

ATTACHMENT N

~~CONFIRMATORY~~ VOLATILE ORGANIC COMPOUND MONITORING PLAN

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Acronyms and Abbreviations

BFB	4-Bromofluorobenzene
BS/BSD	blank spike/blank spike duplicate
CH	Contact-handled
CLP	Contract Laboratory Program
COC	concentration of concern
CRQL	contract-required quantitation limit
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ft	feet
FTIR	Fourier transform infrared spectrometry
g/mol	grams per mole
GC/MS	gas chromatography/mass spectrometry
HWDU	Hazardous Waste Disposal Unit
LCS	laboratory control sample
m	meter
MDL	method detection limit
MOC	Management and Operating Contractor (Permit Condition I.D.3)
MRL	method reporting limit
NIST	National Institute of Standards and Testing
NMAC	New Mexico Administrative Code
ppbv	parts per billion by volume
QA	quality assurance
QAPD	Quality Assurance Program Description
QAPjP	Quality Assurance Project Plan
QC	quality control
RCRA	Resource Conservation and Recovery Act
RPD	relative percent difference
SOP	standard operating procedure
SOW	statement of work
TIC	tentatively identified compound
TRU	Transuranic
<u>VOC</u>	<u>volatile organic compound</u>
WIPP	Waste Isolation Pilot Plant

ATTACHMENT N

CONFIRMATORY VOLATILE ORGANIC COMPOUND MONITORING PLAN

1 N-1 Introduction

2 This Permit Attachment describes the confirmatory monitoring plan for volatile organic
3 compound (VOC) emissions from mixed waste that may be entrained in the exhaust air from the
4 U.S. Department of Energy (DOE) Waste Isolation Pilot Plant (WIPP) Underground Hazardous
5 Waste Disposal Units (HWDUs) during the disposal phase at the facility. The purpose of the
6 confirmatory VOC monitoring is to assure compliance with confirm that the concentrations of
7 VOCs in the emissions from the Underground HWDUs do not exceed the VOC room-based
8 limits specified in Permit Module IV. This VOC monitoring plan consists of two components as
9 follows; (1) Confirmatory VOC Monitoring which assesses compliance with the environmental
10 performance standards in Table IV.F.2.c; and (2) Disposal Room VOC Monitoring which
11 assesses compliance with the disposal room performance standards in Table IV.D.1.
12 Implementation of this plan ensures compliance with the disposal room performance standards
13 as directed by Section 311 of Public Law (P.L.) 108-137 and Section 310 of Public Law 108-
14 147. This plan includes the monitoring design, a description of sampling and analysis
15 procedures, quality assurance (QA) objectives, and reporting activities.

16 N-1a Background

17 The Underground HWDUs are located 2,150 feet (ft) (655 meters [m]) below ground surface, in
18 the WIPP underground. As defined for this Permit, an Underground HWDU is a single
19 excavated panel consisting of seven rooms and two access drifts designated for disposal of
20 contact-handled (CH) and remote-handled (RH) transuranic (TRU) mixed waste. Each room is
21 approximately 300 ft (91 m) long, 33 ft (10 m) wide, and 13 ft (4 m) high. Access drifts connect
22 the rooms and have the same cross section. The Permittees shall dispose of TRU mixed waste
23 in three Underground HWDUs designated as Panel 1, Panel 2 and Panel 3.

24 This plan addresses the following elements:

25 1. Rationale for the design of the monitoring program, based on:

- 26 ● Possible pathways from WIPP during the active life of the facility
- 27 ● Demonstrating compliance with the disposal room performance standards by
- 28 monitoring VOCs in underground disposal rooms
- 29 ● VOC sampling operations at WIPP
- 30 ● Optimum location of the ambient mine air monitoring stations

31 2. Descriptions of the specific elements of the monitoring program, including:

- 32 ● The type of monitoring conducted

- 1 ● The location of the monitoring stations
- 2 ● The monitoring interval
- 3 ● The specific hazardous constituents monitored
- 4 ● The implementation schedule for the monitoring program
- 5 ● The equipment used at the monitoring stations
- 6 ● Sampling and analytical techniques used
- 7 ● Data recording/reporting procedures
- 8 ● Action levels for remedial action if limits are approached

9 The results of baseline VOC monitoring at WIPP were used, in part, to define the VOC
10 monitoring program confirmatory monitoring program that will be established for the Disposal
11 Phase, during which full-scale waste emplacement activities will occur. The baseline VOC
12 monitoring results were presented in Appendix D21 of the WIPP Resource Conservation
13 Recovery Act (RCRA) Part B Permit Application (DOE, 1997). These data represent the
14 anticipated background levels of VOCs during operations at WIPP. The technical basis for
15 Disposal Room VOC Monitoring is discussed in detail in the Technical valuation Report for
16 Room-Based VOC Monitoring (WRES, 2003).

17 N-1b Objectives of the Confirmatory Volatile Organic Compound Monitoring Plan

18 The CH and RH TRU mixed waste disposed in the WIPP Underground HWDUs contain VOCs
19 which could be released from open and closed panels located at WIPP during the disposal
20 phase of the project. This plan describes how:

- 21 ● VOCs released from waste panels will be monitored to confirm that the annual average
22 concentration of VOCs in the air emissions from the Underground HWDUs do not
23 exceed the VOC concentrations of concern (COC) identified in Permit Module IV, Table
24 IV.F.2.c. listed in Table N-2. Appropriate remedial action specified in Permit Condition
25 IV.F.2.d. will be taken if limits are reached.

- 26 ● VOCs released from waste containers in disposal rooms will be monitored to confirm
27 that the concentration of VOCs in the air of closed and active rooms in active panels do
28 not exceed the disposal room performance standards in Permit Module IV, Table IV.D.1.
29 Remedial action, as specified in Permit Condition IV.F.2.g will be taken if the Action
30 Levels in Permit Module IV, Table IV.F.2.g are reached.

31 N-2 Target Volatile Organic Compounds

32 The target VOCs for this sampling plan confirmatory monitoring (Station VOC-A and VOC-B)
33 and room-based monitoring will be as follows: presented in Table N-1.

34 These target VOCs were selected because together they represent approximately 99 percent of
35 the risk due to air emissions. Physical and chemical data for these target VOCs for confirmatory
36 air monitoring are presented in Table N-1.

1 N-3 Monitoring Design

2 Detailed design features of this plan are presented in this section. This plan uses available
3 sampling and analysis techniques to measure VOC concentrations in air. Available ~~s~~Sampling
4 equipment includes the WIPP VOC canister samplers for both the Confirmatory and Disposal
5 Room Monitoring Programs.

6 N-3a Sampling Locations

7 Air samples will be collected in the underground to quantify airborne VOC concentrations as
8 described in the following sections.

9 N-3a(1) Sampling Locations for Confirmatory VOC Monitoring

10 The initial configuration for the confirmatory VOC monitoring stations is shown in Figure N-1. All
11 mine ventilation air which could potentially be impacted by VOC emissions from the
12 Underground HWDUs identified as Panels 1 through 3 will pass monitoring Station VOC-A,
13 located in the E-300 drift as it flows to the exhaust shaft. Air samples will be collected at two
14 locations in the facility to quantify airborne VOC concentrations. VOC concentrations
15 attributable to VOC emissions from open and closed panels containing CH TRU mixed waste
16 will be measured by placing one VOC monitoring station just downstream from Panel 1 at VOC-
17 A. The location of Station VOC-A will remain the same throughout the term of this Permit. The
18 second station (Station VOC-B) will always be located upstream from the open panel being filled
19 with waste (starting with Panel 1 at monitoring Station VOC-B (Figure N-1). In this configuration,
20 Station VOC-B will measure VOC concentrations attributable to releases from the upstream
21 sources and other background sources of VOCs, but not releases attributable to open or closed
22 panels. The location of Station VOC-B will change when disposal activities begin in Panel 2 and
23 again when disposal activities begin in Panel 3, if necessary. Station VOC-B will be relocated to
24 ensure that it is always upstream of the open panel that is receiving TRU mixed waste. Station
25 VOC-A will also measure upstream VOC concentrations measured at Station VOC-B, plus any
26 additional VOC concentrations resulting from releases from the closed and open panels. A
27 sample will be collected from each monitoring station on designated sample days. For each
28 quantified target VOC, the concentration measured at Station VOC-B will be subtracted from the
29 concentration measured at Station VOC-A to assess the magnitude of VOC releases from
30 closed and open panels.

31 The sampling locations were selected based on operational considerations. There are several
32 different potential sources of release for VOCs into the WIPP mine ventilation air. These
33 sources include incoming air from above ground and facility support operations, as well as open
34 and closed waste panels. In addition, because of the ventilation requirements of the
35 underground facility and atmospheric dispersion characteristics, any VOCs that are released
36 open or closed panels may be difficult to detect and differentiate from other sources of VOCs at
37 any underground or above ground location further downstream of Panel 1. By measuring VOC
38 concentrations close to the potential source of release (i.e., at Station VOC-A), it will be possible
39 to differentiate potential releases from background levels (measured at Station VOC-B).

