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**RENEWAL APPLICATION
CHAPTER N**

VOLATILE ORGANIC COMPOUND MONITORING PLAN

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Acronyms and Abbreviations

1		
2		
3	BFB	bromofluorobenzene
4	BS/BSD	blank spike/blank spike duplicate
5		
6	CFR	Code of Federal Regulations
7	CH	Contact-handled
8	CLP	Contract Laboratory Program
9	COC	concentration of concern
10	CRQL	contract-required quantitation limit
11		
12	DOE	U.S. Department of Energy
13		
14	EDD	Electronic Data Deliverables
15	EPA	U.S. Environmental Protection Agency
16		
17	ft	feet
18		
19	GC/MS	gas chromatography/mass spectrometry
20		
21	HWDU	Hazardous Waste Disposal Unit
22		
23	LCS	laboratory control sample
24		
25	m	meter
26	MDL	method detection limit
27	MOC	Management and Operating Contractor (Permit Condition I.D.3)
28	MRL	method reporting limit
29		
30	NIST	National Institute of Standards and Testing
31	NMED	New Mexico Environment Department
32		
33	ppbv	parts per billion by volume
34		
35	QA	quality assurance
36	QAPD	Quality Assurance Program Description
37	QAPjP	Quality Assurance Project Plan
38	QC	quality control
39		
40	RCRA	Resource Conservation and Recovery Act
41	RH	remote-handled
42	RPD	relative percent difference
43		
44	SOP	standard operating procedure
45		
46	TIC	tentatively identified compound
47	TRU	Transuranic
48		
49	VOC	volatile organic compound
50		
51	WIPP	Waste Isolation Pilot Plant

1 **RENEWAL APPLICATION**
2 **CHAPTER N**

3
4 **VOLATILE ORGANIC COMPOUND MONITORING PLAN**

5
6 N-1 Introduction

7 This Renewal Application Chapter describes the monitoring plan for volatile organic compound
8 (VOC) emissions from mixed waste that may be entrained in the exhaust air from the U.S.
9 Department of Energy (DOE) Waste Isolation Pilot Plant (WIPP) Underground Hazardous
10 Waste Disposal Units (HWDUs) during the disposal phase at the facility. The purpose of VOC
11 monitoring is to ensure compliance with the VOC limits specified in Permit Module IV. This
12 VOC monitoring plan consists of two programs as follows: (1) Repository VOC Monitoring,
13 which assesses compliance with the environmental performance standards in Table N-1 ~~Table~~
14 ~~IV.F.2.e~~; and (2) Disposal Room VOC Monitoring, which assesses compliance with the disposal
15 room performance standards in Table N-2 and N-3 ~~Table IV.F.3.b~~. This plan includes the
16 monitoring design, a description of sampling and analysis procedures, quality assurance (QA)
17 objectives, and reporting activities.

18
19 N-1a Background

20 The Underground HWDUs are located 2,150 feet (ft) (655 meters ~~([m])~~) below ground surface,
21 in the WIPP underground. ~~As defined for this Permit, an An~~ Underground HWDU is a single
22 excavated panel consisting of seven rooms and two access drifts designated for disposal of
23 contact-handled (CH) and remote-handled (RH) transuranic (TRU) mixed waste. Each room is
24 approximately 300 ft (91 m) long, 33 ft (10 m) wide, and 13 ft (4 m) high. Access drifts connect
25 the rooms and have the same cross section. ~~The Permittees shall dispose of TRU mixed waste in~~
26 ~~Underground HWDUs designated as Panels 1 through 7.~~

27
28 This plan addresses the following elements:

29
30 ~~1. Rationale for the design of the VOC monitoring programs, based on:~~

- 31
32
- ~~• Possible pathways from WIPP during the active life of the facility~~
 - ~~• Demonstrating compliance with the disposal room performance standards by monitoring VOCs in underground disposal rooms~~
 - ~~• VOC sampling operations at WIPP~~
 - ~~• Optimum location of the ambient mine air monitoring stations~~
- 33
34
35
36

