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NOV 0 8 2019

Mr. John E. Kieling
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Santa Fe, New Mexico 87505

Subject: Corrective Action Management Unit Updated Reference Document Cited in the Resource Conservation and Recovery Act Facility Operating Permit for Sandia National Laboratories/New Mexico, Environmental Protection Agency Identification Number NM5890110518

Dear Mr. Kieling:

The Department of Energy/National Nuclear Security Administration/Sandia Field Office and National Technology and Engineering Solutions of Sandia, LLC are submitting the enclosed updated reference document to the New Mexico Environment Department. This submittal is required within 30 days of the effective date of the updated document, which is October 17, 2019.

This submittal is comprised of one procedure, FOP 08-22, Soil Vapor Monitoring, used by personnel to conduct soil vapor monitoring activities at the Corrective Action Management Unit. Minor revisions have been made as part of the routine three-year review cycle to keep the procedure current and incorporate improvements.

If you have any questions contact David Rast of our staff at (505) 845-5349.

Sincerely,

Jeffrey P. Harrell
Manager

cc w/enclosure:

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NNSA-2019-004663

Submittal of Updated Reference Document Cited in the Resource Conservation and Recovery Act Facility Operating Permit

Sandia National Laboratories
Albuquerque, New Mexico
EPA ID No. NM5890110518

CERTIFICATION STATEMENT

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to ensure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine or imprisonment for knowing violations.

Paul E. Shoemaker, Senior Manager
R & D Science and Engineering
National Technology & Engineering Solutions of Sandia, LLC
Albuquerque, New Mexico
Operator

10/24/2019
Date signed

Jeffrey P. Harrell, Manager
U.S. Department of Energy
National Nuclear Security Administration
Sandia Field Office
Owner

11/8/19
Date signed

Enclosure A

Updated Reference Documents Cited in the RCRA Facility Operating Permit

FOP 08-22 Soil Vapor Monitoring

November 2019

Sandia National Laboratories
EPA ID No. NM5890110518

Sandia National Laboratories

LONG-TERM STEWARDSHIP

Soil Vapor Monitoring

Document Number:	***FOP 08-22***
Revision Number:	***Revision: 5***
Current Revision Date:	10/17/2019
Effective Date:	10/17/2022

Signatures

Author/Reviewer

Robert Ziock		10/7/2019
CAMU Project Lead/Author	**Signature**	**Date**
Tim Jackson		10/16/19
LTS Groundwater Lead	**Signature**	**Date**
Sue Collins		10/7/19
LTS Program Lead/Approver	**Signature**	**Date**

Next review Date:	**10/17/2022**
Review Cycle:	**3 years**

IMPORTANT NOTICE: A controlled copy of this document is located on the Sandia Restricted Network, Long-Term Stewardship document library (currently Aras).

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REVISION HISTORY

REVISION	EFFECTIVE DATE	SUMMARY OF CHANGES
0	01/27/2009	Original Issue
1	05/27/2009	Section 6.3 – "Quality Control Sample Equipment Setup and Sampling Procedure" added.
2	06/09/2011	The rewrite makes FOP not specific to the CAMU. It now applies to soil vapor sampling at any SNL/NM site. Site-specific information for CAMU, CWL, MWL, and TA-V included in the attachments.
3	06/16/2014	Updates include methane gas monitoring and attachment for TA-III Classified Waste Landfill. On-the-Job Training, Authorized User List, and Tailgate Safety Briefing attachments removed. Table B-1 and purge time requirements removed from Attachment B. Updated Attachment C to reflect approval of the LTMMP.
4	10/17/2016	Removed all text referencing methane gas monitoring at TA-III. Added Section 1.3.1, Program Description; Section 7.0, Waste Management; 8.0, Quality Assurance; and 9.0, Data Management. Reorganized and updated Section 6. Updated Attachments A. Combined Attachments B, C, and E. Removed Attachments D, F, G, and H.
5	10/19/2019	Updated Section 1.3; Deleted Section 2.0, Responsible Individuals and Organizations; Added Section 2.0, Training and Qualifications; Deleted Training Course List Table; Removed specific references to TA-V and grouped it with Other Sites in Section 2.0 and Appendix B; Deleted Task Hazard Analysis subsection and table from Section 4.0, Health and Safety; Updated Section 5.0, Equipment and Materials: Reorganized subsections in Section 6.0, Field Procedures; Updated Section 7.0, Waste Management, Section 8.0, Quality Assurance, Section 9.0, Data Management, and Section 10.0, Records; Added Table 10-1, Disposition of Completed Field Forms; Updated Section 11.0, References.