1 N-3a(2) Sampling Locations for Disposal Room VOC Monitoring

2 For purposes of compliance with the Section 311 of Public Law 108-137 and Section 310 of
3 Public Law 108-447, the VOC monitoring of airborne VOCs in underground disposal rooms in
4 which waste has been emplaced will be performed as follows:

- 5 ● A sample head will be installed inside the disposal room behind the exhaust drift
6 bulkhead and at the inlet side of the disposal room.
- 7
- 8 ● TRU mixed waste will be emplaced in the active disposal room.
- 9
- 10 ● When the active disposal room is filled, another sample head will be installed to
11 the inlet of the filled active disposal room. (Figure N-3 and N-4)
- 12
- 13 ● The exhaust drift bulkhead will be removed and re-installed in the next disposal
14 room so disposal activities may proceed.
- 15
- 16 ● A ventilation barrier will be installed where the bulkhead was located in the active
17 disposal room's exhaust drift. Another ventilation barrier will be installed in the
18 active disposal room's air inlet drift, thereby closing that active disposal room.
- 19
- 20 ● Monitoring of VOCs will continue in the now closed disposal room. Monitoring of
21 VOCs will occur in the active disposal room and all closed disposal rooms in
22 which waste has been emplaced until commencement of panel closure activities
23 (i.e., completion of ventilation barriers in Room 1).

24 This sequence for installing sample locations will proceed in the remaining disposal rooms until
25 the inlet air ventilation barrier is installed in disposal room one. An inlet sampler will not be
26 installed in disposal room one because disposal room sampling proceeds to the next panel.

27 N-3b Analytes to Be Monitored

28 The nine VOCs that have been identified for confirmatory and room-based monitoring are listed
29 in Table N-1. The analysis will focus on routine detection and quantification of these compounds
30 in collected samples. Other compounds may also be present in the samples. As part of the
31 analytical evaluations, the presence of other compounds will be investigated. The analytical
32 method will allow semiquantitative evaluation of these compounds as tentatively identified
33 compounds. The analytical laboratory will be directed to classify these compounds as
34 Tentatively Identified Compounds (TICs). For the confirmatory VOC monitoring program, TICs
35 detected in 25% or more of the samples in a running year will be reported to NMED and added
to the target analyte list, unless the Permittees can justify the exclusion from the target analyte
list.

1 TICs detected in the confirmatory and room-based monitoring programs will be placed in the
2 WIPP Operating Record and reported to NMED in the Annual Mine Ventilation Report in
3 accordance with Section IV.F.2.b of Module IV of the HWFP.

4 N-3c Sampling and Analysis Methods

5 The present WIPP VOC monitoring program includes a comprehensive VOC monitoring
6 program established at the facility; equipment, training, and documentation for VOC
7 measurements are already in place.

8 The method that will be used for VOC sampling is based on the concept of pressurized sample
9 collection contained in the U.S. Environmental Protection Agency (EPA) Compendium Method
10 TO-14A (EPA, 1997) TO-15 (EPA, 1999). The TO-14A TO-15 sampling concept uses 6-liter
11 SUMMA[®] passivated or equivalent) stainless-steel canisters to collect integrated air samples at
12 each sample location. This conceptual method will be used as a reference for collecting the
13 samples at WIPP. The samples will be analyzed using gas chromatography/mass spectrometry
14 (GC/MS) under an established QA/quality control (QC) program. Laboratory analytical
15 procedures have been developed based on the concepts contained in both TO-14A TO-15,
16 8260b, and the draft *EPA Contract Laboratory Program - Statement of Work (CLP-SOW) for*
17 *Volatile Organics Analysis of Ambient Air in Canisters* (EPA, 1994). Section N-5 contains
18 additional QA/QC information for this project.

19 The TO-14A TO-15 method is an EPA-recognized sampling concept for VOC sampling and
20 speciation. It can be used to provide integrated samples, or grab samples, and compound
21 quantitation for a broad range of concentrations. The sampling system can be operated
22 unattended but requires detailed operator training. This sampling technique is viable for use
23 while analyzing the sample using other EPA methods such as 8260b.

24 The field sampling systems will be operated in the pressurized mode. In this mode, air is drawn
25 through the inlet and sampling system with a pump. The air is pumped into an initially evacuated
26 SUMMA[®] passivated or equivalent canister by the sampler, which regulates the rate and
27 duration of sampling. ~~The passivation process forms a pure chrome-nickel oxide on the interior~~
28 ~~surfaces of the canisters.~~ The treatment of tubing and canisters used for VOC sampling
29 effectively seals the inner walls and prevents compounds from being retained on the surfaces of
30 the equipment. By the end of each sampling period, the canisters will be pressurized to about
31 two atmospheres absolute. In the event of shortened sampling periods or other sampling
32 conditions, the final pressure in the canister may be less than two atmospheres absolute.
33 Sampling duration will be approximately six hours, so that a complete sample can be collected
34 during a single work shift.

35 The canister sampling system and GC/MS analytical method are particularly appropriate for the
36 VOC Confirmatory Monitoring Program because a relatively large sample volume is collected,
37 and multiple dilutions and reanalyses can occur to ensure identification and quantification of
38 target VOCs within the working range of the method. The contract-required quantitation limits
39 (CRQL) proposed by the EPA in the CLP-SOW are 5 parts per billion by volume (ppbv) or less

1 for the nine target compounds (EPA, 1994). Consequently, low concentrations can be
2 measured. CRQLs are the EPA-specified levels of quantitation proposed for EPA contract
3 laboratories that analyze canister samples by GC/MS. For the purpose of this plan, the CRQLs
4 will be defined as the method reporting limits (MRL). The MRL is a function of instrument
5 performance, sample preparation, sample dilution, and all steps involved in the sample analysis
6 process.

7 ~~Alternative sampling methods will be considered for deployment. One option will be to use~~
8 ~~subatmospheric samplers rather than pressurized sampling systems for stations VOC-A and~~
9 ~~VOC-B. In addition, remote sensing by proposed draft EPA Method TO-16, open-path fourier~~
10 ~~transform infrared spectrometry (FTIR) and extractive FTIR, may constitute supplemental or~~
11 ~~alternative methods for detecting VOCs released from waste panels at WIPP. WIPP personnel~~
12 ~~will continue to follow the development of emerging FTIR technology, and other potentially~~
13 ~~applicable technologies for assessing VOCs in the WIPP environment. Real-time monitoring~~
14 ~~with an FTIR system may be a feasible future option for the VOC Confirmatory Monitoring~~
15 ~~Program. If the Permittees determine that an alternate sampling technique is appropriate, the~~
16 ~~Permittees will submit a request for a Permit modification to the Secretary for review and~~
17 ~~approval. The Permit modification request will include a revised confirmatory VOC monitoring~~
18 ~~plan.~~

19 Disposal room VOC monitoring system will employ the same canister sampling method as used
20 in the confirmatory VOC monitoring. Passivated or equivalent sampling lines will be installed in
21 the disposal room as described in Section N-3a(2). The independent lines will run from the
22 sample inlet point to the individual sampler located in the access drift to the disposal panel. The
23 air will pass through dual particulate filters to prevent sample and equipment contamination.

24 N-3d Sampling Schedule

25 ~~The Permittees will conduct sampling prior to waste emplacement to troubleshoot the~~
26 ~~monitoring and analytical systems. The Permittees will evaluate whether the monitoring systems~~
27 ~~and analytical methods are functioning properly. The assessment period will be determined by~~
28 ~~the Permittees.~~

29 N-3d(1) Sampling Schedule for Confirmatory VOC Monitoring

30 Confirmatory VOC sampling at Stations VOC-A and VOC-B began with initial waste
31 emplacement in Panel 1. Sampling will continue until the certified closure of the last
32 Underground HWDU. Routine sampling will be conducted two times per week.

33 N-3d(2) Sampling Schedule for Disposal Room VOC Monitoring

34 The disposal room sampling will occur once every two weeks, unless the need to increase the
35 frequency to weekly occurs in accordance with Permit Condition IV.F.2.g.

1 N-3e Data Evaluation and Reporting

2 N-3e(1) Data Evaluation and Reporting for Confirmatory VOC Monitoring

3 When the Permittees receive laboratory analytical data from an air sampling event, the data will
4 be validated as specified in Section N-5e. After obtaining validated data from an air sampling
5 event, the data will be evaluated to determine whether the VOC emissions from the
6 Underground HWDUs exceed the COCs. The COCs for each of the nine target VOCs are
7 presented in Permit Module IV, Table IV.F.2.c ~~Table N-2~~. The values are presented in terms of
8 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) and ppbv.

9 The COCs were calculated assuming typical operational conditions for ventilation rates in the
10 mine. The typical operational conditions were assumed to be an overall mine ventilation rate of
11 425,000 standard cubic feet per minute and a flow rate through the E-300 Drift at Station VOC-A
12 of 130,000 standard cubic feet per minute.

