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National Nuclear Security Administration
Sandia Field Office
P.O. Box 5400
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NNSA National Nuclear Security Administration

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NMED
Hazardous Waste Bureau

Mr. John E. Kieling
Chief
Hazardous Waste Bureau
New Mexico Environment Department
2905 Rodeo Park Dr. East, Bldg 1
Santa Fe, New Mexico 87505

Subject: Submittal of the Corrective Action Management Unit (CAMU) Updated Reference Documents Cited in the Resource Conservation and Recovery Act Facility Operating Permit for Sandia National Laboratories/New Mexico (SNL/NM), Environmental Protection Agency Identification Number NM5890110518

Dear Mr. Kieling:

The Department of Energy/National Nuclear Security Administration and Sandia Corporation 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, 2016.

This submittal is comprised of one document used by SNL/NM personnel to perform monitoring activities at the CAMU; FOP 08-22, Soil Vapor Sampling.

Revisions include updates to keep the document current and to reflect ongoing modifications and improvements in industry practices.

If you have questions, please contact Karen Oden of our staff at (505) 845-5162.

Sincerely,

James W. Todd
Assistant Manager for Engineering

Enclosure
cc: See Page 2

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Submittal of Updated Reference Document Cited in the Resource Conservation and Recovery 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.

Michael W. Hazen, Vice President
Sandia Corporation
Albuquerque, New Mexico
Operator

31 Oct 2016
Date Signed

James W. Todd, Assistant Manager
U.S. Department of Energy
National Nuclear Security Administration
Sandia Field Office
Owner

11/4/16
Date Signed

Enclosure A

Updated Reference Document Cited in the Resource Conservation and Recovery Act Facility Operating Permit for Sandia National Laboratories/New Mexico

FOP 08-22 Soil Vapor Sampling

October 2016

Sandia National Laboratories
EPA ID No. NM5890110518

SANDIA NATIONAL LABORATORIES
ANALYTICAL SERVICES DEPARTMENT (4131)

SOIL VAPOR MONITORING
FIELD OPERATING PROCEDURE

FOP 08-22
Revision 4

Author: _____ **Date:** 10/5/2016
Robert Ziock, Technologist
Environmental Compliance and Monitoring

Reviewer: _____ **Date:** 06-Oct-2016
Tim Jackson, Staff Member
Long-Term Stewardship

Reviewer: _____ **Date:** 10/5/16
Rick Dotson, Staff Member
Long-Term Stewardship

Approved: _____ **Date:** 10/13/16
Sue Collins, Program Lead
Long-Term Stewardship

Author: *How frequently does this document need to be reviewed and/or revised?*	*Every three years*
Manager: *Does this document need to be tracked?*	*Yes*

EFFECTIVE DATE: 10/17/2016

TABLE OF CONTENTS

LIST OF TABLES

LIST OF ATTACHMENTS

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 1.1.3, 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.

ACRONYMS and ABBREVIATIONS

ALW	activity level work
AR/COC	Analysis Request/Chain of Custody
CAMU	Corrective Action Management Unit
CWL	Chemical Waste Landfill
FOP	field operating procedure
LTMMP	Long-Term Monitoring and Maintenance Plan
MWL	Mixed Waste Landfill
NMED	New Mexico Environment Department
OJT	on-the-job training
PHS	primary hazard screening
PID	photoionization detector
Sandia	Sandia Corporation
SAP	sampling and analysis plan
SMO	Sample Management Office
SNL/NM	Sandia National Laboratories/New Mexico
TA	Technical Area
TEDS	Training and Employee Development System
THA	task hazard analysis
VOC	volatile organic compound

1.0 PURPOSE, SCOPE, AND OWNERSHIP

1.1 Purpose

The purpose of this field operating procedure (FOP) is to provide 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. This procedure shall be used, as applicable, based upon the regulatory requirements for each site. Site-specific information, requirements and protocol are summarized in site-specific permits, and in attachments to this FOP.

1.2 Scope

This FOP is applicable to all Sandia Corporation (Sandia) employees and contractors 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), Mixed Waste Landfill (MWL), and Technical Area (TA)-V. Site-specific information is provided in Attachments A, B, C, and D for the CAMU, CWL, MWL, and TA-V, respectively. The general guidelines in this FOP may also be applied to non-routine soil vapor monitoring locations/events (*e.g.*, Tijeras Arroyo).

1.3 Ownership

The Analytical Services Department is responsible for development, approval, distribution, revision, and control of this procedure.

1.3.1 Program Description

Soil vapor monitoring is performed as part of Long-Term Stewardship Program operations that are managed by the Analytical Services Department. The Long-Term Stewardship Program's goal is the long-term protection of human health and the environment from hazards associated with former Environmental Restoration Project sites (e.g., CAMU, CWL, MWL), and minimization of Sandia's environmental liability by ensuring environmental compliance with the requirements provided in multiple New Mexico Environment Department permits.