ACRONYMS AND ABBREVIATIONS

ARCOC	Analysis Request/Chain of Custody
AUL	Authorized Users List
CAMU	Corrective Action Management Unit
CSS	Chemical Waste Landfill Sanitary Sewer
CWL	Chemical Waste Landfill
ES&H	Environment, Safety, & Health
FLUTe™	Flexible Liner Underground Technologies
FOP	field operating procedure
HAZWOPER	Hazardous Waste Operations and Emergency Response
Hg	mercury
LTMMP	Long-Term Monitoring and Maintenance Plan
LTS	Long-Term Stewardship
MWL	Mixed Waste Landfill
NMED	New Mexico Environment Department
OJT	on-the-job training
OSHA	Office of Safety and Health
PID	photoionization detector
PVC	polvinyl chloride
psi	pounds per square inch
QAPP	Quality Assurance Project Plan
SAP	sampling and analysis plan
SMO	Sample Management Office
Sandia	Sandia National Laboratories
SNL/NM	Sandia National Laboratories/New Mexico
TA	Technical Area
VZMS	Vadose Zone Monitoring System
VOC	volatile organic compound

1.0 PURPOSE, SCOPE, AND OWNERSHIP

1.1 Purpose

This field operating procedure (FOP) provides guidelines and procedures for soil vapor monitoring at various Sandia National Laboratories/New Mexico (SNL/NM) sites. Soil vapor monitoring can consist of taking *in situ* real-time measurements and/or collecting samples from the vadose zone to measure volatile organic compound (VOC) levels. This procedure is used, as applicable, based upon the regulatory requirements for each site. Site-specific information, requirements and protocol are summarized in site-specific permits, plans, and in attachments to this FOP.

1.2 Scope

This FOP is applicable to all Sandia National Laboratories (Sandia) Members of the Workforce who perform soil vapor monitoring activities at SNL/NM. Soil vapor monitoring is routinely performed at the Corrective Action Management Unit (CAMU) containment cell, Chemical Waste Landfill (CWL), and Mixed Waste Landfill (MWL). The general guidelines in this FOP may also be applied to nonroutine soil vapor monitoring locations/events (e.g., Tijeras Arroyo and Technical Area [TA]-V).

1.3 Ownership

The Long-Term Stewardship (LTS) Program is responsible for development, approval, distribution, revision, and control of this procedure.

2.0 TRAINING AND QUALIFICATIONS

Personnel conducting soil vapor monitoring field activities shall meet the following training and qualification requirements:

1. Sign form LTS-AUL, *Authorized Users List*, to affirm they have read and understand this FOP and agree to operate within the stated constraints.
2. Read and sign an LTS-AUL for the following documents for sample management:
   - Sample Management Office - *Sample Management and Custody* (AOP 95-16)
   - *Sample Handling, Packaging, and Shipping* (LOP 94-03)
   - Quality Assurance Project Plan for the Sample Management Office (SMO-QAPP)
3. Perform on-the-job-training (OJT) according to and documented by form LTS-OJT.

2.1 Chemical Waste Landfill, Corrective Action Management Unit, and Mixed Waste Landfill

Field personnel who perform soil vapor monitoring at the CAMU, CWL, and/or MWL shall obtain the following permit-required training within six months of their first fieldwork day.

1. 24- or 40-hour Occupational Safety and Health Administration (OSHA) Hazardous Waste Operations and Emergency Response (HAZWOPER) Training and Annual 8-hour Refresher, thereafter.
2. Permit-specific training and annual refresher, thereafter. Permit-specific training, reading material, and classroom instruction requirements are obtained from the Training Director.

2.2 Other Projects

For other projects, the project lead will specify any additional required reading or training (e.g., project-specific sampling and analysis plan [SAP]).

3.0 HEALTH AND SAFETY

3.1 Introduction

Sandia performs work in a safe and environmentally responsible manner (Sandia *Environment, Safety, & Health [ES&H] Policy*). The Sandia Worker Safety & Health Program is in place to reduce or prevent the potential for injuries, illnesses, and accidental losses by providing workers with a safe and healthful workplace. Sandia Department Managers are responsible for ensuring protection of workers and holding workers accountable for complying with controls.

> *Workers have the right, responsibility, and obligation to stop work that they believe is being performed in an unsafe manner or that may threaten the environment. (Sandia Worker Safety and Health Program).*

3.2 Instructions to Personnel Performing Soil Vapor Sampling Activities

- Obtain the mandatory ES&H requirements (e.g., training and reading lists) from the responsible manager.
- Complete training, on schedule.
- Sign form LTS-AUL, *Authorized Users List*, to affirm you have read, understand and agree to perform work within operational limits.
- A health and safety meeting shall be conducted and documented on form LTS 2015-001 each day before the start of field activities.

4.0 DATA QUALITY OBJECTIVE

The data quality objective of this FOP is to ensure compliance with requirements outlined in site-specific soil vapor SAPs and/or work plans and to produce representative, accurate, and defensible analytical results.

5.0 EQUIPMENT AND MATERIALS

The equipment and materials required for performing soil vapor monitoring are as follows:

- Electric power supply.

- Vacuum pump, purge chambers, and sampling manifold assemblies.
- Flow rate meter.
- Vacuum gauge.
- Photoionization detector (PID).
- SUMMA® canister(s).
- Gas cylinder containing ultra-pure nitrogen gas.
- Regulator for gas cylinder.
- Key(s) to unlock padlocks.
- Tools.
- Two-way radio.

See Appendices A and B for site-specific equipment.

6.0 FIELD PROCEDURES

Soil vapor monitoring for VOCs involves presampling preparation, monitoring system and equipment inspection, equipment set up and purging/sample collection, quality control sample collection, and shipment of samples to the analytical laboratory. The following sections detail the overall soil vapor monitoring procedure in the sequence the activities are performed.