37 ~~2. Descriptions of the specific elements of the VOC monitoring programs, including:~~

- 38
39
- Target analytes to be monitored
 - The type of monitoring conducted
 - The location of the monitoring stations
 - The monitoring interval
 - The specific hazardous constituents monitored
- 40
41
42
43

- 1 • The implementation schedule for the VOC monitoring programs
- 2 • The equipment used at the monitoring stations
- 3 • Sampling and analytical techniques used
- 4 • Data recording/reporting procedures
- 5 • Action levels for remedial action if limits are approached

6
7 ~~The results of baseline VOC monitoring at WIPP were used, in part, to define the VOC~~
8 ~~monitoring programs. The baseline VOC monitoring results were presented in Appendix D21 of~~
9 ~~the WIPP Resource Conservation Recovery Act (RCRA) Part B Permit Application (DOE,~~
10 ~~1997). These data represent the anticipated background levels of VOCs during operations at~~
11 ~~WIPP. The technical basis for Disposal Room VOC Monitoring is discussed in detail in the~~
12 ~~Technical Evaluation Report for Room Based VOC Monitoring (WRES, 2003).~~
13

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

15 The CH and RH TRU mixed waste disposed in the WIPP Underground HWDUs contain VOCs
16 which could be released from WIPP during the disposal phase of the project. This plan describes
17 how:

- 18
19 • Volatile Organic Compounds VOCs released from waste panels will be monitored to
20 confirm that the annual average concentration of VOCs in the air emissions from the
21 Underground HWDUs do not exceed the VOC concentrations of concern (COC)
22 identified in Table N-1 Permit Module IV, Table IV.F.2.e. Appropriate remedial action,
23 as specified in Permit Condition IV.F.2.d, will be taken if the limits in Permit Module IV,
24 Table IV.F.2.e Table N-1 are reached.
- 25 • Volatile Organic Compounds VOCs released from waste containers in disposal rooms
26 will be monitored to confirm that the concentration of VOCs in the air of closed and
27 active rooms in active panels do not exceed the VOC disposal room limits identified in
28 Table N-2 Permit Module IV, Table IV.D.1. Appropriate remedial action, as specified in
29 Permit Condition IV.F.3.e, will be taken if the Action Levels in Permit Module IV, Table
30 IV.F.3.b Table N-3 are reached.

31 N-2 Target Volatile Organic Compounds

32 The target VOCs for repository monitoring (Station VOC-A and VOC-B) and disposal room
33 monitoring presented in Table N-14.

34
35 These target VOCs were selected because together they represent approximately 99 percent of
36 the risk due to air emissions.

37 38 N-3 Monitoring Design

39 Detailed design features of this plan are presented in this section. This plan uses available
40 sampling and analysis techniques to measure VOC concentrations in air. Sampling equipment

1 includes the WIPP VOC canister samplers both the Repository and Disposal Room VOC
2 Monitoring Programs.