2.0 RESPONSIBLE INDIVIDUALS AND ORGANIZATIONS

The **Department Manager** is responsible for the following:

- Providing programmatic guidance leading to the development of this FOP.
- Review and approval of the procedure.

- Establishing and documenting field technician training in compliance with this FOP, site-specific permits (CAMU and CWL), and the MWL Long-Term Monitoring and Maintenance Plan (LTMMP).

The **Field Support Operations Project Lead** is responsible for the following:

- Coordinating with the Department Manager, Project Lead and Field Technicians regarding soil vapor sampling activities and the documentation of all required training.
- Assigning qualified Field Technicians to conduct the activities described in this procedure.
- Supervising the Field Technicians.
- On-the-job training (OJT), as necessary, for new personnel performing field activities. Document training by completing an OJT Form (EP 2009-OJT).
- Reviewing, implementing, and verifying the completion of all training required for Field Technicians.
- Providing Field Technicians with necessary equipment and supplies to conduct field work.
- Reviewing, revising, and maintaining technical work documents.

The **Project Lead** or designee is responsible for the following:

- Reviewing and concurring with this procedure and the related site-specific attachment(s).
- Providing overall coordination and management of site-specific soil vapor monitoring events.
- Providing copies of the relevant sections of the site-specific permit and sampling and analysis plan (SAP) (CAMU and CWL) and the MWL LTMMP for Field Technician review and signoff, prior to sampling.
- Reviewing field documentation and analytical results.
- Assisting with the revision of this procedure as necessary or every three years.

The **Field Technician** is responsible for the following:

- Completing all necessary and required training as specified by the Field Support Operations Project Lead. At a minimum, required training shall include the training defined in this FOP, site-specific permits (CAMU and CWL), and the MWL LTMMP.
- Maintaining requisite training status.
- Inspecting and maintaining equipment.
- Completing a program specific tailgate safety meeting form prior to each day's soil vapor monitoring activities. Program forms are available on the 4100 Controlled Documents webpage.
- Collecting and storing samples properly, when applicable.

- Delivering samples to the Sample Management Office (SMO) in a timely manner, relative to analytical holding times, when applicable.
- Completing and reviewing field documentation forms.
- Inspecting soil vapor monitoring locations during each sampling event and documenting the inspections along with any deficiencies and/or repairs, or breach of monitoring location security. Reporting deficiencies and/or breach of security to the Field Support Operations Project Lead and the Project Lead.
- Providing recommendations for revisions to this procedure (*i.e.*, process improvement feedback as appropriate).

3.0 TRAINING QUALIFICATIONS

Personnel conducting soil vapor monitoring shall complete all training required to perform work under this FOP and in accordance with site-specific permits and the MWL LTMMP:

- Field personnel shall sign an Authorized Users List (EP2009-AUL) to affirm they have read and understand this document, and agree to operate within the stated constraints.
- Read SNL/NM Corporate Policy ESH100 Environment Safety & Health.
- Required department training and training identified in the primary hazard screening (PHS) results.
- Read applicable site-specific training (*i.e.*, PHS, health and safety plan, etc.)
- Read applicable sections of site-specific permits and SAPs (CAMU and CWL), the MWL LTMMP, and comply with the related training program requirements.
- Document site-specific permit training requirements (CAMU, CWL) for a Field Technician (on file at the CAMU Administrative Trailer).
- OJT, as necessary, for new personnel performing field activities. Document training by completing an OJT Form (EP 2009-OJT).
- Complete training courses listed in Table 3-1.

Table 3-1. Training Course List

Course Code	Course Title
CHM100	Chemical Safety
CHM103	Site Specific Chemical Safety
ELC105	Basic Electrical Safety (> 50 volts)
ENV100	OSHA Health & Safety Basic Training – General Worker (40 HR)
ENV103	OSHA Health & Safety Training Refresher (8 HR)
ENV112	Hazardous Waste & Environmental Management Training
ESH100	Environment Safety& Health Awareness
MCH200	Hand and Power Tool Safety
MED102	Standard First Aid
MED104	Heartsaver CPR
OTS101	Occupational Thermal Stress
PPE106	Personal Protective Equipment Training
PRS150	Pressure Safety Orientation
PRS250	Advance Pressure Safety
RAD102	General Employee Radiological Training

4.0 HEALTH AND SAFETY

Activity level work (ALW) evaluations have been performed on the activities described in this FOP and are detailed in safety cases ALW 14-02 (CAMU) and ALW 14-11 (CWL and MWL). The evaluations were performed in conjunction with the PHS SNL05A01119 (CAMU) and PHS SNL11A00081 (CWL and MWL).

