completion materials, specification of designs, and drilling methods. The design and other specifications are incorporated into the project work plan or as the FTL/PM directs.

4.1 Clearances

Before breaking ground, confirm that drilling locations have been appropriately cleared of potential overhead, surface, and subsurface hazards per the project work plan. This should include a utility locating subcontractor to identify subsurface infrastructure and anomalies. The clearance process also includes completing public utility locating service calls (e.g., Dig Alert, USA North 811) and completing any coordination and permitting procedures with the onsite Department/Directorate of Public Works personnel required by the project contract.

Review available forms and diagrams that document the selected location of the drilling location relative to underground/overhead utility lines, surface structures, or buried objects.

Copies of the site clearance documents should be kept onsite.

4.2 Health and Safety

- Hold Tailgate Safety Meetings in the manner and frequency stated in the APP.
- Personnel at the site should have appropriate training and qualifications as per the APP.
- Personnel within the exclusion zone should pay close attention to rig operations during drilling. The rotating or swinging drilling components can snag or catch loose clothing or strike personnel and cause severe injury or death.
- Hearing protection is especially critical when sonic drilling, as the rig can generate high-frequency noise and considerable noise when drilling through gravel and cobbles.
- Establishing clear communication signals with the drilling crew is mandatory because verbal signals may not be heard during the drilling process. The entire crew should be made aware to inform the driller of any unforeseen hazard—or when anyone is approaching the exclusion zone.

4.3 Equipment Blank Testing

A representative section of tubing will be equipment blank tested by using the longest length of tubing expected and sampling without purging, collecting a volume that is less than the amount of air within the tubing.

A representative permeable probe tip will be equipment blank tested by running deionized water over and through the inside of the tip into a sample bottle.

4.4 Site Conditions and Drilling Logistics

Prepare the site per the project work plan. Before mobilizing, determine the logistics of drilling, logging, sampling, cuttings containment, and construction. The FTL or the Field Geologist should assess the drilling site with the driller. This assessment should identify potential hazards (i.e., slip/trip/fall, overhead power lines) and determine how drilling operations may impact the environment (i.e., dust, debris, noise). As per the project work plan, potential hazards should be evaluated and corrected, or the borehole location changed or shifted.

- Drill site space requirements commonly include an area for the rig and swing-out clearances, access for a support truck, and forklift and/or debris bin.
- The FTL or the Field Geologist should inform the driller of the appropriate equipment (e.g., cookie-cutter) to penetrate the surface cover (e.g., asphalt, concrete, cement).
- Lubricating compounds used on drill pipe and drive casing threads must be approved in advance and must not contain compounds incompatible with project objectives.
- The drilling method will be hand auger, direct push, or hollow-stem auger. Air rotary and rotosonic drilling methods disrupt the soil gas equilibrium and should not be used unless there is a longer equilibrium time prior to sampling. Mud rotary drilling is not an appropriate method for installing soil gas probes.

4.5 Mobilization

- The drill rig is mobilized to the site and located over the borehole location
- The drill rig is leveled with a set of hydraulic pads attached to the front and rear of the drill rig

- The driller should always raise the mast slowly and carefully to prevent tipping or damaging the rig and avoid obstructions or hazards

5.0 Nested Soil Gas Probe Installation Procedures

5.1 Drilling

The following procedures assume that the drilling of the borehole occurred per the project work plan and appropriate SOPs (see SWE-FSOP-300 Series [various drilling methods]).

During fieldwork, the Field Geologist will generally:

- Observe and monitor rig operations
- Conduct health and safety monitoring and sampling, and supervise health and safety compliance

5.2 Borehole Preparation

At total depth, remove soil cuttings through circulation or rapidly spin the augers before constructing the nested soil gas probes. Review logs and notes with the driller for any zones or depths exhibiting drilling problems that may affect nested soil gas probe installation. Condition the hole or take other actions mutually agreed upon by the Field Team (FTL, PM, Field/Project Geologist, driller) to aid in soil gas probe installation.

Remove the drill pipe and bit if using rotary techniques, or remove the center bit if using the hollow-stem auger technique. Install the soil gas probe construction materials inside the open borehole or through the drive casing or auger center, using a tremie pipe as needed.