13 Since the mine ventilation rates at the time the air samples are collected may be different than
14 the mine ventilation rates during typical operational conditions, the Permittees will measure
15 and/or record the overall mine ventilation rate and the ventilation rate in the E-300 Drift at
16 Station VOC-A that are in use during each sampling event. The Permittees shall also measure
17 and record temperature and pressure conditions during the sampling event to allow all
18 ventilation rates to be converted to standard flow rates.

19 If the air samples were collected under the typical mine ventilation rate conditions, then the
20 analytical data will be used without further manipulation. The concentration of each target VOC
21 detected at Station VOC-B will be subtracted from the concentration detected at Station VOC-A.
22 The resulting VOC concentration represents the concentration of VOCs being emitted from the
23 open and closed Underground HWDUs upstream of Station VOC-A (or the Underground HWDU
24 VOC emission concentration.)

25 If the air samples were not collected under typical mine ventilation rate operating conditions, the
26 air monitoring analytical results from both Station VOC-A and Station VOC-B will be normalized
27 to the typical operating conditions. This will be accomplished using the mine ventilation rates in
28 use during the sampling event and the following equation:

29 **[No changes are proposed to Equation N-1]** (N-1)

30 Where: NVOC_{AB} = Normalized target VOC concentration from Stations
31 VOC-A or VOC-B
32 VOC_{AB} = Concentration of the target VOC detected at Station VOC-A or
33 VOC-B under non-typical mine ventilation rates
34 scfm = Standard cubic feet per minute

1 The Permittees shall notify the Secretary in writing, within five (5) working days of obtaining
2 validated analytical results, whenever the concentration of any VOC specified in Permit Module
3 IV, Table IV.D.1. exceeds the action levels specified in Permit Module IV, Table IV.F.2.g.

4 The Permittees shall submit to the Secretary an annual report along with the confirmatory
5 monitoring data as specified in Permit Condition IV.F.2.f.

6 N-4 Sampling and Analysis Procedures

7 This section describes the equipment and procedures that will be implemented during sample
8 collection and analysis activities for VOCs at WIPP.

9 N-4a Sampling Equipment

10 The sampling equipment that will be used includes the following: 6-liter (L) stainless-steel
11 SUMMA® canisters (or equivalent), and VOC canister samplers, treated stainless steel tubing,
12 and a dual filter housing. A discussion of each of these items is presented below.

13 N-4a(1) SUMMA® Canisters

14 Six-liter, stainless-steel canisters with SUMMA® passivated (or equivalent) interior surfaces will
15 be used to collect and store all ambient air and gas samples for VOC analyses collected as part
16 of the monitoring processes. These canisters will be cleaned and certified prior to their use, in a
17 manner similar to that described by Compendium Method ~~TO-14A~~ TO-15 and the draft EPA
18 CLP-SOW for Analysis of Ambient Air in Canisters (EPA, 1994). The canisters will be certified
19 clean to below the required reporting limits for the VOC analytical method for the target VOCs
20 (~~see Table N-4~~). The vacuum of certified clean samplers will be verified at the sampler upon
21 initiation of a sample cycle.

22 N-4a(2) Volatile Organic Compound Canister Samplers

23 A conceptual diagram of a VOC sample collection unit is provided in Figure N-2. ~~Two such~~
24 ~~systems, located~~ Such units will be used at monitoring Stations VOC-A and VOC-B, ~~will be~~
25 ~~operational at the time waste disposal operations begin in Panel 4~~ and at sampling locations for
26 room-based measurements. The sampling system units consists of a sample pumps, flow
27 controllers, sample inlets, ~~two~~ inlet filters in series to remove particulate matter,
28 vacuum/pressure gauges, electronic timers, inlet purge vents, two sampling ports, and sufficient
29 collection canisters so that any delays attributed to laboratory turnaround time and canister
30 cleaning and certification will not result in canister shortages. Knowledge of sampler flow rates
31 and duration of sampling will allow calculation of sample volume. The set point flow rate will be
32 verified before and after sample collection from the mass flow indication. Prior to their initial use
33 and annually thereafter, the sample collection units will be tested and certified to demonstrate
34 that they are free of contamination above the reporting limits of the VOC analytical method (see
35 Section N-5). Ultra-high purity humidified zero air will be pumped through the inlet line and
36 sampling unit and collected in previously certified canisters as sampler blanks for analysis. The

1 cleaning and certification procedure is derived from concepts contained in the EPA
2 Compendium Method TO-14A (EPA, 1997) TO-15 (EPA, 1999).

3 N-4a(3) Sample Tubing

4 Treated stainless steel tubing is used as a sample path from the desired sample point, to the
5 sample collection unit. This tubing is treated to prevent the inner walls from absorbing
6 contaminants, they are pulled from the sample point to the sample collection unit.

7 N-4b Sample Collection

8 Six-hour integrated samples will be collected on each sample day. Alternative sampling
9 durations may be defined for experimental purposes. The VOC canister sampler at each
10 location will sample ambient air on the same programmed schedule. The sample pump will be
11 programmed to sample continuously over a six-hour period during the workday. The units will
12 sample at a nominal flow rate of 33.3 actual milliliters per minute over a six-hour sample period.
13 This schedule will yield a final sample volume of approximately 12 L. Flow rates and sampling
14 duration may be modified as necessary for experimental purposes and to meet the data quality
15 objectives.

16 Sample flow will be checked each sample day using an in-line mass flow controller. The flow
17 controllers are initially factory-calibrated and specify a typical accuracy of better than 10 percent
18 full scale. Additionally, each air flow controller is calibrated at a manufacturer-specified
19 frequency using a National Institute of Standards and Testing (NIST) primary flow standard.

20 Upon initiation of waste disposal activities in Panel 1, samples will be collected twice each week
21 (at Stations VOC-A and VOC-B). Samples collected at the panel locations should represent the
22 same matrix type (i.e., elevated levels of salt aerosols). To verify the matrix similarity and
23 assess field sampling precision, field duplicate samples will be collected (two canisters filled
24 simultaneously by the same sampler) from each sampling station (Stations VOC-A and VOC-B)
25 during the first sampling event and at an overall frequency of 5 percent thereafter (see
26 Section N-5a).

27 Prior to collecting disposal room samples, the sample line is purged to ensure that the air
28 collected is not air that has been stagnant in the tubing. This is important in regard to the
29 disposal room sample particularly because of the long lengths of tubing associated with these
30 samples. The confirmatory samples do not require this action due to the short lengths of tubing
31 required at these locations.

32 N-4c Sample Management

33 Field sampling data sheets will be used to document the sampler conditions under which each
34 sample is collected. These data sheets have been developed specifically for VOC monitoring at
35 the WIPP facility. The individuals assigned to collect the specific samples will be required to fill

1 in all of the appropriate sample data and to maintain this record in sample logbooks. The
2 program team leader will review these forms for each sampling event.

3 All sample containers will be marked with identification at the time of collection of the sample. A
4 Request-for-Analysis Form (~~Figure N-3~~) will be completed to identify the sample canister
5 number(s), sample type and type of analysis requested.

6 All samples will be maintained, and shipped if necessary, at ambient temperatures. Collected
7 samples will be transported in appropriate containers. Prior to leaving the underground for
8 analysis, sample containers may undergo radiological screening. No potentially contaminated
9 samples or equipment will be transported to the surface. No samples will be accepted by the
10 receiving laboratory personnel unless they are properly labeled and sealed to ensure a tamper
11 free shipment.

12 An important component of the sampling program is a demonstration that collected samples
13 were obtained from the locations stated and that they reached the laboratory without alteration.
14 To satisfy this requirement, evidence of collection, shipment, laboratory receipt, and custody will
15 be documented with a completed Chain-of-Custody Form (~~Figure N-4~~). Chain-of-custody
16 procedures will be followed closely, and additional requirements imposed by the laboratory for
17 sample analysis will be included as necessary.

18 Individuals collecting samples will be responsible for the initiation of custody procedures. The
19 chain of custody will include documentation as to the canister certification, location of sampling
20 event, time, date, and individual handling the samples. Deviations from procedure will be
21 considered variances. Variances must be preapproved by the program manager and recorded
22 in the project files. Unintentional deviations, sampler malfunctions, and other problems are
23 nonconformances. Nonconformances must be documented and recorded in the project files. All
24 field logbooks/data sheets must be incorporated into WIPP's records management program.

25 N-4d Sampler Maintenance

26 Periodic maintenance for canister samplers and associated equipment will be performed during
27 each cleaning cycle. This maintenance will include, but not be limited to, replacement of
28 damaged or malfunctioning parts without compromising the integrity of the sampler, leak testing,
29 and instrument calibration. Additionally, complete spare units will be maintained on-site to
30 minimize downtime because of sampler malfunction. At a minimum, canister samplers will be
31 certified for cleanliness initially and annually thereafter upon initial use, after any parts that are
32 included in the sample flow path are replaced, or any time analytical results indicate potential
33 contamination. All sample canisters will be certified prior to each usage.