3
4 N-3a Sampling Locations

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

7
8 N-3a(1) Sampling Locations for Repository VOC Monitoring

9 The initial configuration for the repository VOC monitoring stations is shown in Figure N-1. All
10 mine ventilation air ~~which~~ **that** could potentially be impacted by VOC emissions from the
11 Underground HWDUs identified as Panels 1 through 78 will pass monitoring Station VOC-A,
12 located in the E-300 drift as it flows to the exhaust shaft. Air samples will be collected at two
13 locations in the facility to quantify airborne VOC concentrations. VOC concentrations
14 attributable to VOC emissions from open and closed panels containing CH TRU mixed waste
15 will be measured by placing one VOC monitoring station just downstream from Panel 1 at VOC-
16 A. The location of Station VOC-A will remain the same throughout the term of this Permit. The
17 second station (Station VOC-B) will always be located upstream from the open panel being filled
18 with waste (starting with Panel 1 at monitoring Station VOC-B (Figure N-1). In this
19 configuration, Station VOC-B will measure VOC concentrations attributable to releases from the
20 upstream sources and other background sources of VOCs, but not releases attributable to open or
21 closed panels. The location of Station VOC-B will change when disposal activities begin in the
22 next panel. Station VOC-B will be relocated to ensure that it is always upstream of the open
23 panel that is receiving TRU mixed waste. Station VOC-A will also measure upstream VOC
24 concentrations measured at Station VOC-B, plus any additional VOC concentrations resulting
25 from releases from the closed and open panels. A sample will be collected from each monitoring
26 station on designated sample days. For each quantified target VOC, the concentration measured
27 at Station VOC-B will be subtracted from the concentration measured at Station VOC-A to
28 assess the magnitude of VOC releases from closed and open panels.

29
30 The sampling locations were selected based on operational considerations. There are several
31 different potential sources of release for VOCs into the WIPP mine ventilation air. These
32 sources include incoming air from above ground and facility support operations, as well as open
33 and closed waste panels. In addition, because of the ventilation requirements of the underground
34 facility and atmospheric dispersion characteristics, any VOCs that are released **from** open or
35 closed panels may be difficult to detect and differentiate from other sources of VOCs at any
36 underground or above ground location further downstream of Panel 1. By measuring VOC
37 concentrations close to the potential source of release (i.e., at Station VOC-A), it will be possible
38 to differentiate potential releases from background levels (measured at Station VOC-B).

39
40 N-3a(2) Sampling Locations for Disposal Room VOC Monitoring

41 For purposes of compliance with Section 310 of Public Law 108-447, the VOC monitoring of
42 airborne VOCs in underground disposal rooms in which waste has been emplaced will be
43 performed as follows:

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

22 This sequence for installing sample locations will proceed in the remaining disposal rooms until
23 the inlet air ventilation barrier is installed in disposal Room 1. An inlet sampler will not be
24 installed in disposal Room 1 because disposal room sampling proceeds to the next panel.

25 N-3a(3) Ongoing Disposal Room VOC Monitoring in Panels 3 through 7

27 The Permittees shall continue VOC monitoring in Room 1 of Panels 3 through 7 after
28 completion of waste emplacement until final panel closure unless an explosion-isolation wall is
29 installed in the panel.

30 N-3b Analytes to Be Monitored

32 The nine VOCs that have been identified for repository and disposal room monitoring are listed
33 in Table N-14. The analysis will focus on routine detection and quantification of these
34 compounds in collected samples. As part of the analytical evaluations, the presence of other
35 compounds will be investigated. The analytical laboratory will be directed to classify and report
36 all of these compounds as Tentatively Identified Compounds (TICs).

37
38 TICs detected in 10% or more of any VOC monitoring samples (exclusive of those collected
39 from Station VOC-B) that are VOCs listed in Appendix VIII of 20.4.1.200 NMAC
40 (incorporating 40 Code of Federal Regulations (CFR) §261), collected over a running twelve-
41 month timeframe, will be added to the target analyte lists for both the repository and disposal
42 room VOC monitoring programs, unless the Permittees can justify the exclusion from the target
43 analyte list(s).

1 TICs detected in the repository and disposal room VOC monitoring programs will be placed in
2 the WIPP Operating Record and reported to NMED in the Semi-Annual VOC Monitoring Report
3 as specified in Permit Condition IV.F.2.b.
4

5 N-3c Sampling and Analysis Methods

6 The VOC monitoring programs include a comprehensive VOC monitoring program established
7 at the facility; equipment, training, and documentation for VOC measurements are already in
8 place.
9