Measure the total depth of the completed boring using a weighted sounding line. The borehole depth is checked to assure that formation material has not heaved to fill the borehole. If heaving has taken place, discuss cleaning, re-drilling, or installation options in the open section of the boring with the Field Team (FTL, PM, Field/Project Geologist, or driller).

5.3 Backfilling Over-Drilled Boreholes

If the hole was over-drilled to a depth greater than needed for soil gas probe installation, backfill material such as grout, filter pack, bentonite pellets, or bentonite chips (as specified in the project work plan) may be added to the bottom of the boring to raise the bottom of the hole to the desired depth.

- Before placing materials, confirm the borehole dimensions and calculate the estimated volume of material required, including allowances for hydration of dry materials.
- Closely monitor the progress of borehole backfilling by frequently tagging the level in the borehole and comparing against estimated fill quantities. This is especially important if irregularities in the borehole are suspected (e.g., voids, sloughing).
- Pump grout through a tremie pipe and fill the borehole from the bottom of the boring upward. During grouting, submerge the tremie pipe below the top of the grout column in the borehole to prevent free fall and bridging.
- Add gradually to prevent bridging if filter pack or bentonite solids (chips/pellets) are used.
- Obtain approval of the final depth of the borehole in advance from the FTL or PM. Stop grout, filter pack, or bentonite addition when the general level has reached approximately one foot below the desired base

of the nested soil gas probes. Hydrate the bentonite plug for at least one hour before installing a filter pack.

5.4 Assembling and Installing Nested Soil Gas Probes

Installation of nested soil gas probes involves constructing multiple probes in one boring so that multiple depths can be sampled at one location to obtain vertical profile soil gas data within the vadose zone. Nested soil gas probes must be sealed between sampling intervals to ensure that the sample collected is from the targeted depth in the vadose zone (Figure 1).

Before installation, inspect the tubing, permeable probe tip, and any other soil gas probe construction materials to confirm that no damage has occurred during shipment and decontamination activities. During the inspection, confirm that materials, dimensions, and quantities are accurate before proceeding. If there are any foreign materials or moisture in the tubing, clean and dry or replace the tubing. Attach the permeable probe tip to the tubing and attach the tubing to the outside of the downhole support rod.

Assemble and carefully lower the downhole support rod with soil gas probes through the open borehole, drive casing, or inside the augers with tremie pipe as needed until the desired depth is reached. Suspend the downhole support rod by the installation rig, so it does not rest on the bottom of the boring. If the downhole support rod was dropped, lowered abruptly, or for any other reason suspected of being damaged during placement, the downhole support rod and attached soil gas probes should be removed from the boring and inspected.

In certain instances, the downhole support rod and attached soil gas probes may rise after being placed in the borehole due to heaving sands. If this occurs, the driller must not place any drilling equipment (drill pipe, hammers, etc.) to prevent the downhole support rod from rising. The Field Geologist notes the amount of rise and consults with Project Geologist for an appropriate course of action.

Use centralizers on the downhole support rod to keep it centered in the borehole.

Record the following information in the FLB/notepad:

- Diameter of the boring
- Total depth of boring
- Total length of each probe's tubing
- Depth of each probe's permeable tip

5.5 Installing Filter Pack and Transition Bentonite

Based on borehole and soil gas probe dimensions, calculate volumes of filter pack, dry bentonite, and bentonite pellets or grout required. Place a layer of filter pack (one to two feet, unless otherwise specified in the project work plan) at the bottom of the borehole.

When constructing nested soil gas probes within a cased hole or through hollow-stem augers, install the filter pack by pouring and allowing it to free-fall through the center of the drive casing/augers or tremie according to the project work plan. Add filter pack slowly while withdrawing the drive casing/augers. Withdraw the drive casing/augers slowly during filter pack installation in increments no greater than one foot. Take care to minimize the height of the filter pack inside the auger/drive casing during pouring to avoid potentially "sand locking" the downhole support rod and soil gas probe tubing and pulling it up with the auger/drive casing.