6.1 Presampling Preparations

The following are completed prior to collecting soil vapor samples:

- Initiate a Bottle Order for SUMMA® canisters from the Sample Management Office (SMO), at least 2 weeks ahead of the monitoring event.
- Obtain SMO 2012-ARCOC, *Analysis Request Chain of Custody* (ARCOC) form and sample control numbers, accessible from the SMO application. Prepare and print ARCOC form and sample labels.
- Obtain LTS 2015-004, *Soil Vapor Sampling Log Form*.
- Obtain inspection form (site-specific or LTS 2015-005), *Soil Vapor Monitoring Inspection Log Form*.
- For CAMU only, obtain LTS 2015-002, *Site Access Form.*
- Obtain a PID from the Industrial Hygiene Instrumentation Lab.
- Obtain SUMMA® canisters from the SMO.

6.2 Sample Management and Custody

Label and manage samples, including completion of the ARCOC form, according to SMO procedure AOP 95-16, *Sample Management and Custody.*

6.3 Inspections

Inspections of soil vapor monitoring networks, wells, and equipment are performed and documented in accordance with requirements found in site-specific SAPs. Inspection frequency and inspection forms vary by site. Deficiencies and repairs are documented and addressed according to requirements found in site-specific permits, plans, and SAPs.

6.4 Sample Collection Methodology

Refer to Appendix A (CAMU site-specific information) and Appendix B (CWL and MWL site-specific information) for equipment setup and sample collection methodology. For other projects, the project leader provides site-specific information.

6.5 Quality Control Equipment Setup and Sample Collection

Details for collection of quality control samples at the CAMU can be found in Appendix A. Details for collection of quality control samples at the CWL, MWL, and other projects are provided in event-specific SAPs (mini-SAPs).

6.6 Sample Packaging and Shipping to Laboratory

The SUMMA® canisters, the completed ARCOC, and a copy of the completed LTS 2015-004, *Soil Vapor Sampling Log Form* are delivered to the SMO Package Facility according to LOP 94-03, *Sample Handling, Packaging, and Shipping.*

The SMO Packaging Coordinator accepts custody and responsibility for packaging and shipping to the contracted analytical laboratory.

7.0 WASTE MANAGEMENT

Waste generated in the soil vapor monitoring process is managed in compliance with GN470110, *Managing Waste at* Sandia *National Laboratories*.

8.0 QUALITY ASSURANCE

Quality assurance for soil vapor monitoring includes conforming to the sampling and analysis plans detailed in site-specific permits and plans, quality assurance requirements found in the Quality Assurance section of the *LTS Program Management Plan* and the activities outlined in this FOP.

Following completion of a monitoring event, field forms are reviewed for accuracy and/or omissions by the Project Lead or designee. Any corrections to the forms are made prior to final disposition.

Laboratory analytical results are qualified and verified following the processes described in the SMO QAPP, *Quality Assurance Project Plan for the Sample Management Office*; AOP 00-03, *Data Validation Procedure for Chemical and Radiochemical Data*; and SMO 05-03, *Procedure for Completing the Contract Verification.* Laboratory analytical results are reviewed by the SMO prior to entry into the Environmental Data Management System database.

9.0 DATA MANAGEMENT

Data generated from soil vapor sampling is managed in accordance with the *SMO Data Management Plan* (AOP 95-44).

10.0 RECORDS

Records associated with soil vapor monitoring include the LTS-AUL form for FOP 08-22, completed field documentation forms, and analytical laboratory reports. Documents are managed according to project or permit requirements and are maintained in the site-specific operating record at the CAMU Project Trailer and/or the SNL/NM Records Center, as required. The final disposition of forms generated from soil vapor monitoring is shown in Table 10-1.

Table 10-1. Disposition of Completed Field Forms

Form	CAMU	CWL	MWL	Other Projects
LTS-AUL	1, 2	1, 2	1, 2	2
LTS-OJT	1, 2	1, 2	1, 2	2
LTS 2015-001	1, 2	1, 2	1, 2	2
LTS 2015-002	1, 2	NA	NA	NA
LTS 2015-004	1, 2	1, 2	1, 2	2
LTS 2015-005	1, 2	1, 2	1, 2	2
SMO-2012 ARCOC	2, 3	2, 3	2, 3	2, 3

Notes:
1 = Site-specific Operating Record – CAMU Field Operations Trailer.
2 = Corporate Records (CFRC).
3 = SMO Data Management System.

11.0 REFERENCES

New Mexico Environment Department (NMED), April 2004. *Compliance Order on Consent Pursuant to the New Mexico Hazardous Waste Act § 74-4-10*, prepared by the New Mexico Environment Department in the matter of Respondents U.S. Department of Energy and Sandia Corporation, Sandia National Laboratories, Bernalillo County, New Mexico, April 29, 2004.

New Mexico Environment Department (NMED), October 2009 and subsequent revisions. Resource Conservation and Recovery Act, Post-Closure Care Permit, EPA ID No. NM5890110518, to the U.S. Department of Energy/Sandia Corporation, for the Sandia National Laboratories Chemical Waste Landfill, New Mexico Environment Department Hazardous Waste Bureau, Santa Fe, New Mexico, October 15, 2009.