10 The method used for VOC sampling is based on the concept of pressurized sample collection
11 contained in the U.S. Environmental Protection Agency (EPA) Compendium Method TO-15
12 (EPA, 1999). The TO-15 sampling concept uses 6-liter SUMMA[®] passivated (or equivalent)
13 stainless-steel canisters to collect integrated air samples at each sample location. This conceptual
14 method will be used as a reference for collecting the samples at WIPP. The samples will be
15 analyzed using gas chromatography/mass spectrometry (GC/MS) under an established
16 QA/quality control (QC) program. Laboratory analytical procedures have been developed based
17 on the concepts contained in both TO-15 and 8260B. Section N-5 contains additional QA/QC
18 information for this project.
19

20 The TO-15 method is an EPA-recognized sampling concept for VOC sampling and speciation.
21 It can be used to provide integrated samples, or grab samples, and compound quantitation for a
22 broad range of concentrations. The sampling system can be operated unattended but requires
23 detailed operator training. This sampling technique is viable for use while analyzing the sample
24 using other EPA methods such as 8260B.
25

26 The field sampling systems will be operated in the pressurized mode. In this mode, air is drawn
27 through the inlet and sampling system with a pump. The air is pumped into an initially
28 evacuated SUMMA[®] passivated (or equivalent) canister by the sampler, which regulates the rate
29 and duration of sampling. The treatment of tubing and canisters used for VOC sampling
30 effectively seals the inner walls and prevents compounds from being retained on the surfaces of
31 the equipment. By the end of each sampling period, the canisters will be pressurized to about
32 two atmospheres absolute. In the event of shortened sampling periods or other sampling
33 conditions, the final pressure in the canister may be less than two atmospheres absolute.
34 Sampling duration will be approximately six hours, so that a complete sample can be collected
35 during a single work shift.
36

37 The canister sampling system and GC/MS analytical method are particularly appropriate for the
38 VOC ~~M~~onitoring ~~P~~rograms because a relatively large sample volume is collected, and
39 multiple dilutions and reanalyses can occur to ensure identification and quantification of target
40 VOCs within the working range of the method. The contract-required quantitation limits
41 (CRQL) are ~~5~~ five parts per billion by volume (ppbv) or less for the nine target compounds.
42 Consequently, low concentrations can be measured. CRQLs are the EPA-specified levels of
43 quantitation proposed for EPA contract laboratories that analyze canister samples by GC/MS.
44 For the purpose of this plan, the CRQLs will be defined as the method reporting limits (MRL).

1 The MRL is a function of instrument performance, sample preparation, sample dilution, and all
2 steps involved in the sample analysis process.

3
4 ~~The disposal room~~ VOC monitoring system in open panels will employ the same canister
5 sampling method as used in the repository VOC monitoring. Passivated or equivalent sampling
6 lines will be installed in the disposal room as described in Section N-3a(2) and maintained once
7 the room is closed until the panel associated with the room is closed. The independent lines will
8 run from the sample inlet point to the individual sampler located in the access drift to the
9 disposal panel. The air will pass through dual particulate filters to prevent sample and equipment
10 contamination.

11 12 N-3d Sampling Schedule

13 The Permittees will evaluate whether the monitoring systems and analytical methods are
14 functioning properly. The assessment period will be determined by the Permittees.

15 16 N-3d(1) Sampling Schedule for Repository VOC Monitoring

17 Repository VOC sampling at Stations VOC-A and VOC-B will begin with initial waste
18 emplacement in Panel 1. Sampling will continue until the certified closure of the last
19 Underground HWDU. Routine sampling will be conducted two times per week.