34 N-4e Analytical Procedures

35 Analytical procedures used in the analysis of VOC samples from canisters are based on
36 concepts contained in Compendium Method ~~TO-14A (EPA, 1997)~~ TO-15 (EPA, 1999) and in the

1 draft CLP-SOW for Analysis of Ambient Air (EPA, 1994). The technical approach for canister
2 sample analysis is summarized below:

3 Analysis of samples will be performed by a certified laboratory. Methods will be specified in
4 procurement documents and will be selected to be consistent with EPA recommended
5 procedures in SW-846 (EPA, 1996). Additional detail on analytical techniques and methods will
6 be given in laboratory SOPs.

7 The Permittees will establish the criteria for laboratory selection, including the stipulation that
8 the laboratory follow the procedures specified in SW-846 and that the laboratory follow EPA
9 protocols. The selected laboratory shall demonstrate, through laboratory SOPs, that it will follow
10 appropriate EPA SW-846 requirements and the requirements specified by the EPA protocols.
11 The laboratory shall also provide documentation to the Permittees describing the sensitivity of
12 laboratory instrumentation. This documentation will be retained in the facility operating record
13 and will be available for review upon request by NMED.

14 The SOPs for the laboratory currently under contract will be maintained in the operating record
15 by the Permittees. The Permittees will provide NMED with an initial set of applicable laboratory
16 SOPs for information purposes, and provide NMED with any updated SOPs on an annual basis.

17 Data validation will be performed by the Permittees. Copies of the data validation report will be
18 kept on file in the operating record for review upon request by NMED.

19 N-4e(1) Sample Preparation

20 Because canisters will be pressurized during the sampling procedure, laboratory pressurization
21 will not normally be necessary for analyses. Canister pressures will be verified by the laboratory
22 when they are received to confirm that significant losses did not take place during shipping and
23 storage.

24 N-4e(2) Analytical System Requirements

25 The GC/MS analytical system will consist of three major components: the sample introduction
26 system, the analyte separation system (GC), and the analyte detector system (MS):

27 ● ~~Sample Introduction System for Canisters: This system may include a drying tube to~~
28 ~~remove moisture from the gas stream. One or more cryogenic traps may be used to~~
29 ~~focus and desorb trapped material. Transfer lines within the introduction unit will be~~
30 ~~heated as necessary so that volatile compounds are not actively adsorbed. Valves and~~
31 ~~solenoids will be heated and of a low dead volume type. The introduction system will~~
32 ~~have an in-line mass flow controller. The introduction unit will be capable of introducing~~
33 ~~internal standards directly into the sample flow path.~~

34 ● ~~Analyte Separation: Analyte separation will be achieved by GC. The GC will be capable~~
35 ~~of subambient temperature programming.~~

- 1 ● ~~Detection System: Analyte detection will be accomplished by MS. The MS must be~~
2 ~~capable of scanning from 35 to 300 mass-to-charge ratio in one second or less, using 70~~
3 ~~electron-volt electron energy in the electron impact ionization mode, and produce a~~
4 ~~mass spectrum which meets all the instrument performance acceptance criteria when 50~~
5 ~~nanograms of 4-bromofluorobenzene (BFB) is analyzed. The MS must have a data~~
6 ~~system capable of continuous acquisition and storage on machine readable media~~
7 ~~storing all raw data, and a computer algorithm for analyte quantitation and forward library~~
8 ~~searching. All raw and processed GC/MS data must be stored on magnetic tape or disk~~
9 ~~and maintained as Lifetime Records (i.e., for the life of the confirmatory VOC monitoring~~
10 ~~program plus six years).~~

11 N-4e(3) Standard Preparation

12 ~~Primary analytical standards will be prepared by the laboratory from commercially available,~~
13 ~~certified calibration gases. Alternatively, primary standards may be generated internally by the~~
14 ~~laboratory. Primary standards of analytes that are gases at standard temperature and pressure~~
15 ~~may be prepared internally in a static gas dilution bottle. For analytes that are liquid or solid at~~
16 ~~standard temperature and pressure, a mixture may be made and loaded directly into a standard~~
17 ~~preparation cylinder. These internally generated standards will be checked against EPA audit~~
18 ~~cylinders or other reference materials to verify the accuracy of their concentrations.~~

19 ~~Primary standards will be prepared for the nine target compounds as well as the internal~~
20 ~~standards. Secondary standards used for instrument calibration will be prepared from dilution of~~
21 ~~the primary standards.~~

22 N-4e(4) Calibration Procedures

23 ~~Prior to the analysis of a standard curve, the GC/MS system must undergo a mass calibration~~
24 ~~check. This check is performed by introducing 50 nanograms of BFB into the capillary column~~
25 ~~through the preconcentrator. The requirements (criteria) for relative ion abundances for BFB,~~
26 ~~listed in Table N-3, must be met before analyses may proceed. BFB requirements must be met~~
27 ~~for each 12 hours of operation.~~

28 ~~Quantitative standards for the nine target analytes will be analyzed at five concentrations.~~
29 ~~These concentrations should define the linear range of the instrument for these nine~~
30 ~~compounds; however, if some nonlinearity exists, concentrations may be determined by curve~~
31 ~~fitting or physically plotting the data. One standard concentration shall be at or near a~~
32 ~~concentration corresponding to the required MRL for each target compound. Relative response~~
33 ~~factors will be generated for each target compound. These response factors must meet the~~
34 ~~requirements listed in Section N-5a(3). As discussed above, if low concentration standards do~~
35 ~~not meet the linearity requirement, a curve-fitting routine may be used. The method used to~~
36 ~~quantify the data must be reported with the analytical results. In addition, a single point~~
37 ~~calibration check will be performed for each 12 hours of analytical system operation.~~

1 ~~N-4e(5) Library Searches~~

2 ~~In every sample analyzed, a forward search of the NIST library of mass spectra for tentatively~~
3 ~~identified compounds must be performed for all chromatographic peaks greater than 10 percent~~
4 ~~of the nearest internal standard.~~

5 ~~N-4e(6) Data Reporting~~

6 ~~The laboratory will provide a data package that identifies and describes the sample analyzed,~~
7 ~~the analysis date, the analytical results, the QC check results and description of any unusual~~
8 ~~conditions encountered.~~

9 ~~Sample target analyte concentrations will be quantified using the average relative response~~
10 ~~factor of the initial calibration standards and will be reported in ppbv. Non-target sample~~
11 ~~contaminants identified by NIST library searches will be reported as tentatively identified~~
12 ~~compounds, and concentration calculations will be based on the response of the nearest~~
13 ~~internal standard. The relative response factor used for quantitation, as well as copies of~~
14 ~~spectra with the library search results (purity and/or fit), will be submitted with the results. A~~
15 ~~table listing the run sequence with the corresponding internal standard area counts will be~~
16 ~~reported with the analytical results. A narrative describing any problems with sample analyses~~
17 ~~will be included. Any nonconformances must be included with the reporting of the data.~~

18 ~~N-4f Laboratory Selection~~

19 ~~Sample will be analyzed at the WIPP on-site analytical laboratory and/or at a suitable contract~~
20 ~~analytical laboratory. Upon selection of an off-site contract laboratory, the Permittees will ensure~~
21 ~~that procured services conform to specified requirements. These measures generally will~~
22 ~~include one or more of the following: (1) evaluation of the supplier's capability to provide~~
23 ~~services in accordance with requirements, including a history of providing similar services;~~
24 ~~(2) evaluation of objective evidence of conformance, such as laboratory document submittals;~~
25 ~~and (3) examination of delivered services.~~

26 ~~If the WIPP on-site analytical laboratory is utilized to conduct the sample analyses, then~~
27 ~~duplicate samples from each sampling station (Stations VOC-A and VOC-B) will be collected at~~
28 ~~an overall frequency of 10 percent. The duplicate samples will be analyzed by an independent~~
29 ~~off-site analytical laboratory (see Section N-5a).~~

30 ~~N-4g Laboratory Procedures~~

31 ~~Specific laboratories that perform analyses and sampler certification activities for the~~
32 ~~Confirmatory VOC Monitoring Program are required to develop and maintain the following SOPs~~
33 ~~as appropriate:~~

- 34 ~~● Canister cleaning and certification~~
35 ~~● Sampler cleaning and certification~~

- 1 —●— Analyses of VOCs in SUMMA[®] canisters
- 2 —●— Data QA and reporting

3 ~~Analytical laboratories are required to maintain an internal program QA manual, and to develop~~
4 ~~and prepare a Quality Assurance Project Plan (QAPjP) covering cleaning and certification of~~
5 ~~canisters and laboratory analysis of canister samples.~~

6 N-5 Quality Assurance

7 The QA activities for the confirmatory VOC monitoring program will be conducted in accordance
8 with the document *EPA Requirements for Quality Assurance Project Plans for Environmental*
9 *Data Operations* (EPA, 1994), and the *Interim Guidelines and Specifications for Preparing*
10 *Quality Assurance Project Plans* (EPA, 1983). The QA criteria for the confirmatory VOC
11 monitoring program are listed in Table N-4. This section addresses the methods to be used to
12 evaluate the components of the measurement system and how this evaluation will be used to
13 assess data quality. The QA limits for the sampling procedures and laboratory analysis shall be
14 in accordance with the limits set forth in the specific EPA Method referenced in standard
15 operating procedures employed by either the Permittees or the laboratory. The Permittees
16 standard operating procedures will be in the facility Operating Record and available for review
17 by NMED at anytime. The laboratory standard operating procedures will also be in the facility
18 Operating Record and will be supplied to the NMED as indicated in Section N-4e of this
19 Attachment.