A task hazard analysis (THA) has been performed on the activities described in this FOP and is detailed in Section 4.1. The THA classifies the potential hazards and rates them based on the probability of occurrence. The THA lists control measures that will be used to mitigate the potential hazards. A site-specific PHS (see Section 9.0 for list of applicable PHSs) shall be completed prior to soil vapor monitoring activities to help identify potential hazards that can be expected when performing the work. The control measures may include exposure assessment surveys (by a SNL/NM industrial hygienist), courses, and training that are identified as part of the PHS results. This approach to identifying, rating, and controlling hazards is consistent with SNL/NM's Integrated Safety Management System initiative. Hazards classification is standard industrial hazards for activities identified in this FOP.

A tailgate safety meeting shall be conducted and documented on the program specific tailgate safety meeting form each day before the start of field activities.

In the event that work is stopped due to:

- safety related issue(s),
- an injury incurred while performing the tasks identified in this procedure, or
- as the result of an audit,

the Field Technician shall immediately notify the Field Support Operations Team Lead, the Project Lead, and the Department Manager. The Field Technician shall seek the assistance of the Field Support Operations Team Lead for the mitigation of the hazard and the completion of a Work Resumption Authorization Form (EP 2009-WRA). The Department Manager shall sign the completed form prior to the restart of work.

4.1 Task Hazard Analysis

Task Description - Soil Vapor Sampling for Volatile Organic Compounds

Soil vapor samples are collected from the vadose zone at various SNL/NM sites (*e.g.*, CAMU, CWL, MWL, TA-V) and are analyzed to determine levels of volatile organic compound (VOC) contaminants in the surrounding soil pore space. The samples are collected by connecting sample tubing on the soil vapor monitoring system directly to a sampling container (*i.e.*, SUMMA® canister). The SUMMA® canister is under a vacuum and has a valve that when opened, draws in the vapor sample. Prior to sample collection, each monitoring location (port) is purged to remove stagnant air and draw representative soil vapor from the soil pore space surrounding the sampling port in the subsurface. VOC screening with a photoionization detector (PID) or equivalent detector shall be performed prior to sample collection to provide real-time data relative to stabilization of organic soil vapor concentrations during the purging process. (Note: VOC screening with a PID or equivalent detector during the purging and sampling process is not necessary for worker health and safety purposes). A THA is provided in Table 4-1.

Table 4-1. Task Hazard Analysis
Soil Monitoring for VOCs

Level of Protection—Level D Personal Protective Equipment (safety shoes/boots, safety glasses)

Potential Hazard	Hazard Rating	Control
Chemical (various VOCs)	SIH	• There will be no contact with contaminated soils during soil vapor monitoring activities. Soil vapors can be monitored using a photoionization detector as part of the purging process for VOC sampling. Historically VOC levels have been low (parts per million). Eating, drinking and smoking will not be permitted while performing soil monitoring activities.
Physical • Heat stress • Cold stress • Sunburn • Mechanical hazards • Pinch points • Strains, and lifting hazards • Slips, trips, falls • Motor vehicle accident • Electrical • Vacuum (negative pressure)	SIH	• Soil vapor monitoring activities are not physically demanding. Workers will be trained on heat stress, cold stress, and sunburn hazards. Sunscreen will be provided. • Appropriate inspections of equipment will be performed prior to use. • Leather work gloves will be worn when handling steel cable and removing vault covers. • Proper lifting techniques will be reinforced. • Proper housekeeping will be maintained. • Holes around monitoring area will be filled or covered to eliminate slip, trip hazards. • Seat belts will be worn anytime drivers and passengers are in a moving motor vehicle. • Proper ground fault circuit interrupter devices will be used for the electric equipment and tested before each use. • A management approved pressure safety data package is in place for equipment used for soil vapor sampling.
Radiological	SIH	• There are no radiological hazards specifically related to soil vapor monitoring at the Corrective Action Management Unit, Chemical Waste Landfill, Mixed Waste Landfill, and Technical Area V.
Fire	SIH	• Fire extinguishers will be located in mobile equipment.

Notes: SIH – standard industrial hazards
VOC – volatile organic compound

5.0 EQUIPMENT AND MATERIALS

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

- Analysis Request/Chain-of-Custody (AR/COC) forms and sample labels.
- Logbook (if applicable).
- Field forms:
  - Soil Vapor Sampling Log Form (LTS 2015-004).
  - Inspection form (site-specific or Soil Vapor Monitoring Inspection Log Form (LTS 2015-005).