20 21 N-3d(2) Sampling Schedule for Disposal Room VOC Monitoring

22 The disposal room sampling in open panels will occur once every two weeks, unless ~~the need to~~
23 ~~increase the frequency to weekly occurs in accordance with Permit Condition IV.F.3.c.~~
24 analytical results indicate one or more of the VOCs specified in Table N-2 in any of the closed
25 rooms in an active panel has reached the “50% Action Level” in Table N-3, in which case the
26 sampling frequency for such closed rooms will increase to once per week. The once per week
27 sampling will continue either until the concentrations in the closed room(s) fall below the “50%
28 Action Level” in Table N-3, or until closure of Room 1 of the panel, whichever occurs first. If
29 one or more of the VOCs in Table N-2 in the active open room or immediately adjacent closed
30 room reaches the “95% Action Level” in Table N-3, another sample will be taken to confirm the
31 existence of such a condition. If the second sample confirms that one or more of VOCs in the
32 immediately adjacent closed room have reached the “95% Action Level” in Table N-3, the active
33 open room will be abandoned, ventilation barriers will be installed, waste emplacement will
34 proceed in the next open room, and monitoring of the subject closed room will continue at a
35 frequency of once per week until commencement of panel closure.

36
37 Beginning with Panel 3, disposal room sampling in filled panels will occur monthly until final
38 panel closure unless an explosion-isolation wall is installed. The Permittees will sample VOCs
39 in Room 1 of each filled panel.

1 N-3e Data Evaluation and Reporting

2 N-3e(1) Data Evaluation and Reporting for Repository 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-5d. After obtaining validated data from an air sampling
 5 event, the data will be evaluated to determine whether the VOC emissions from the Underground
 6 HWDUs exceed the COCs. The COCs for each of the nine target VOCs are presented in
 7 Table N-1 Permit Module IV, Table IV.F.2.e. The values are presented in terms of micrograms
 8 per cubic meter ($\mu\text{g}/\text{m}^3$) and ppbv.
 9

10 The COCs were calculated assuming typical operational conditions for ventilation rates in the
 11 mine. The typical operational conditions were assumed to be an overall mine ventilation rate of
 12 425,000 standard cubic feet per minute and a flow rate through the E-300 Drift at Station
 13 VOC-A of 130,000 standard cubic feet per minute.
 14

15 Since the mine ventilation rates at the time the air samples are collected may be different than the
 16 mine ventilation rates during typical operational conditions, the Permittees will measure and/or
 17 record the overall mine ventilation rate and the ventilation rate in the E-300 Drift at Station
 18 VOC-A that are in use during each sampling event. The Permittees shall also measure and
 19 record temperature and pressure conditions during the sampling event to allow all ventilation
 20 rates to be converted to standard flow rates.
 21

22 If the air samples were collected under the typical mine ventilation rate conditions, then the
 23 analytical data will be used without further manipulation. The concentration of each target VOC
 24 detected at Station VOC-B will be subtracted from the concentration detected at Station VOC-A.
 25 The resulting VOC concentration represents the concentration of VOCs being emitted from the
 26 open and closed Underground HWDUs upstream of Station VOC-A (or the Underground
 27 HWDU VOC emission concentration-).
 28

29 If the air samples were not collected under typical mine ventilation rate operating conditions, the
 30 air monitoring analytical results from both Station VOC-A and Station VOC-B will be
 31 normalized to the typical operating conditions. This will be accomplished using the mine
 32 ventilation rates in use during the sampling event and the following equation:
 33
 34

35
$$NVOC_{AB} = VOC_{ab} * \left(\frac{425,000_{scfm} / 130,000_{scfm}}{V_{O\ scfm} / V_{E-300\ scfm}} \right) \quad (N-1)$$

36
 37
 38 Where: $NVOC_{AB}$ = Normalized target VOC concentration from Stations VOC-
 39 A or VOC-B
 40 VOC_{AB} = Concentration of the target VOC detected at Station
 41 VOC-A or VOC-B under non-typical mine ventilation rates
 42 scfm = Standard cubic feet per minute

1 The Permittees shall notify the Secretary in writing, within seven-~~(7)~~ calendar days of obtaining
2 validated analytical results, whenever the concentration of any VOC specified in Table N-2
3 ~~Permit Module IV, Table IV.D.1~~ exceeds the action levels specified in Table N-3 ~~Permit Module~~
4 ~~IV, Table IV.F.3.b~~.