20 ~~These data quality objectives are based on control criteria proposed by the EPA as presented in~~
21 ~~the *GLP-SOW for the Volatile Organics Analysis of Ambient Air in Canisters* (EPA, 1994).~~

22 ~~N-5a Quality Assurance Objectives for the Measurement of Precision, Accuracy, Sensitivity, and~~
23 ~~Completeness~~

24 ~~QA objectives for this plan will be defined in terms of the following data quality parameters:~~

25 ~~Precision. For the duration of this program, precision will be defined and evaluated by the RPD~~
26 ~~values calculated between field duplicate samples and between laboratory duplicate samples.~~

27 ~~[Equation N-2 proposed of deletion]~~ (N-2)

28 ~~where: — A = Original sample result~~
29 ~~— B = Duplicate sample result~~

30 ~~Accuracy. Analytical accuracy will be defined and evaluated through the use of analytical~~
31 ~~standards. Because recovery standards cannot reliably be added to the sampling stream,~~
32 ~~overall system accuracy will be based on analytical instrument performance evaluation criteria.~~

1 These criteria will include performance verification for instrument calibrations, laboratory control
2 samples, sample surrogate recoveries, and sample internal standard areas. These criteria will
3 constitute the verification of accuracy for target analyte quantitation (i.e., quantitative accuracy).
4 Evaluation of standard ion abundance criteria for BFB will be used to evaluate the accuracy of
5 the analytical system in the identification of targeted analytes, as well as the evaluation of
6 unknown contaminants (i.e., qualitative accuracy).

7 Sensitivity. Sensitivity will be defined by the required MRLs for the program. Attainment of
8 required MRLs will be verified by the performance of statistical method detection limit (MDL)
9 studies in accordance with ~~40 Code of Federal Regulations § 136~~. The MDL represents the
10 minimum concentration that can be measured and reported with 99 percent confidence that the
11 analyte concentration is greater than zero. An MDL study will be performed by the program
12 analytical laboratory prior to sampling and analysis, and annually thereafter.

13 Completeness. Completeness will be defined as the percentage of the ratio of the number of
14 valid sample results received (i.e., those which meet data quality objectives) versus the total
15 number of samples collected. Completeness may be affected, for example, by sample loss or
16 destruction during shipping, by laboratory sample handling errors, or by rejection of analytical
17 data during data validation.

18 N-5a(1) Evaluation of Laboratory Precision

19 Laboratory sample duplicates and blank spike/blank spike duplicates (BS/BSD) will be used to
20 evaluate laboratory precision. QA objectives for laboratory precision are listed in Table N-4, and
21 are based on precision criteria proposed by the EPA for canister sampling programs (EPA,
22 1994). These values will be appropriate for the evaluation of samples with little or no matrix
23 effects. Because of the potentially high level of salt-type aerosols in the WIPP underground
24 environment, the analytical precision achieved for WIPP samples may vary with respect to the
25 EPA criteria. RPDs for BS/BSD analyses will be tracked through the use of control charts. RPDs
26 obtained for laboratory sample duplicates will be compared to those obtained for BS/BSDs to
27 ascertain any sample matrix effects on analytical precision. BS/BSDs and laboratory sample
28 duplicates will be analyzed at a frequency of 10 percent, or one per analytical lot, whichever is
29 more frequent.

30 N-5a(2) Evaluation of Field Precision

31 Field duplicate samples will be collected at a frequency of 5 percent for both monitoring
32 locations. The data quality objective for field precision is 35 percent for each set of duplicate
33 samples.

34 N-5a(3) Evaluation of Laboratory Accuracy

35 Quantitative Accuracy. Quantitative analytical accuracy will be evaluated through performance
36 criteria on the basis of (1) relative response factors generated during instrument calibration,
37 (2) analysis of laboratory control samples (LCS), and (3) recovery of internal standard

1 ~~compounds. The criteria for the initial calibration (5-point calibration) is \leq 30 percent relative~~
2 ~~standard deviation for target analytes. After the successful completion of the 5-point calibration,~~
3 ~~it is sufficient to analyze only a midpoint standard for every 12 hours of operation. The midpoint~~
4 ~~standard will pass a 30 percent difference acceptance criterion for each target compound before~~
5 ~~sample analysis may begin.~~

6 A blank spike or LCS is an internal QC sample generated by the analytical laboratory by spiking
7 a standard air matrix (humid zero air) with a known amount of a certified reference gas. The
8 reference gas will contain the target VOCs at known concentrations. Percent recoveries for the
9 target VOCs will be calculated for each LCS relative to the reference concentrations. Objectives
10 for percent recovery are listed in Table, and are based on accuracy criteria proposed by the
11 EPA for canister sampling programs (EPA, 1994). LCSs will be analyzed at a frequency of
12 10 percent, or one per analytical lot, whichever is more frequent.

13 Internal standards will be introduced into each sample analyzed, and will be monitored as a
14 verification of stable instrument performance. In the absence of any unusual interferences,
15 areas should not change by more than 40 percent over a 12-hour period. Deviations larger than
16 40 percent are an indication of a potential instrument malfunction. If an internal standard area in
17 a given sample changes by more than 40 percent, the sample will be reanalyzed. If the
18 40 percent criterion is not achieved during the reanalysis, the instrument will undergo a
19 performance check and the midpoint standard will be reanalyzed to verify proper operation.
20 Response and recovery of internal standards will also be compared between samples, LCSs,
21 and calibration standards to identify any matrix effects on analytical accuracy.

22 ~~Qualitative Accuracy. Qualitative accuracy in the identification of target VOCs will be evaluated~~
23 ~~by the relative ion abundance criteria established for the internal standard compound BFB. For~~
24 ~~each 12 hours of sample analysis, a 50-nanogram injection of BFB must be made, and the~~
25 ~~requirements listed in Table N-3 will be met before the instrument may be used to analyze~~
26 ~~samples.~~

27 ~~The MDL for each of the nine target compounds will be evaluated by the analytical laboratories~~
28 ~~before sampling begins. The initial and annual MDL evaluation will be performed in accordance~~
29 ~~with 40 *Code of Federal Regulations* § 136 and with EPA/530-SW-90-021, as revised and~~
30 ~~retitled, "Quality Assurance and Quality Control" (Chapter 1 of SW-846) (1996).~~

31 N-5a(5) Completeness

32 ~~The expected completeness for this program is greater than or equal to 90 percent. Data~~
33 ~~completeness will be tracked monthly.~~

34 N-5b Sample Handling and Custody Procedures

35 ~~Sample packaging, shipping, and custody procedures are addressed in Section N-4C.~~

1 ~~N-5c Calibration Procedures and Frequency~~

2 ~~Calibration procedures and frequencies for analytical instrumentation are listed in Section N-~~
3 ~~4e(4).~~

4 ~~N-5d Analytical Procedures~~

5 ~~The analytical procedures for the Confirmatory VOC Monitoring Program, which are based on~~
6 ~~the draft *GLP-SOW for Volatile Organics Analysis of Ambient Air in Canisters* (EPA, 1994) and~~
7 ~~EPA Method TO-14A (EPA, 1997), are outlined in Section N-4e.~~

8 ~~N-5e~~a Data Reduction, Validation, and Reporting

9 A dedicated logbook will be maintained by the operators. This logbook will contain
10 documentation of all pertinent data for the sampling. Sample collection conditions, maintenance,
11 and calibration activities will be included in this logbook. Additional data collected by other
12 groups at WIPP, such as ventilation airflow, temperature, pressure, etc., will be obtained to
13 document the sampling conditions.

14 Data validation procedures will include at a minimum, a check of all field data forms and
15 sampling logbooks will be checked for completeness and correctness. Sample custody and
16 analysis records will be reviewed routinely by the QA officer and the laboratory supervisor.