- AC power provided by ground fault circuit interrupter (GFCI) outlets.
- Vacuum pump, purge chambers, and sampling manifold assemblies.
- Flow rate meter.
- Vacuum gauge.
- PID.
- SUMMA® canister(s).
- Gas cylinder containing ultra-pure nitrogen gas.
- Key(s) to unlock padlocks.

See Attachments A (CAMU) and B (CWL, MWL, and TA-V) for site-specific equipment.

6.0 FIELD PROCEDURES

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

6.1 Pre-Sampling Preparations

The following shall be completed before soil vapor sampling can begin:

1) Obtain AR/COC and sample control numbers from the Sample Management Office Home Page. Prepare and print out AR/COC and sample labels.
2) Obtain Soil Vapor Sampling Log Form (LTS 2015-004).
3) Inspection form (site-specific or Soil Vapor Monitoring Inspection Log Form (LTS 2015-005).
4) Obtain PID from the SNL/NM Safety and Health Instrumentation Program.
5) Obtain the SUMMA® canisters from the SMO.

6.2 Equipment Setup and Sample Methodology

See Attachments A (CAMU) and B (CWL, MWL, and TA-V) for site-specific equipment setup and sample methodology.

6.3 Calculating Purge Times

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

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 running time to evacuate three sampling tube/well volumes from each sampling port is calculated as follows:

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

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

6.4 Quality Assurance Equipment Setup and Sample Collection

See site-specific quality assurance requirements in Attachments A (CAMU) and B (CWL, MWL, and TA-V), and site-specific permits (CAMU and CWL) and the MWL LTMMP for collecting duplicate, split, and field and trip blank samples if applicable.

Duplicate and Split Samples

A duplicate environmental sample is collected in order to estimate the overall reproducibility of the sampling and analytical process. Collect the duplicate sample immediately after the original environmental sample or simultaneously to reduce variability caused by time and/or sampling mechanics.

Field Blank Sample

A field blank sample is submitted to assess whether contamination of an environmental sample may have resulted from ambient field conditions. The sample is prepared in the field by collecting an ultra-pure nitrogen gas sample.

Trip Blank

A trip blank of ultra-pure nitrogen gas collected at a location not affected by the possible contaminant(s) of concern, is used to identify contaminants introduced into samples during transit to the laboratory.

6.5 Inspections

Inspections of soil vapor monitoring locations and equipment shall be performed in accordance with site requirements (*i.e.*, permits, MWL LTMMP). An example of a Soil Vapor Monitoring Inspection Log Form (LTS 2015-005) is available on the 4100 Controlled Documents webpage. (Note: Inspection frequency and the format of inspection forms may vary based on site-specific requirements detailed in applicable permits or regulatory documents.) Deficiencies and repairs shall be documented per site requirements.

6.6 Shipping Samples to Laboratory

Take the SUMMA® canisters, the completed AR/COC, and a copy of the completed Soil Vapor Sampling Log Form to the SMO for shipment to the laboratory.

7.0 WASTE MANAGEMENT

Waste is managed in compliance with SNL/NM Corporate Policy ESH100 Environmental Safety & Health.

8.0 QUALITY ASSURANCE

See Section 6.4 for quality assurance equipment setup and sample collection.

9.0 DATA MANAGEMENT

After sample analysis, the laboratory will deliver the data package results electronically and/or by over-night mail delivery. The SMO will review and process the electronic data file and the hardcopy data package using the SMO-05-03, *Contract Verification Review Procedure* and the SMO 05-04, *Procedure for Electronic Data Deliverable Processing*. Data validation is performed upon the request of the Project Lead using AOP 00-03, *Data Validation Procedure for Chemical and Radiochemical Data for the Sample Management Office*. The Project Lead is responsible for using professional judgment in evaluating the data quality.

10.0 RECORD

Analytical reports will be provided with acceptable quality assurance/quality control. The following records will be maintained at the Customer Funded Record Center:

- authorized user list
- sampling and analytical results
- field forms
- inspection forms
- logbooks (if applicable).

Sampling results shall be kept electronically in the Environmental Data Management System database. Copies of logbooks (if applicable), authorized user list, field and inspection forms shall be maintained at the CAMU Administrative Trailer for the CAMU, CWL, and MWL per site-specific permits (CAMU and CWL) and the MWL LTMMP. Training records shall be kept electronically in the Training and Employee Development System (TEDS) database. TEDS shall be accessible from the CAMU Administrative Trailer.

11.0 REFERENCES

AOP 00-03, "Data Validation Procedure for Chemical and Radiochemical Data for the Sample Management Office", SNL/NM, Sample Management Office, (latest edition).