Monitor filter pack settlement by initially measuring the sand level (before beginning to withdraw the drive casing/augers). Repeatedly take depth soundings using a weighted tape to continually monitor the level of the sand in the auger/drive casing as it is removed. Monitor the top of the downhole support rod and soil gas probe tubing to detect any movement due to settlement or from drive casing/auger removal. If the top of the downhole support rod and/or soil gas probe tubing moves upwards at any time during the installation process, the driller should not be allowed to force the top of the downhole support rod or tubing from further movement, which could cause the tubing to bend or break in the borehole.

Place the probe midway in the filter pack with approximately six inches of sand below and six inches above the probe. Once approximately one foot thick (or as specified in the project work plan) filter pack placement is complete, measure and record the depth to the top of the pack in the FLB/notepad.

Place an approximately one-foot thick (or as specified in the project work plan) layer of dry granular bentonite between the filter pack and the seal.

5.6 Installing Seals

Above the dry granular bentonite layer, install a seal (hydrated bentonite for temporary probes expected to be in place for less than a year or neat cement-grout for permanent probes) up to the bottom of the next soil gas probe filter pack (or just below ground surface for the shallowest probe). If pellets or chips are used, add them gradually to avoid bridging. Take repeated depth soundings using a weighted tape to ascertain the top of the bentonite seal. Allow the seal to hydrate for at least 30 minutes before proceeding.

- Unless otherwise specified, cement grout should be mixed using approximately 6 to 7 gallons of water per 94-pound bag of Type I/II Portland cement to a density of approximately 15 pounds/gallon.
- If needed, add bentonite (5 to 10 percent) to the cement grout to strengthen the mix and delay the setting time.
- Specific mixtures and other types of cement and grout proposed should be evaluated on a case-by-case basis by the Field Geologist and communicated to the drillers.

During grout installation, maintain the bottom of the tremie pipe below the top of the grout to prevent free fall and bridging. When using drive casing or hollow-stem auger techniques, raise the drive casing/augers in short increments during grout pouring, keeping the bottom of the drive casing/augers below the top of the grout. It is essential to calculate the approximate volume of grout required; note reduced/excessive volumes, which may indicate irregularities in the annulus or grout flow into a formation. Cease grouting when the grout level has risen to approximately one to two feet of the ground surface, depending on the surface completion type (flush-mount versus aboveground). Monitor grout levels to ensure that grout taken into the formation is replaced by additional grout. If settling occurs, additional topping off of the grout may be necessary.

5.7 Surface Completion

Make sure the top of the tubing of each soil gas probe extends enough out of the borehole to allow for ease of sampling. Each tubing should be labeled with the appropriate probe depth identification and capped/secured to prevent foreign materials, moisture, and ambient air from entering the tubing opening with a gas-tight cap.

Before installing any well box or vault over the soil gas probes, confirm clearances between the tubing and inside vault lid and the final height of the vault top above ground surface. Where installations are in parking lots, roads, concrete slabs, etc., consider the final height of the surrounding surface.

Set and cement into position a well box or vault, usually one inch to a few inches above ground surface, depending on design requirements. Raise the top of the well box or vault slightly above grade and slope the cement collar to grade to promote surface drainage away from the well box or vault.

Place the soil gas probe tubing in the vault in a way to reduce the chance of creasing or breaking the tubing, which would compromise the air-tight seal when sampling the probe.

6.0 Demobilization/Site Restoration

Debris generated by the drilling operation/soil gas probe construction should be disposed of appropriately. The site should be cleaned, the ground washed as necessary, and the site conditions restored as per the project work plan. Any hazards remaining due to drilling activities should be identified and appropriate barriers and markers should be put in place per the APP. Soil cuttings and fluids should be adequately contained, clearly labeled, and maintained to comply with the project work plan.

7.0 Document Control

Field forms should be completed in their entirety. If an entry is not applicable, indicate “n/a” or line out the entry.

After a task or project, field documentation, including the field logbook and field forms, will be scanned and placed on the server in the appropriate folder, along with photographs and GPS data. Original documents will be submitted to the PM/Assistant PM and kept in the project file. See FSOP-001 (Field Documentation).

8.0 Quality Assurance/Quality Control

Conduct the 3-Phases of Quality Control Method described in the project work plan.