17 Data will be reported as specified in Section N-3(e) and Permit Module IV.

18 ~~Acceptable data for this monitoring program will meet stated precision and accuracy criteria.~~
19 ~~The QA objectives for precision, accuracy, and completeness as shown in Table N-4 can be~~
20 ~~achieved when established methods of analyses are used as proposed in this plan and~~
21 ~~standard sample matrices are being assessed. However, because of the potential for the~~
22 ~~samples to contain high levels of salt-type aerosols, the degree to which the QA objectives for~~
23 ~~the program can be achieved is presently uncertain. The program data will be evaluated and QA~~
24 ~~objectives modified as necessary based on the results of the QC testing program. If the~~
25 ~~Permittees determine that alternate QA objectives are required, the Permittees will submit a~~
26 ~~request for a Permit modification to the Secretary for approval.~~

27 ~~N-5f~~b Performance and System Audits

28 System audits will initially address start-up functions for each phase of the project. These audits
29 will consist of on-site evaluation of materials and equipment, review of canister and sampler
30 certification, review of laboratory qualification and operation and, at the request of the QA
31 officer, an on-site audit of the laboratory facilities. The function of the system audit is to verify
32 that the requirements in this plan have been met prior to initiating the program. System audits
33 will be performed at or shortly after to the initiation of the monitoring program and on an annual
34 basis thereafter.

1 Performance audits will be accomplished as necessary through the evaluation of analytical QC
2 data by performing periodic site audits throughout the duration of the project, and through the
3 introduction of third-party audit cylinders (laboratory blinds) into the analytical sampling stream.
4 Performance audits will also include a surveillance/review of data associated with canister and
5 sampler certification, a project-specific technical audit of field operations, and a laboratory
6 performance audit. Field logs, logbooks, and data sheets will be reviewed weekly. Blind-audit
7 canisters will be introduced once during the sampling period. Details concerning scheduling,
8 personnel, and data quality evaluation are addressed in the QAPjP.

9 N-5gc Preventive Maintenance

10 Sampler maintenance is described briefly in Section N-4d Maintenance of analytical equipment
11 will be addressed in the analytical SOP.

12 N-5hd Corrective Actions

13 If the required completeness of valid data (~~90~~95 percent) is not maintained, corrective action
14 may be required. Corrective action for field sampling activities may include recertification and
15 cleaning of samplers, reanalysis of samples, additional training of personnel, modification to
16 field and laboratory procedures, and recalibration of test equipment.

~~Laboratory corrective actions may be required to maintain data quality. The laboratory
17 continuing calibration criteria indicate the relative response factor for the midpoint standard will
18 be less than 30 percent different from the mean relative response factor for the initial calibration.
19 Differences greater than 30 percent will require recalibration of the instrument before samples
20 can be analyzed. If the internal standard areas in a sample change by more than 40 percent,
21 the sample will be reanalyzed. If the 40 percent criterion is not achieved during the reanalysis,
22 the instrument will undergo a performance check and the midpoint standard reanalyzed to verify
23 proper operation. Deviations larger than 40 percent are an indication of potential instrument
24 malfunction.
25~~

~~The laboratory results for samples, duplicate analyses, LCSs, and blanks should routinely be
26 within the QC limits. If results exceed control limits, the reason for the nonconformances and
27 appropriate corrective action must be identified and implemented.
28~~

29 N-5ie Records Management

30 The ~~Confirmatory~~ VOC Monitoring Program will require administration of record files (both
31 laboratory and field data collection files). The records control systems will provide adequate
32 control and retention for program-related information. Records administration, including QA
33 records, will be conducted in accordance with applicable DOE, MOC, and WIPP requirements.

34 Unless otherwise specified, monitoring program records will be retained as permanent lifetime
35 records. Temporary and permanent storage of QA records will occur in facilities that prevent
36 damage from temperature, fire, moisture, pressure, excessive light, and electromagnetic fields.

1 Access to stored ~~Confirmatory~~ VOC Monitoring Program QA Records will be controlled and
2 documented to prevent unauthorized use or alteration of completed records.

3 Revisions to completed records (i.e., as a result of audits or data validation procedures) may be
4 made only with the approval of the responsible program manager and in accordance with
5 applicable QA procedures. Original and duplicate or backup records of project activities will be
6 maintained at the WIPP site. Documentation will be available for inspection by internal and
7 external auditors.

1 N-6 References

2 U.S. Department of Energy. 1997. *Resource Conservation and Recovery Act Part B Permit*
3 *Application, Waste Isolation Pilot Plant (WIPP)*, Carlsbad New Mexico, Re. 6.4, 1997

4 U.S. Environmental Protection Agency. 1983. *Interim Guidelines and Specifications for*
5 *Preparing Quality Assurance Project Plans*. QAMS-005/80, EPA-600/4-83-004

6 U.S. Environmental Protection Agency. 1994. *Draft Contract Laboratory Program Statement of*
7 *Work, Volatile Organics Analysis of Ambient Air in Canisters*, EPA 540/R-94-085, December
8 1994, Washington, D.C.

9 U.S. Environmental Protection Agency. 1994. EPA QA/R-5, *Draft Interim Final, EPA*
10 *Requirements for Quality Assurance Project Plans for Environmental Data Operations*,
11 Washington, D.C.

12 U.S. Environmental Protection Agency. 1996. SW-846, *Test Methods for Evaluating Solid*
13 *Waste, Physical/Chemical Methods*. 3rd Edition. Office of Solid Waste and Emergency
14 Response, Washington, D.C.

15 ~~U.S. Environmental Protection Agency. 1997. *Compendium Method TO-14A: Determination of*~~
16 ~~*Volatile Organic Compounds (VOCs) In Ambient Air Using Specially Prepared Canisters With*~~
17 ~~*Subsequent Analysis By Gas Chromatography*, EPA 625/R-96/010b. Center for Environmental~~
18 ~~Research Information, Office of Research and Development, Cincinnati, OH, January 1997.~~

19 [U.S. Environmental Protection Agency. 1999 *Compendium Method TO-15: Determination of*](#)
20 [Volatile Organic Compounds \(VOCs\) In Air Collected in Specially Prepared Canisters and](#)
21 [Analyzed by Gas Chromatography/Mas Spectrometry](#), EPA 625/R-96/010b. Center for
22 [Environmental Research Information, Office of Research and Development, Cincinnati, OH,](#)
23 [January 1999.](#)

24 [Washington Regulatory and Environmental Services, 2004. *Technical Evaluation Report for*](#)
25 [WIPP Room-Based VOC Monitoring.](#)

1

TABLES

1 Table N-1 Target Analytes and Methods for
2 Confirmatory VOC (Station VOC-A and VOC-B) Monitoring and Room-Based
3 Monitoring

4

<u>Target Analyte</u>	<u>EPA Standard Analytical Method</u>
<u>Carbon tetrachloride</u>	<u>EPA TO-15^a</u> <u>EPA SW-846^b</u> <u>EPA SW-8260^b</u>
<u>Chlorobenzene</u>	
<u>Chloroform</u>	
<u>1,1-Dichloroethylene</u>	
<u>1,2-Dichloroethane</u>	
<u>Methylene chloride</u>	
<u>1,1,2,2 -Tetrachloroethane</u>	
<u>Toluene</u>	
<u>1,1,1- Trichloroethane</u>	

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14 ^a U.S. Environmental Protection Agency, 1999, Compendium of Methods for the Determination of Toxic
15 Organic Compounds in Ambient Air- Second Edition, <http://www.epa.gov.ttn.amtic.airtox.html>

16 ^b U.S. Environmental Protection Agency, SW-846 Test Methods for Evaluation Solid Wastes,
17 Chemical and Physical Methods, <http://www.epa.gov/epaoswer/hazwaste/test/main.htm>

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Table N-1
 Target Analytes for VOC Monitoring During the WIPP Disposal Phase

Target Analyte	Common Synonyms and Acronyms	Chemical	Molecular Weight (g/mol)	Boiling Point (°C)*
Carbon tetrachloride	Tetrachloromethane	CCl_4	153.8	77
Chlorobenzene	Monochlorobenzene, Benzene chloride	C_6H_5Cl	112.6	132
Chloroform	Trichloromethane	$CHCl_3$	119.4	61
1,1 - Dichloroethylene	1,1 - Dichloroethene, Vinylidene chloride, 1,1 - DCE	$C_2H_2Cl_2$	96.95	31
1,2 - Dichloroethane	1,2 - DCA, DCA, Ethylene, dichloride, EDC, sym-Dichloroethane	$C_2H_4Cl_2$	98.96	83
Methylene chloride	Dichloromethane	CH_2Cl_2	84.94	40
1,1,2,2 - Tetrachloroethane	sym-Tetrachloroethane, Tetrachloroethane	$C_2H_2Cl_4$	167.9	147
Toluene	Methylbenzene	C_7H_8	92.13	111
1,1,1 - Trichloroethane	1,1,1 - TCA, TCA, Methyl chloroform	$C_2H_3Cl_3$	133.42	74

g/mol — grams per mole
 °C — Degrees Celsius

* — Handbook of Chemistry and Physics, 62nd Edition, CRC Press, 1982

1 Table N-2
 2 ~~Volatile Organic Compound Concentrations of Concern*~~

Compound	Molecular Weight (g/mol)	Drift E-300 Concentration	
		$\mu\text{g}/\text{m}^3$	ppbv
Carbon tetrachloride	153.8	1050	165
Chlorobenzene	112.6	1015	220
Chloroform	119.4	890	180
1,1-Dichloroethylene	96.95	410	100
1,2-Dichloroethane	98.96	175	45
Methylene chloride	84.94	6700	1930
1,1,2,2-Tetrachloroethane	167.9	350	50
Toluene	92.13	715	190
1,1,1-Trichloroethane	133.42	3200	590

13 $\mu\text{g}/\text{m}^3$ — micrograms per cubic meter

14 ppbv — parts per billion by volume

15 * — Calculated at 25 degrees Celsius and 760 millimeters of mercury.