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. Resource Conservation and Recovery Act Facility Operating Permit, EPA ID No. NM5890110518, 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,

PLA 04-01, "Health and Safety Plan for the CAMU Containment Cell", SNL/NM, Environmental Programs and Assurance, (latest edition).

SMO-05-03, "Contract Verification Review Procedure", SNL/NM, Sample Management Office, (latest edition).

SMO 05-04, "Procedure for Electronic Data Deliverable Processing", Sample Management Office, (latest edition).

SNL PHS # SNL05A01119 "CAMU Containment Cell Monitoring", SNL/NM, (latest edition).

SNL PHS # SNL06A00497 "Vadose Zone Monitoring at the Mixed Waste Landfill", SNL/NM, (latest edition).

SNL PHS # SNL11A00081 "Environmental Programs Soil Vapor Well Sampling", SNL/NM (latest edition).

Attachment A

Corrective Action Management Unit

Site-Specific Information

Corrective Action Management Unit (CAMU) Introduction and Background

Soil moisture monitoring requirements for the 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).

Prior to performing work field technicians shall complete/document all required training as indicated in Table 1 of FOP 08-22, *Soil Vapor Sampling*, PLA 04-01, *Health & Safety Plan for the Corrective Action Management Unit*, and Attachment of the F the Resource Conservation and Recovery Act Facility Operating Permit, EPA ID No. NM5890110518.

CAMU Soil Vapor Sampling Network

The CAMU uses the following 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 (ft.) 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 ft. above ground and is sealed with a threaded 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 ft. and 15 ft. 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 ft. 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). Record the flow rate 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 if applicable (CSS only), and soil vapor screen volumes. Because minimum purge times are so small, they have been increased to a 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) which meet or exceed the minimum established criteria.

Detailed procedure

Record the required information on the Soil Vapor Sampling Log Form (LTS 2015-004).

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 [in] 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) Purge sampling tube, well casing if applicable (CSS locations only), and soil vapor screen. Use the purge volumes specific and flow rate meter values to calculate the purge times.
10) Obtain continuous photoionization detector (PID) measurements from the vacuum exhaust port.
11) Wait until the correct volume has been extracted and record the final PID measurement.
12) Close in-line valve and turn off vacuum pump. Record stop time (sampling time) and open SUMMA® canister valve until the vacuum gauge on the manifold reaches approximately minus 10 in. Hg then close the SUMMA® canister valve. Record the ending vacuum. (Note: The analytical laboratory, requests that approximately minus 10 in. Hg of vacuum remain in the SUMMA® canister at completion of sampling.)
13) Remove manifold from the SUMMA®.
14) Fill out date and sampling time on sample label and attach it to SUMMA® canister tag. Do not attach sample label to canister itself.
15) Complete Analysis Request/Chain-of-Custody.