Quality Assurance (QA) and Quality Control (QC) procedures for soil gas probe installation field documentation review will be performed by the FTL or PM to confirm that procedures and documentation content and level of detail comply with this SOP. If a deficiency or a variance is identified, the PM should document the deficiency/variance and determine the need for corrective action in coordination with the QA Manager.

If a non-registered geologist performs the oversight, a registered Project Geologist is responsible for reviewing the fieldwork documentation for the accurate and complete representation of the drilling and approval of final logs/forms.

9.0 Documentation Review

The FTL is responsible for the daily review of the fieldwork documentation for legibility and compliance with requirements identified in Section 4.0 “Pre-Field Planning” and Section 5.0 “Nested Soil Gas Probe Installation Procedures.” Errors and omissions should be explained, and revisions to an entry should be signed and dated by the FTL.

The PM is responsible for the review and signoff of final approved documents stored in the project file.

10.0 References

California Environmental Protection Agency (CalEPA), 2015. *Advisory – Active Soil Gas Investigations*. July. Available from: https://dtsc.ca.gov/wp-content/uploads/sites/31/2021/11/VI_ActiveSoilGasAdvisory_FINAL_a.pdf

Tri-Service Environmental Risk Assessment Workgroup (TSERAWG), 2009. *DoD Vapor Intrusion Handbook*. January. Available from: https://www.denix.osd.mil/irp/vaporintrusion/

U.S. Army Corps of Engineers (USACE), 2024. *Safety and Health Requirements. EM 385-1-1*. March.