New Mexico Environment Department (NMED), March 2012. *New Mexico Solid Waste Rules, Solid Waste Management Act, Article 8 and Article 9, Solid Waste Rules 20.9.2 – 20.9.10 NMAC*. New Mexico Environment Department Solid Waste Bureau, Santa Fe, New Mexico.

New Mexico Environment Department (NMED), January 2015, and subsequent revisions. Resource Conservation and Recovery Act Facility Operating Permit, EPA ID No. NM5890110518. Issued to the U.S. Department of Energy/Sandia Corporation for the Sandia National Laboratories Hazardous and Mixed Waste Treatment and Storage Units and Post-Closure Care of the Corrective Action Management Unit, New Mexico Environment Department Hazardous Waste Bureau, Santa Fe, New Mexico, January 27, 2015.

Sandia National Laboratories/New Mexico (SNL/NM), October 2016, and subsequent revisions. *Quality Assurance Project Plan for the Sample Management Office*, (SMO-QAPP), Analytical Services Department, Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), October 2016, and subsequent revisions. *Sample Management and Custody*, (AOP 95-16), Sample Management Office, Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), June 2017, and subsequent revisions. *Data Validation Procedure for Chemical and Radiochemical Data*, (AOP 00-03), Sample Management Office, Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), March 2019, and subsequent revisions. *SMO Data Management Plan*, (AOP 00-03), Sample Management Office, Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), April 2019, and subsequent revisions. *Sample Handling, Packaging and Shipping*, (LOP 94-03), Sample Management Office, Sandia National Laboratories, Albuquerque, New Mexico.

Sandia National Laboratories/New Mexico (SNL/NM), April 2019, and subsequent revisions. *Procedure for Completing the Contract Verification*, (SMO 05-03), Sample Management Office, Sandia National Laboratories, Albuquerque, New Mexico.

Related Sandia National Laboratories Policies and Processes

- ESH001, *Environment, Safety, and Health Policy*
- GN470110, *Managing Waste at Sandia National Laboratories*
- PG470246, *Worker Safety and Health Program*

APPENDIX A
Corrective Action Management Unit Site-Specific Information

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Introduction and Background

Soil vapor monitoring requirements for the Corrective Action Management Unit (CAMU) are defined in the *Resource Conservation and Recovery Act* Facility Operating Permit, EPA ID No. NM5890110518, Attachment H, Section H.5 (NMED January 2015).

CAMU Soil Vapor Monitoring Network

The CAMU uses two monitoring subsystems to monitor for volatile organic compounds (VOCs) as supplemental data for the CAMU Vadose Zone Monitoring System (VZMS) leak detection program:

CSS – The six Chemical Waste Landfill Sanitary Sewer (CSS) vertical monitoring well points are positioned between the CAMU containment cell and the sanitary sewer line. The monitoring well points are approximately 20 feet deep. The bottom of each well contains a 2-foot section of galvanized steel screen to support soil vapor sampling. The remaining length is constructed of 2-inch diameter, galvanized steel pipe that protrudes 2 feet above ground and is sealed with a threaded polvinyl chloride (PVC) cap with a sampling port.

VSA – The Vertical Sensor Array (VSA) consists of eleven pairs of vertically oriented monitoring locations. Five are located on both the eastern and western margins of the containment cell. The eleventh monitoring location is situated at the northern end of the cell. Each VSA location contains two soil vapor sampling screens that are 5 feet and 15 feet beneath the containment cell sub-liner. The soil vapor screens are 1 foot-long by 2 inch-diameter and are connected to polyethylene tubing with an inner diameter of 0.25 inches. The tubing extends approximately 50 feet and terminates at a sampling port located in an above-ground enclosure.

Equipment Setup and Sampling Procedure

Figure A-1 shows a general schematic of the vacuum pump, sampling manifold, and SUMMA® canister setup for collecting an environmental sample. The vacuum pump is turned on to draw gas from the sampling tubing. The flow valve is opened to allow the gas to flow at a rate compatible with the total sampling time (purge). The flow rate is recorded and is used to determine when sufficient purge gas has been removed.

The amount of gas to be drawn from the system during the purge should be more than enough to remove the resident gas (the old gas) in the system. The recommended minimum volume of gas removal is three sampling tube (well casing for CSS), and soil vapor screen volumes. Because minimum purge times are so small, they have been increased to required purge times that are consistent with historical purge times (ASSOP 04-01, "*Activity Specific Standard Operating Procedure for Active Soil-Gas Sampling Using Method TO-14 at the Corrective Action Management Unit (CAMU)*", SNL/NM Environmental Restoration Project, November 2001) that meet or exceed the minimum established criteria.

Detailed procedure

Record the required information on LTS 2015-004, *Soil Vapor Sampling Log Form*.