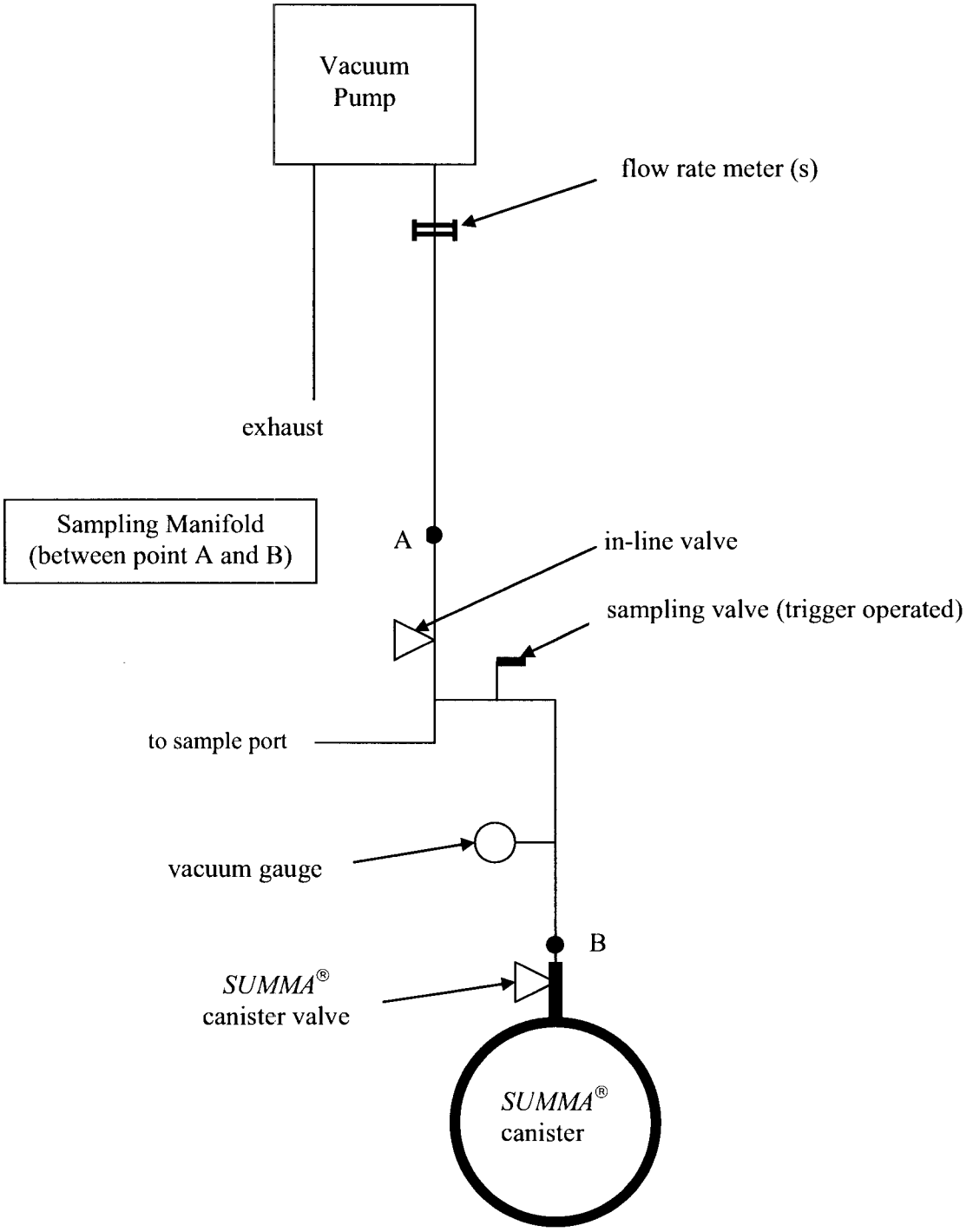

Figure A-1
Vacuum Pump, Sampling Manifold, and SUMMA® Canister Setup

Quality Assurance Samples

The following quality assurance samples shall be collected:

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

Collect quality assurance samples with an ending vacuum value of minus 10 in. Hg remaining in the SUMMA® canisters.

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 in. (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 a total of two 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.