Figure 1

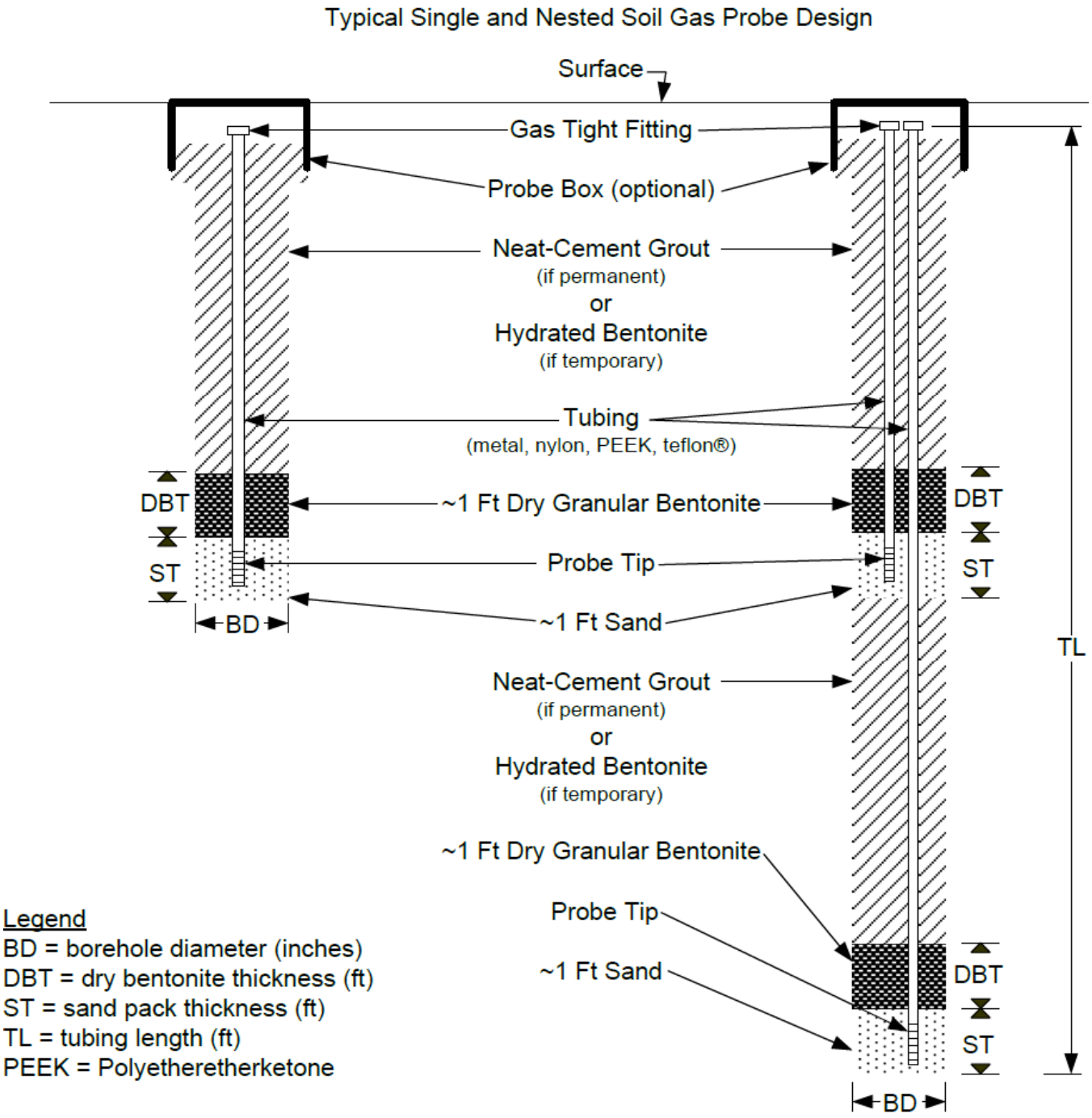

Figure 1 Source: *Advisory – Active Soil Gas Investigations* (CalEPA, 2015)

Attachment B
Field Documentation Forms

Ahtna

Chain of Custody Record

COC Number _____
COC Form _____ of _____

Project Number		Lab Work Order	
Installation/Site		Lab Turnaround Time	◉ 2 w ○ 1 w ○ 3 d ○ 2 d ○ 24 h ○ _____
Activity		Transporter Name	
Purchase Order#		Waybill Number	
Field Team Leader *(name, phone, email)*		Ahtna POC *(name, phone, email)*	

Laboratory Sequence No.	Field Sample ID	Date	Time	Matrix[2]	#.Bottles/Canisters	Preservation Used[1]											Use for Matrix Spike/Dup	Laboratory Point of Contact / Sample Specific Comments
																		(Laboratory Organization)
																		(Laboratory Project Manager)
																		(Telephone)
																		(Email address)
																		Sample Specific Comments

(Comments)

(Relinquished by Field Team/Company)	*(Date/Time)*	*(Received By Field or Laboratory Sample Custodian/Organization)*	*(Date/Time)*	*(Relinquished by/Organization)*	*(Date/Time)*
(Received by/Organization)	*(Date/Time)*	*(Relinquished By/Organization)*	*(Date/Time)*	*(Received by/Organization)*	*(Date/Time)*

[1] Preservation Used: HCl (1), HNO3 (2), H2SO4 (3), NaOH (4), H3PO4, Other _____ (6), Other _____ (7), Other _____ (8), Other _____ (9)

[2] Ambient air (AA), indoor air (AI), soil gas (GS), sediment (SE), soil (SO), ground water (WG), surface water (WS), process water (WT)

Soil Vapor Well/Probe Sampling-Project Specific

Installation/Site		Project Number	
Event Name		Field Team Leader	
Date		Location ID	

Field Team (list name/affiliation)

Weather Conditions

Rain Event (Verify: ☐ <½ in. ☐ ≥½ in.)

A significant rain event is ≥½ inch of rain in a 24-hr period before sampling. If ≥½ inch, obtain field variance.

Sampling Container

Container Type	☐ 1-L Summa	☐ 6-L Summa	☐Tedlar Bag (list size) _____
Certification Level	☐ Batch	☐ Individual	☐ Not Certified

Shut-In Test

Sample Type[1]	Canister ID	Manifold ID	Initial		After 15 minutes		Pass/ Fail[3]
			Time	Vacuum[2]	Time	Vacuum[2]	
N							
FD							

[1] (N) normal (FD) field duplicate (AA) ambient air; extra lines provided for additional shut-in testing
[2] Vacuum measured in inches of mercury (in. Hg)
[3] The shut-in test passes if the drop in vacuum is no greater than 1 in. Hg after 15 minutes of observation

Leak Test

Initial and Final Flow Rate (mL/min.) [4] _____ / _____

Start Time	Helium Concentration (%) [5]								End Time	Pass/ Fail
	t=0 minutes		t=5 minutes		t=10 minutes		t=15 minutes			
	Inline	Enclosed	Inline	Enclosed	Inline	Enclosed	Inline	Enclosed		