1. Connect intake tube of vacuum pump to sampling port.
2. Connect sampling manifold to vacuum pump
3. Connect sample container (i.e., SUMMA® canister) to sampling manifold.
4. Close in-line valve and sampling valve.
5. Open SUMMA® canister valve and record initial vacuum displayed on the vacuum gauge.
   Note: The nominal vacuum at SNL/NM (approximate elevation 5,400 feet) is 23 to 25 inches mercury (Hg).
6. Close the SUMMA® canister valve.
7. Open the in-line valve.
8. Apply vacuum to the system by turning on pump and record the start time.
9. Record the flow rate.
10. Purge the sampling tube, well casing (CSS locations only), and soil vapor screen. Use the purge volumes and specific and flow rate meter values to calculate the purge times.
11. Obtain continuous PID measurements from the vacuum exhaust port.
12. Wait until the correct volume has been extracted and record the final PID measurement.
13. Close in-line valve and turn off vacuum pump. Record the stop time and open SUMMA® canister valve until the vacuum gauge on the manifold reaches approximately minus 10 inches Hg; then close the SUMMA® canister valve. Record the ending vacuum.
    Note: The analytical laboratory requests that approximately minus 10 inches Hg of vacuum remain in the SUMMA® canister at completion of sampling.
14. Remove manifold from the SUMMA® canister.
15. Record collection date and time on sample label and attach it to SUMMA® canister tag. Do not attach sample label to canister itself.
16. Complete ARCOC form SMO 2012-ARCOC.
17. Deliver completed field documentation forms, with the exception of the ARCOC form, to the project leader.

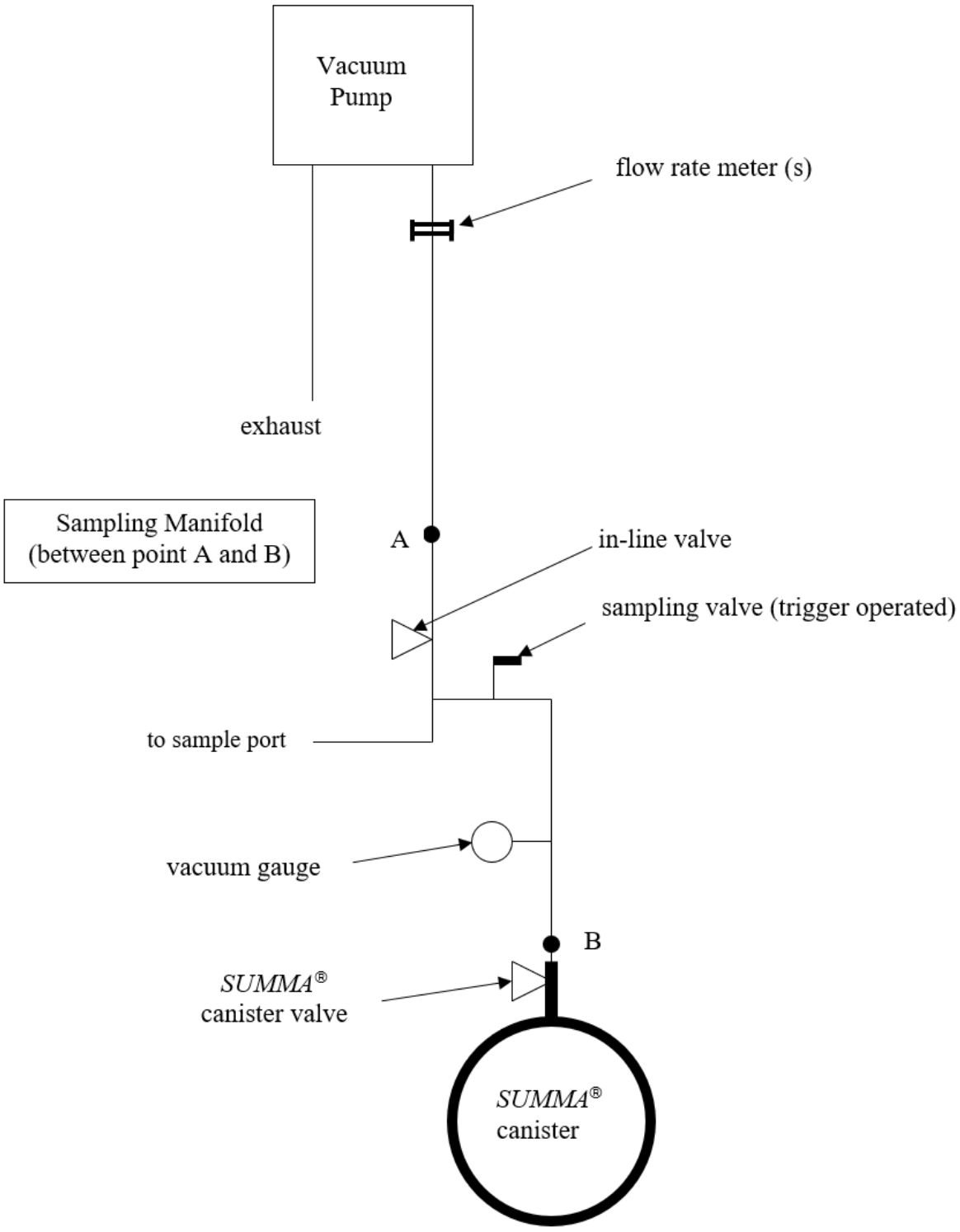

Figure A-1. Vacuum Pump, Sampling Manifold, and SUMMA® Canister Setup

Quality Control Samples

The following quality control samples are collected:

- One trip blank of ultrapure nitrogen gas collected at a location not affected by the possible contaminant(s) of concern.
- One field blank of ultrapure nitrogen gas collected at the first sampling location.
- One duplicate sample collected at a CSS location.
- One duplicate sample collected at a VSA 5-foot location.
- One duplicate sample collected at a VSA 15-foot location.