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Table N-3
Bromofluorobenzene Key Ions and Ion Abundance Criteria

Mass	Ion Abundance Criteria
50	8 to 40 percent of mass 95
75	30 to 66 percent of mass 95
95	Base Peak, 100 percent Relative Abundance
96	5 to 9 percent of mass 95
173	<2 percent of mass 174
174	50 to 120 percent of mass 95
175	4 to 9 percent of mass 174
176	93 to 101 percent of mass 174
177	5 to 9 percent of mass 176

Table N-4
 Quality Assurance Objectives for Accuracy, Precision, Sensitivity,
 and Completeness

Compound	Accuracy (Percent Recovery)	Precision (RPD)		Required MRL (ppbv)	Completeness (Percent)
		Laboratory	Field		
Carbon tetrachloride	60 to 140	25	35	2	90
Chlorobenzene	60 to 140	25	35	2	90
Chloroform	60 to 140	25	35	2	90
1,1-Dichloroethylene	60 to 140	25	35	5	90
1,2-Dichloroethane	60 to 140	25	35	2	90
Methylene chloride	60 to 140	25	35	5	90
1,1,2,2-Tetrachloroethane	60 to 140	25	35	2	90
Toluene	60 to 140	25	35	5	90
1,1,1-Trichloroethane	60 to 140	25	35	5	90

MRL—method reporting limit

RPD—relative percent difference

1

FIGURES

1

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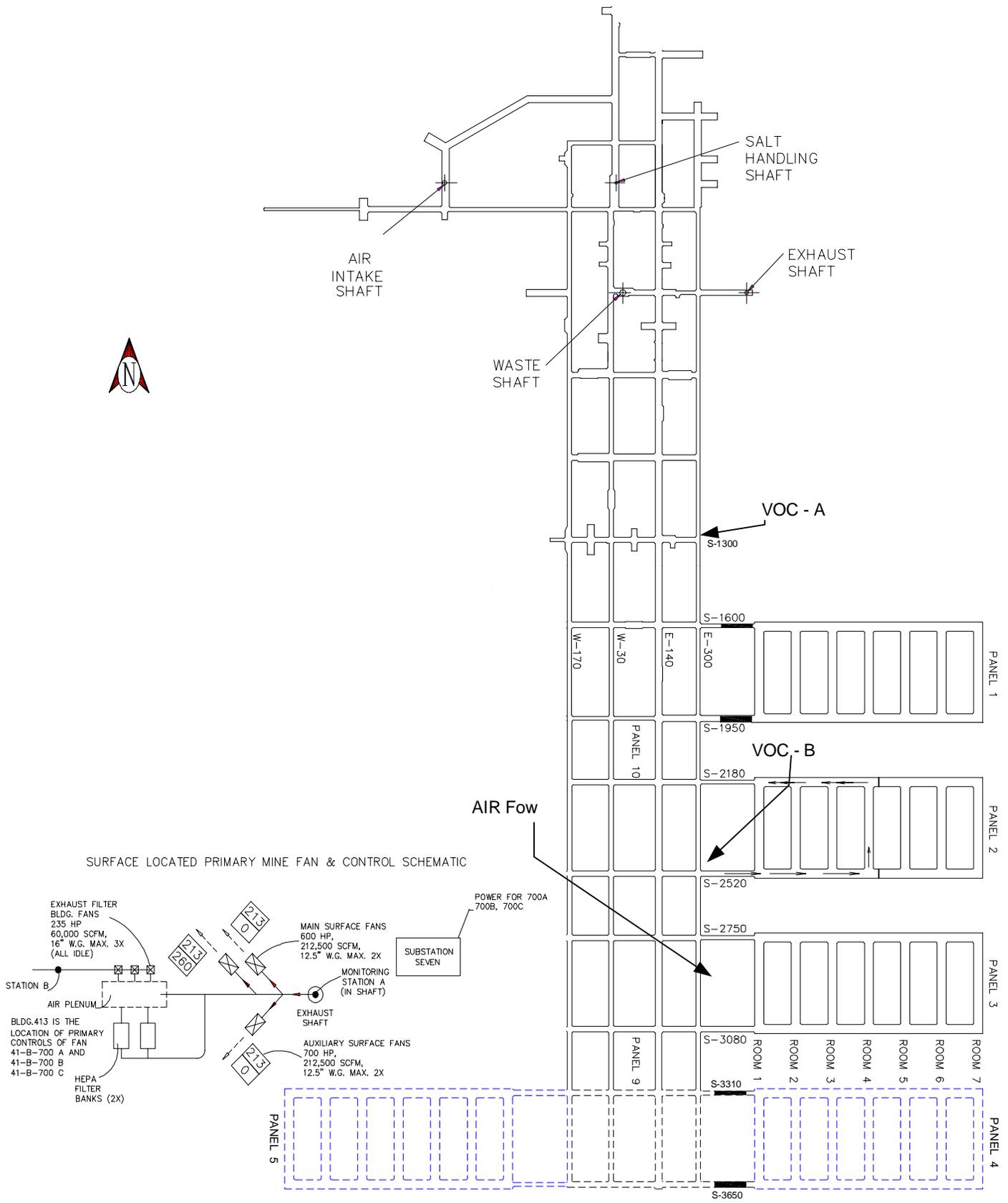
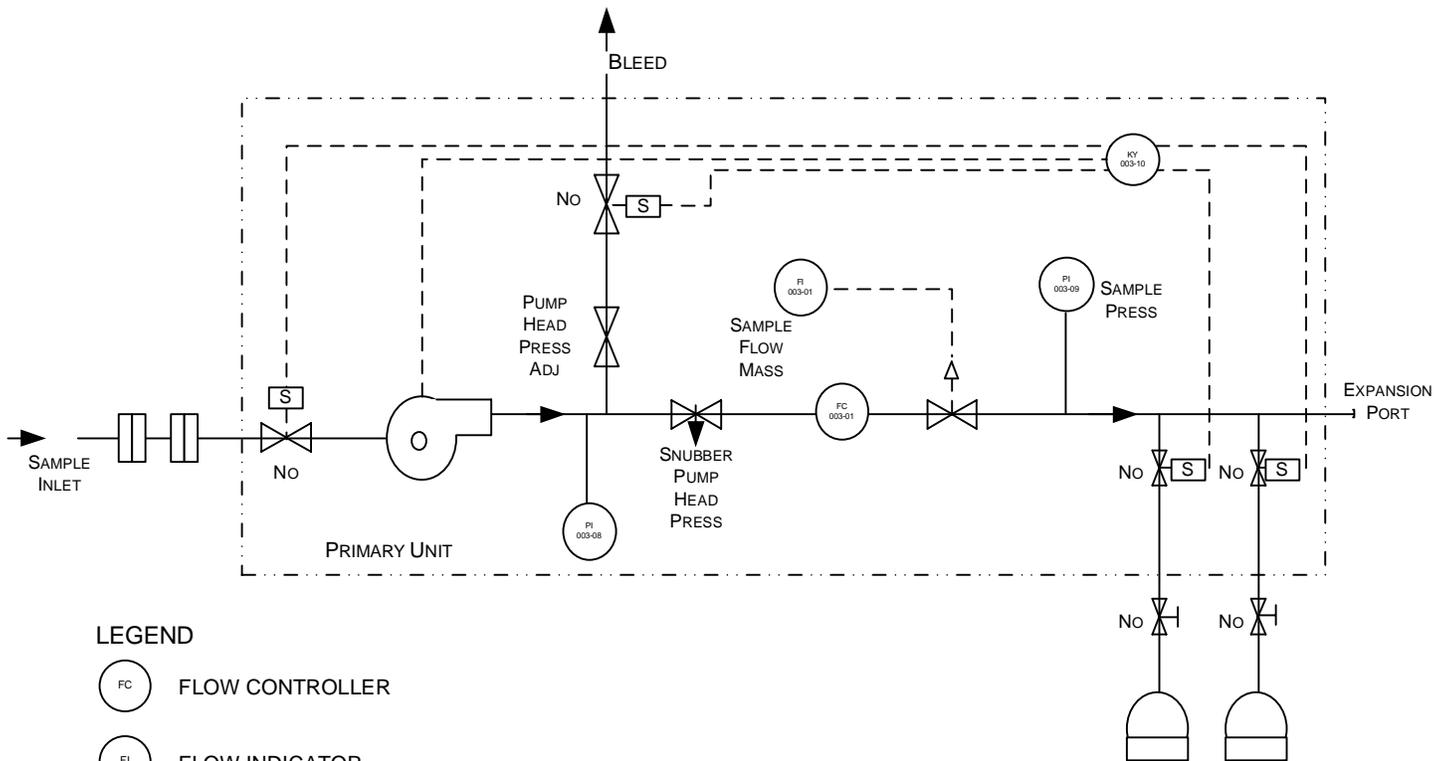


Figure N-1
Panel Flow Area



LEGEND

-  FLOW CONTROLLER
-  FLOW INDICATOR
-  PRESSURE / VACUUM INDICATOR
-  TIMER / RELAY
-  RADIATION ASSESSMENT FILTER
-  VACUUM PUMP
-  SAMPLER CANISTER

NOTE: Number and Arrangement of Components May Vary Depending on Sampling Location (i.e., confirmatory vs. Room-Based) and Number of Samples To Be Collected.