[4] Record both the initial and final rates. Target 200 mL/minute for wells up to 20 feet, or 400 mL/minute for wells > 20 feet.
[5] If the inline % He is ≥ 5% of the enclosed space, corrective action is necessary to remedy the leak (e.g., enclosed He=30%, 30% × .05 = 1.5% inline)

Pore Space Purge (Based on Screen Depth)

Start Time		Flow Rate (mL/min.)	
End Time		Total Purge Time (Including Leak Test)	

Soil Vapor Well/Probe Sampling-Project Specific

Sample Collection

Sample Type	Field Sample ID	Start Sampling		End Sampling	
		Time	Vacuum (in Hg)[6]	Time	Vacuum (in Hg) [7]
N					
FD					
AA					

[6] Do not use if the vacuum is less than 25 in. Hg
[7] The final volume should be between 4–8 in. Hg. Field variance from FTL is needed if outside the range

Addition of Helium During Sample Collection

	Helium Concentration (%)[8]								
Sample Type	t= 0 min	t=2 mins	t=4 mins	t=6 mins	t=8 mins	T=10 mins	T=12 mins	T=14 mins	Final
N									
FD									
AA									

[8] The concentration in the shroud must remain above 20% for the duration of the sample collection.

Sample Analysis

Laboratory Name _____

Description	Method	Analyte(s)

Comments (additional observations, probe conditions, other)

Initial _____ Signature _____ Date _____

Soil Gas and Indoor Air Collection Log

Site 12, Former Fort Ord, California

Date:_____ Location ID: _____ Probe Depth (ft bgs): _____

Probe ID: _____ Location Description: _____

GPS: N _____ W _____ Probe Leak Test (Pass/Fail):_____

FIELD SAMPLE: Soil Gas / Sub – Slab / Indoor Air / Ambient Air

Sample Container:____ 1 / 6-L SUMMA Canister _____ Other Canister ID:_____

Equipment Test (Pass/Fail): _____

Sample ID: _____ Collection start time: _____

Initial Canister Pressure/Vacuum (inches Hg): _____ (vacuum of at least – 25" Hg)

Final Canister Pressure/Vacuum (inches Hg): _____ (vacuum between – 4" to – 8" Hg)

FIELD DUPLICATE SAMPLE: _____ Not applicable

Sample Container:____ 1 / 6-L SUMMA Canister _____ Other Canister ID:_____

Equipment Test (Pass/Fail): _____ Duplicate Flow Controller ID: _____

Sample ID: _____ Collection start time: _____

Initial Canister Pressure/Vacuum (inches Hg): _____ (vacuum of at least –25" Hg)

Final Canister Pressure/Vacuum (inches Hg):_____ (vacuum between – 4" to – 8" Hg)

ANALYSES AND REVIEW:

Analysis Requested: _____ EPA TO-15 Other: _____

Laboratory: _____

Remarks: _____

Sampler Signature: _____ Date**: _____**

Project Manager Review Signature: _____ Date: _____

Notes:
Hg = mercury
GPS = global positioning system, equipment/method: _____
ft bgs = feet below ground surface
L = liter

Soil Gas Sampling Train Shut-In Test Log

Soil Vapor Intrusion Study

Site 12, Former Fort Ord, California

Canister ID	**Probe ID**	**Date**	Start:	End:	**Pass/Fail***
			Time/Inch, Hg	Time/Inch, Hg	

Notes:

Hg = mercury

*Passing of the equipment test is no drop in vacuum after 15 minutes of observation with Summa canister connected to shut off soil gas probe after the leak test.

Page _____ of _____

Field Personnel Signature _____ Date _____

Soil Gas Probe Integrity Testing Log

Soil Vapor Intrusion Study

Site 12, Former Fort Ord, California

Probe ID	Date	% He	% He	% He	% He	% He	% He	Pass/Fail*

Notes:

% = percent (by volume)

He = helium

*Passing is three successive readings 5 minutes apart with % He less than 2.5% when checking probe and connections under a helium filled shroud (leak test).

Page _____ of _____

Field Personnel Signature _____ Date _____