Collect quality control samples with an ending vacuum value of minus 10 inches Hg remaining in the SUMMA® canisters. Note: The duplicate sample is collected immediately after the original environmental sample, or simultaneously, to reduce variability caused by time and/or sampling mechanics.

Field Blank and Trip Blank Equipment Setup and Sampling Process

See Figure A-2 for a general schematic of the vacuum pump, sampling manifold, and SUMMA® canister setup for collecting field blank and trip blank.

1. Close needle valve, purge valve, and regulator.
2. Connect regulator manifold assembly to SUMMA® canister and cylinder containing nitrogen gas.
3. Open nitrogen gas cylinder valve.
4. Adjust regulator to 8 pounds per square inch (psi) line pressure.
5. Adjust needle valve until compound gauge measures positive 8 psi.
6. Close nitrogen gas cylinder valve.
7. Open purge valve to purge line.
8. Close purge valve when compound gauge measures zero.
9. Repeat steps 3 through 8 two more times.
10. Open nitrogen gas cylinder valve.
11. Open SUMMA® canister valve.
12. Close SUMMA® canister valve when compound gauge measures approximately minus 10 in. of Hg (see site-specific attachments for ending vacuum values).
13. Close nitrogen gas cylinder valve.
14. Open purge valve.
15. Disconnect regulator manifold assembly from SUMMA® canister and nitrogen gas cylinder.
16. Close needle valve, purge valve, and regulator.

Calculating Purge Times

The purge time is a function of the combined volume of the sampling tube, well casing (if applicable), soil vapor screen, and the flow rate through the sampling tube. A minimum of three combined volumes are purged at each location before a sample is collected.

Site-specific purge volumes are based upon individual soil vapor monitoring location construction details.

Volume calculations for cylindrical pipes and sampling tubes are as follows:

$V = \pi r^2 h$, where: V = volume, r = radius, h = height

Minimum pump run time to evacuate three sampling tube/well casing volumes from each sampling port is calculated as follows:

$t = (V/Q)*3$, where: t = time, V = volume, Q = flow rate

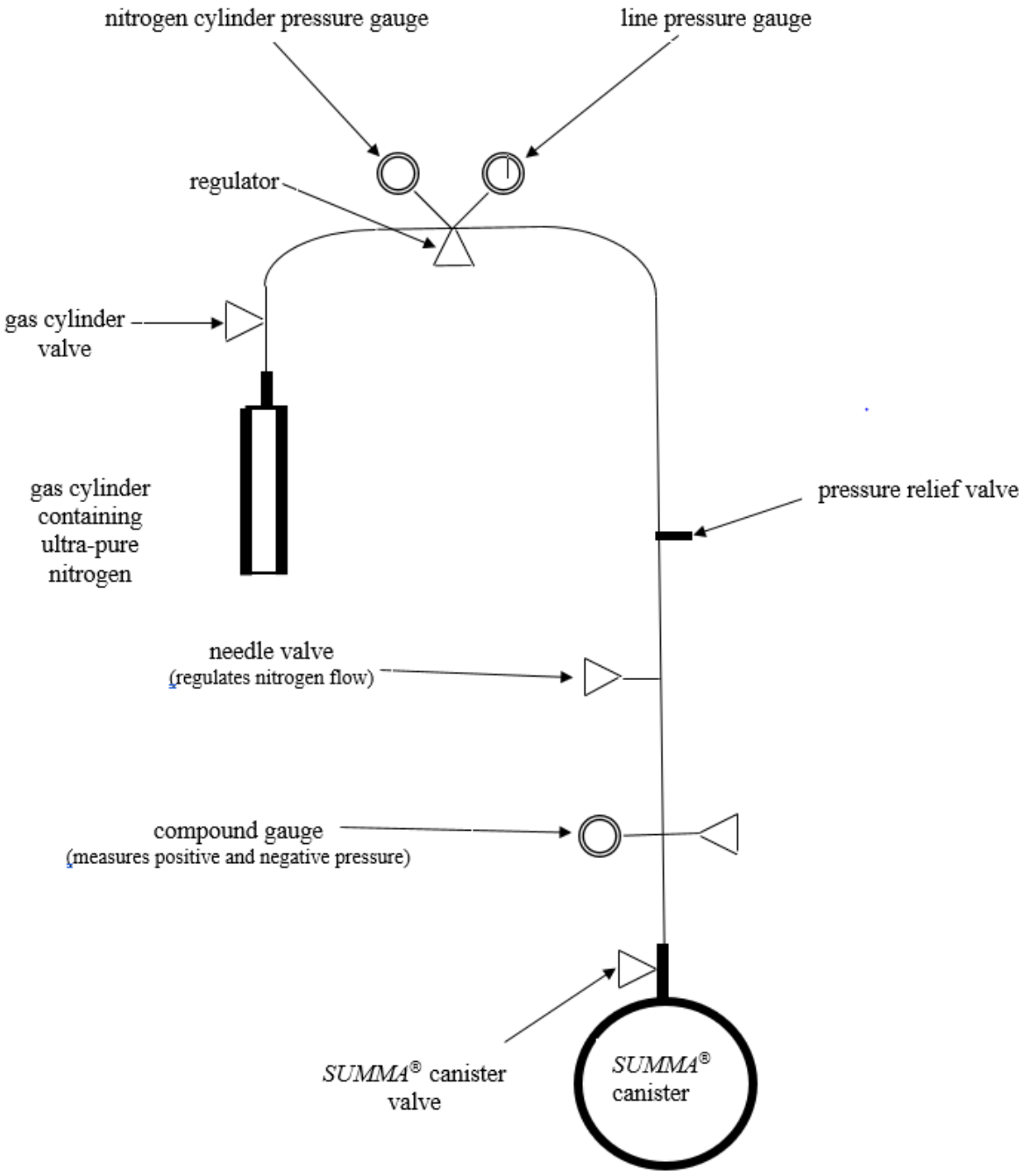

Figure A-2. Field Blank and Trip Blank Sampling Regulator Manifold and SUMMA® Canister Setup

APPENDIX B
Chemical Waste Landfill and Mixed Waste Landfill Site-Specific Information

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Chemical Waste Landfill Background

Soil vapor monitoring at the Chemical Waste Landfill (CWL) is performed under the New Mexico Environment Department (NMED)-approved Post-Closure Care Permit (PCCP) (NMED October 2009 and subsequent revisions), in conformance with the "Soil-Gas Sampling and Analysis Plan," Permit Attachment 3 (NMED October 2009).

Field technologists must meet all training requirements specified in the PCCP prior to performing CWL soil vapor monitoring.

CWL Soil Vapor Monitoring Network

The CWL soil vapor monitoring network consists of the following five soil vapor monitoring wells: UI-1, UI-2, D-1, D-2, and D-3. The UI designation refers to "Upper Intermediate" indicating the general depth horizon that these wells are designed to sample. The D designation refers to "Deep" and is similarly indicative of the sampling depth interval. There are three soil vapor sampling ports associated with each of the UI series wells and five soil vapor sampling ports associated with each of the D series wells. One soil vapor screen at each sampling depth consists of a 2-foot long by 0.31-inch inner diameter stainless steel screen that is attached to a 0.215-inch stainless steel tube that extends to the surface.

Mixed Waste Landfill Background

Soil vapor monitoring at the Mixed Waste Landfill (MWL) is performed under the NMED-approved Long-Term Monitoring and Maintenance Plan (LTMMP), and in conformance with the "Soil-Vapor Sampling and Analysis Plan for the Mixed Waste Landfill," LTMMP, Appendix D.

Field technologists must read the pertinent sections of the LTMMP prior to performing soil vapor monitoring at the MWL.

MWL Soil Vapor Monitoring Network

The MWL soil vapor monitoring network consists of the following five soil vapor monitoring wells: MWL-SV-01, MWL-SV-02, MWL-SV-03, MWL-SV-04, and MWL-SV-05. The soil vapor implant at MWL-SV-01 and MWL-SV-02 consists of a 0.5-foot-long by 0.5-inch-diameter stainless steel screen. It is attached to a nominal 0.25-inch-diameter polyethylene tube that extends 41 feet to the ground surface and a sampling port.

The soil vapor monitoring systems at MWL-SV-03, MWL-SV-04, and MWL-SV-05 consist of three Flexible Liner Underground Technologies (FLUTe^{TM}) multi-port soil vapor monitoring wells with five sampling ports per location. Each sampling port consists of FLUTe™ spacer (volume of 0.9 liters) set at 50-, 100-, 200-, 300-, and 400-foot depths attached to nominal 0.25-inch-diameter polyethylene tubing.

Equipment Setup and Sampling Procedure

The tubing for the sampling system can be assembled by the client or purchased from a vacuum or pressure manufacturer. The geometry of the system is shown in Figure B.1. The tubing for

each port is connected to the inlet of the sampling system. The vacuum pump is turned on to draw gas from the monitoring well. The flow valve is opened to allow the gas to flow at a rate compatible with the total sampling time (purge). The flow rate is recorded to determine when sufficient purge gas volume has been removed.

The amount of gas to be drawn from the system during the purge should exceed the resident gas (the old gas) in the system. Since the flow in the system may be laminar, it is difficult to remove all of the old gas. Turbulent flow is better because it removes the gas along the wall more quickly; therefore, based on subject matter expert calculations, equipment must have the capability for turbulent flow or a minimum drawdown of 0.5 bar (~7.3 psi vacuum), assuming laminar flow velocity at the tubing wall is zero.

The recommended minimum volume of gas removal is three tube volumes. The more gas purged from the system, the more distant the origin of the gas sampled in the formation.

Detailed Procedure

Record the required information on the LTS 2014-004, *Soil Vapor Sampling Log Form*.