Figure N-2
VOC Monitoring System Design

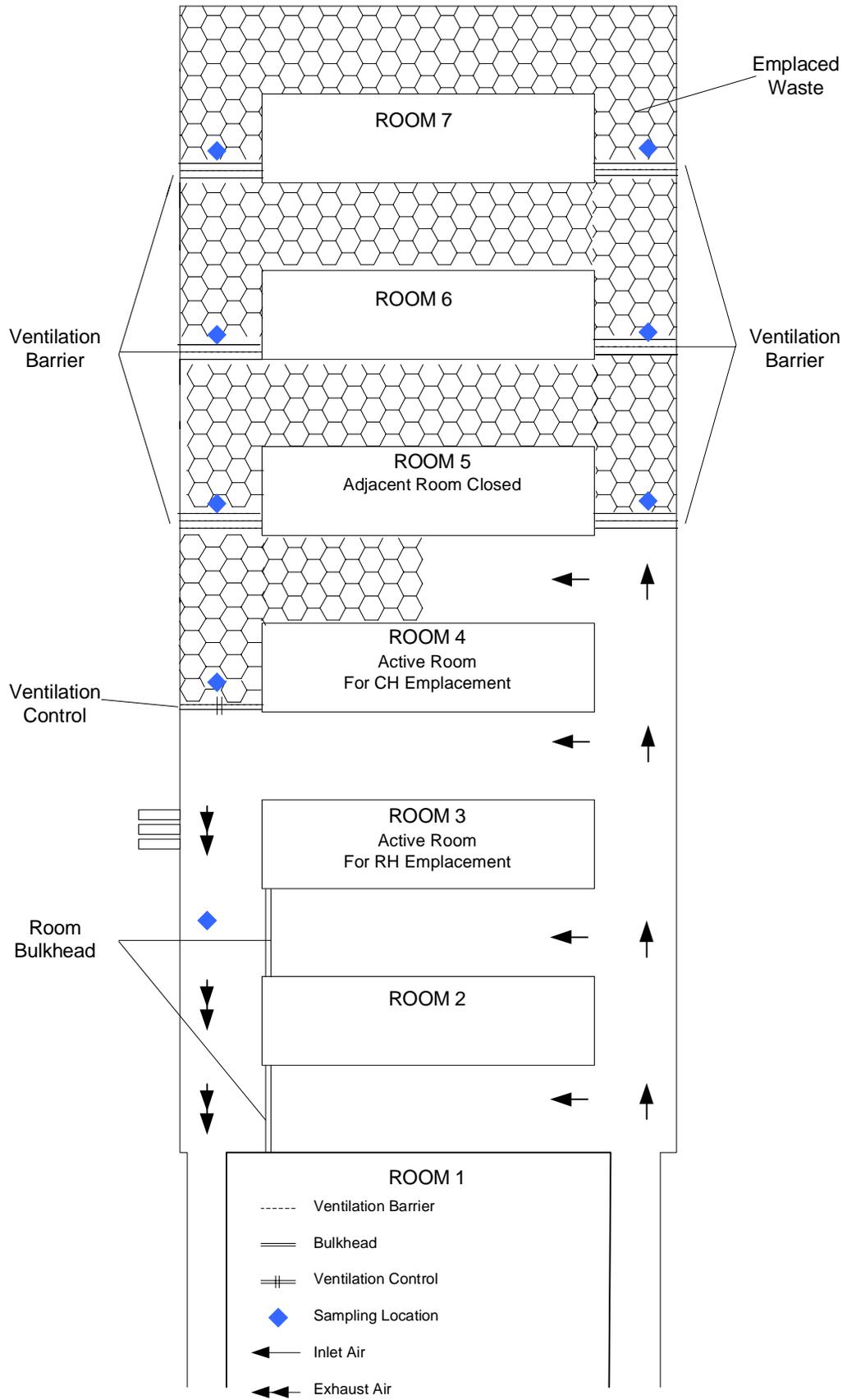
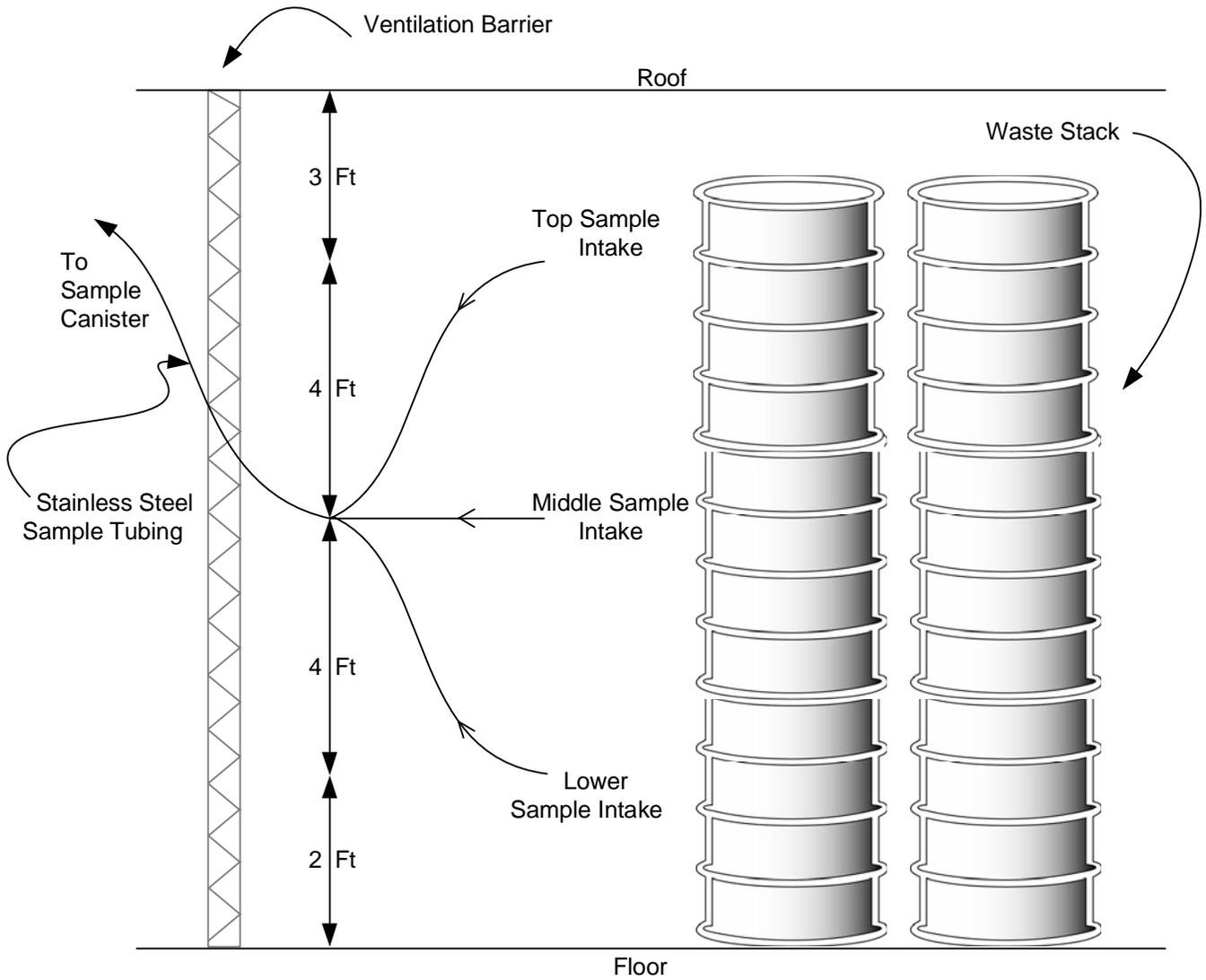


Figure N-3
Disposal Room Monitoring



(not to scale, all measurements approximate)

Figure N-4
Typical Sample Head Arrangement For Disposal Room Monitoring