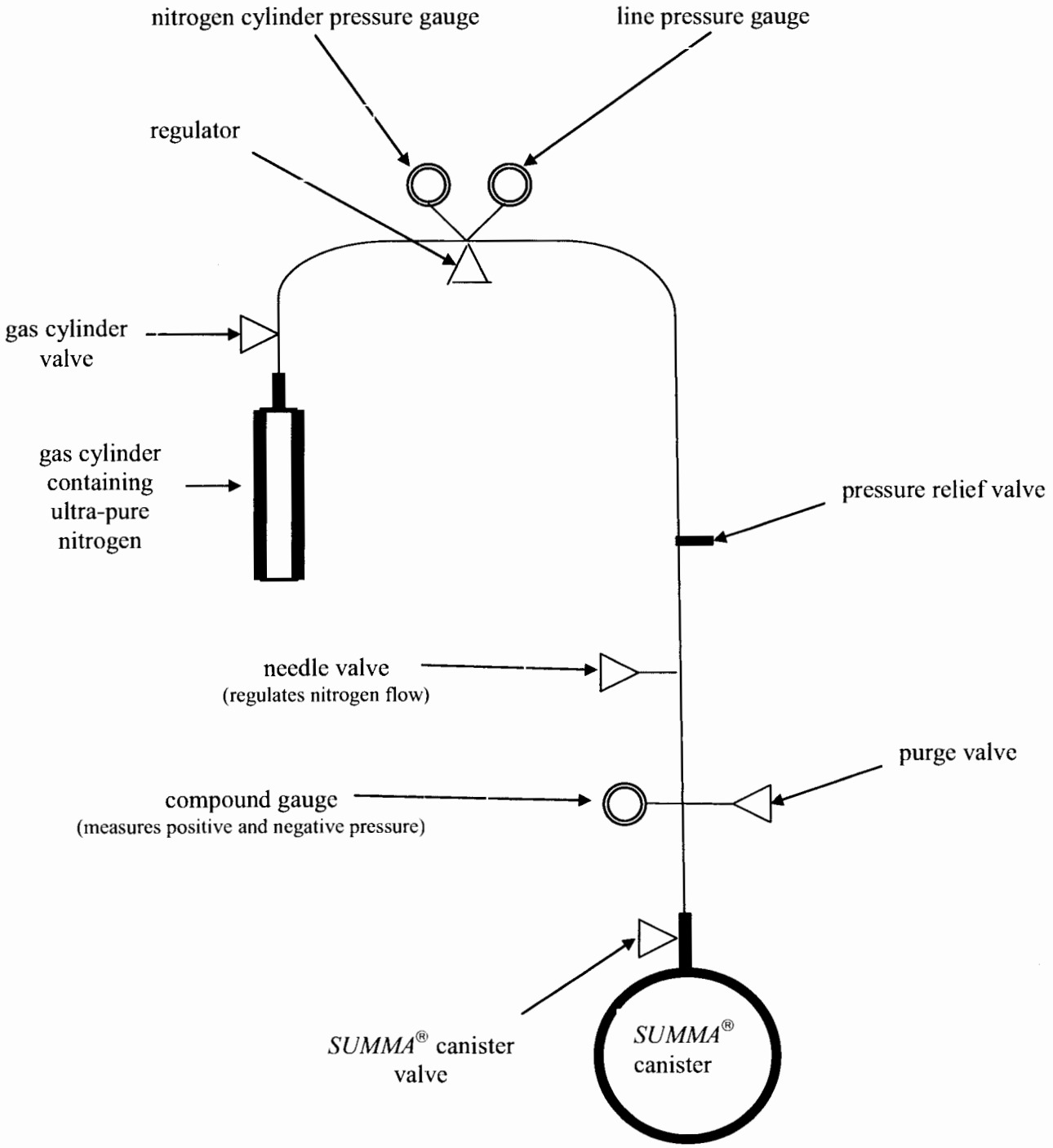

Figure A-2
Field Blank and Trip Blank Sampling Regulator Manifold and SUMMA® Canister Setup

Attachment B

Chemical Waste Landfill, Mixed Waste Landfill, and Technical Area V

Site-Specific Information

Chemical Waste Landfill (CWL) Background

Soil vapor sampling at the CWL shall be 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). In all cases, the requirements of the PCCP Sampling Analysis Plan (SAP) take precedence over those of any other referenced or listed document and/or procedure, including FOP 08-22, *Soil Vapor Sampling*.

Prior to performing CWL soil vapor sampling, field technician must meet all training requirements as specified in the PCCP.

CWL Soil Vapor Sampling Network

The CWL soil vapor sampling 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 feet (ft.) long by 0.31 inches (in.) inner diameter stainless steel screen that is attached to a 0.215 in. stainless steel tube that extends to the surface.

Mixed Waste Landfill (MWL) Background

Soil vapor sampling at the MWL shall be performed under the NMED approved LTMMP (NMED January 2014), and in conformance with the "Soil-Vapor Sampling and Analysis Plan for the Mixed Waste Landfill," LTMMP Appendix D. In all cases, the requirements of the LTMMP SAP take precedence over those of any other referenced or listed document and/or procedure, including FOP 08-22, *Soil Vapor Sampling*.

Prior to performing soil vapor sampling at the MWL, field technicians shall read the pertinent sections of the LTMMP.

MWL Soil Vapor Sampling Network

The MWL soil vapor sampling 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 ft. long by 0.5 in. diameter stainless steel screen. It is attached to a nominal 0.25 in. diameter polyethylene tube that extends 41 ft. to the ground surface and a sampling port.

The soil vapor sampling systems at MWL-SV-03, MWL-SV-04, and MWL-SV-05 consists 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) are set at 50, 100, 200, 300, and 400 foot depths and attach to nominal 0.25 in. diameter polyethylene tubing.

Technical Area V (TA-V) Background

Soil vapor monitoring is performed under the NMED issued a Compliance Order on Consent (NMED April 2004) to the United States Department of Energy and Sandia Corporation, and supplement a Corrective Measures Evaluation for the TA-V area of groundwater contamination. In all cases, the requirements of established or approved regulatory-approved work plan requirements for soil sampling take precedence over those of any other referenced or listed document and/or procedure, including FOP 08-22, *Soil Vapor Sampling.*

TA-V Soil Vapor Sampling Network

The TA-V soil vapor sampling network consists of three soil vapor monitoring wells (TAV-SV01, TAV-SV02, and TAV-SV03), with soil vapor sampling ports at depths of approximately 50 ft., 100 ft., 150 ft., 200 ft., 250 ft., 300 ft., 350 ft., 400 ft., 450 ft., and 500 ft. below ground surface. The soil vapor screen at each location consists of a 1-ft. long by 0.5-in. diameter stainless steel screen. It is attached to 0.25 in. outside diameter stainless steel tube that extends to the ground surface and a sampling port.

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 sampling tubing. The flow valve is opened to allow the gas to flow at a rate compatible with the total sampling time (purge). Record the flow rate 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. Since the flow in the system may be laminar, it is difficult to remove all of the old gas. Turbulent flow is better in that it removes the gas along the wall more quickly; therefore, based on subject matter expert calculations, equipment shall have the capability for turbulent flow or a minimum drawdown of 0.5 bar (~7.3 psi vacuum), and assuming that laminar flow velocity at the tubing wall is zero.