1. Connect purging chamber to vacuum pump.
2. Connect well or port-specific sampling tube extension to the sampling system.
3. Connect sample tube to the purge chamber.
4. Apply a vacuum to the system.
5. Open the flow meter to the flow rate compatible with the volume to be extracted and record the start time.
6. Note the vacuum on the pressure gauge (the extraction pressure).
7. Obtain continuous photoionization detector measurements from the vacuum exhaust port (if required).
8. Wait until the correct volume has been extracted.
9. Close the flow valve on the flow meter and record the stop time.
10. Wait until the pressure has recovered to near ambient (optional).
11. Disconnect sample tube from purge chamber.
12. Connect sample manifold to the sample container (e.g., SUMMA® canister).
13. Connect sample tube to the sample manifold.
14. Open the sample container valve and record container pressure on the sample manifold pressure gauge.
15. Open sample manifold valve and let the collection volume fill until the pressure again returns to approximately minus 10 inches of mercury (Hg) (Note: The analytical laboratory requests that approximately 10 inches Hg of vacuum remain in the SUMMA® canister at completion of sampling.)

16. Close the valve on sample container and disconnect from sampling manifold.
17. Repeat steps 3 to 15 at each sample interval.

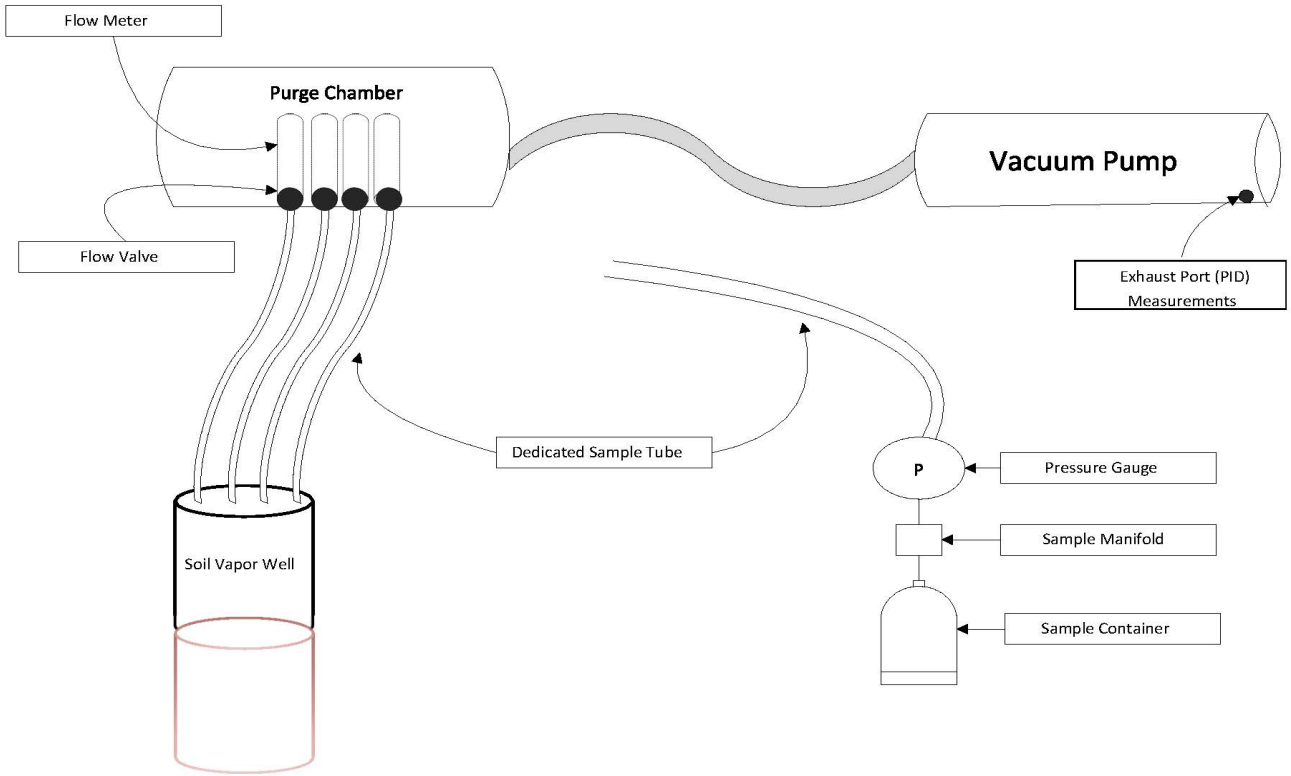

Figure B-1. Sampling System Tubing Configuration

The sampling systems are designed to minimize the dead-end volumes in the system on the upstream side of the flow valve (e.g., the pressure gauge connection). This reduces the possible accumulation of old gas in the tubing system and allows a thorough flow of gas during the purge cycle. Additional sampling systems may be used to collect field quality control samples including field blank and duplicate samples by simultaneous or in-series collection methods.

Sampling Tube Volume and Purge Time Calculations

Vapor Well Volume = (V soil vapor screen, or FLUTe™ spacer, or vapor implant + V of sampling tube)

V to purge = 3 * (Vapor Well Volume)

Minimum pump run time to evacuate three volumes from each sampling port is calculated as follows:

t = V to purge / Q where:

t = time

V = volume

Q = flow rate (to be determined in the field based on equipment limitations)

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