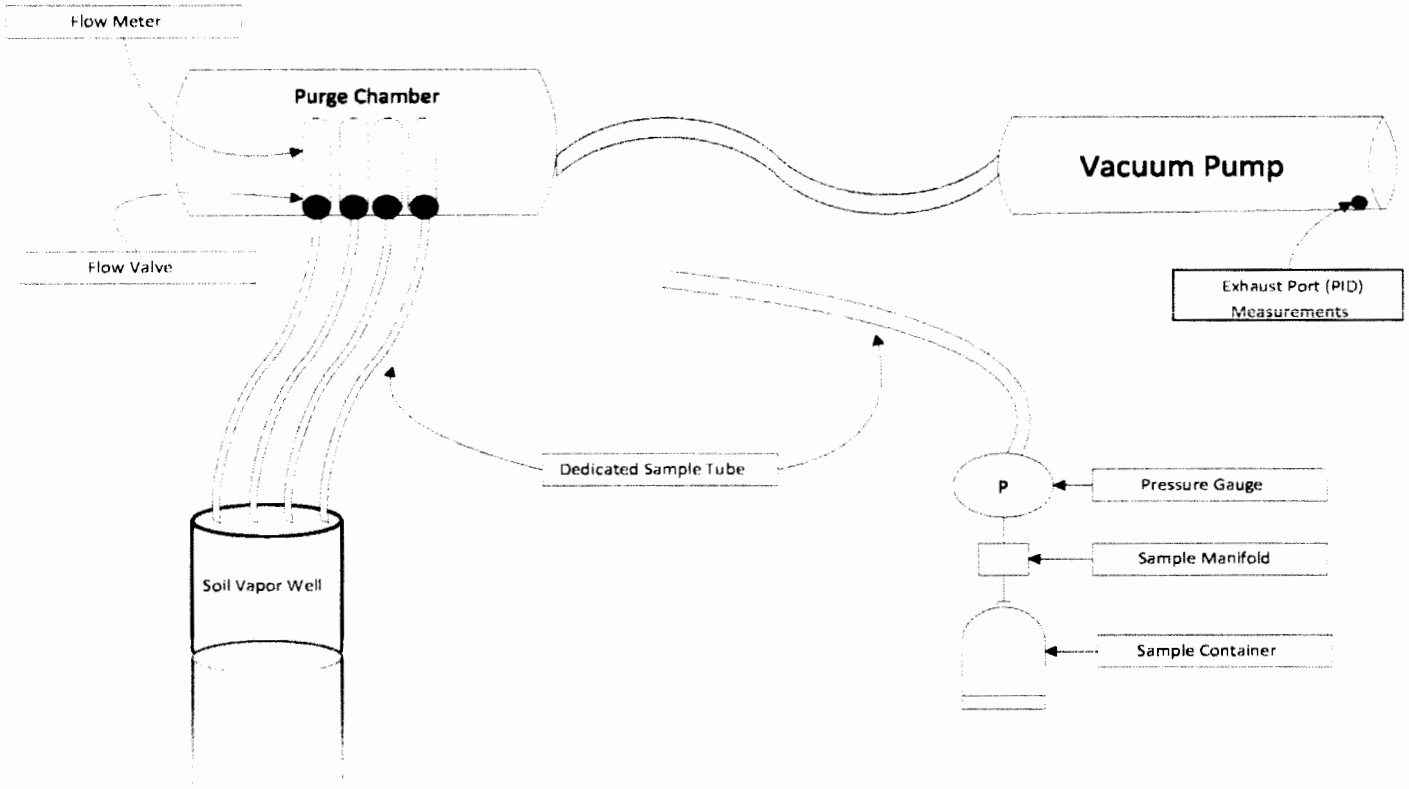

Figure B-1, Vacuum Pump, Sampling Manifold, and SUMMA® Canister

The recommended minimum volume of gas removal is three tube volumes. The more gas that is purged from the system, the more distant the origin of the gas sampled in the formation. The apparent limit is that the sampling purge volumes withdrawn should not be a significant influence on the natural flow field in the formation between sampling events.

Detailed procedure

Record the required information on the Soil Vapor Sampling Log Form (LTS 2015-004).

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 in. 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.

Additional sampling systems may be used to collect field quality samples including field blank and duplicate samples by simultaneous or in-series collection methods. It is best practice to remove gas remaining in the sample tubing or sampling manifolds any longer than necessary. Each sampling system should be equipped with valves that allow the system to be flushed with an inert gas (e.g., nitrogen gas).

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.

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)