5
6 The Permittees shall submit to the Secretary the Semi-Annual VOC Monitoring Report ~~specified~~
7 ~~in Permit Condition IV.F.2.b~~ that also includes results from disposal room VOC monitoring.
8

9 N-4 Sampling and Analysis Procedures

10 This section describes the equipment and procedures that will be implemented during sample
11 collection and analysis activities for VOCs at WIPP.
12

13 N-4a Sampling Equipment

14 The sampling equipment that will be used includes the following: 6-liter (L) stainless-steel
15 SUMMA[®] canisters, VOC canister samplers, treated stainless steel tubing, and a dual filter
16 housing. A discussion of each of these items is presented below.
17

18 N-4a(1) SUMMA[®] Canisters

19 Six-liter, stainless-steel canisters with SUMMA[®] passivated interior surfaces will be used to
20 collect and store all ambient air and gas samples for VOC analyses collected as part of the
21 monitoring processes. These canisters will be cleaned and certified prior to their use, in a
22 manner similar to that described by Compendium Method TO-15. The canisters will be certified
23 clean to below the required reporting limits for the VOC analytical method for the target VOCs
24 (~~see~~ Table N-25). The vacuum of certified clean samplers will be verified at the sampling
25 location ~~er~~ upon initiation of a sample cycle.
26

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

28 A conceptual diagram of a VOC sample collection unit is provided in Figure N-2. Such units
29 will be used at monitoring Stations VOC-A and VOC-B and at sampling locations for disposal
30 room measurements. The sampling unit consists of a sample pump, flow controller, sample inlet,
31 inlet filters in series to remove particulate matter, vacuum/pressure gauge, electronic timer, inlet
32 purge vent, two sampling ports, and sufficient collection canisters so that any delays attributed to
33 laboratory turnaround time and canister cleaning and certification will not result in canister
34 shortages. Knowledge of sampler flow rates and duration of sampling will allow calculation of
35 sample volume. The set point flow rate will be verified before and after sample collection from
36 the mass flow indication. Prior to their initial use and annually thereafter, the sample collection
37 units will be tested and certified to demonstrate that they are free of contamination above the
38 reporting limits of the VOC analytical method (~~see~~ Section N-5). Ultra-high purity humidified
39 zero air will be pumped through the inlet line and sampling unit and collected in previously
40 certified canisters as sampler blanks for analysis. The cleaning and certification procedure is
41 derived from concepts contained in the EPA Compendium Method TO-15 (EPA, 1999).
42

1 N-4a(3) Sample Tubing

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

6 N-4b Sample Collection

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

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

21 Upon initiation of waste disposal activities in Panel 1, samples will be collected twice each week
22 (at Stations VOC-A and VOC-B). Samples collected at the panel locations should represent the
23 same matrix type (~~i.e.~~ e.g., elevated levels of salt aerosols). To verify the matrix similarity and
24 assess field sampling precision, field duplicate samples will be collected (two canisters filled
25 simultaneously by the same sampler) from each sampling station (Stations VOC-A and VOC-B)
26 during the first sampling event and at an overall frequency of five percent thereafter (see
27 Section N-5a).
28

29 Prior to collecting the active open disposal room and closed room samples, the sample lines are
30 purged to ensure that the air collected is not air that has been stagnant in the tubing. This is
31 important in regard to the disposal room sample particularly because of the long lengths of
32 tubing associated with these samples. The repository samples do not require this action due to
33 the short lengths of tubing required at these locations.
34

35 N-4c Sample Management

36 Field sampling data sheets will be used to document the sampler conditions under which each
37 sample is collected. These data sheets have been developed specifically for VOC monitoring at
38 the WIPP facility. The individuals assigned to collect the specific samples will be required to fill
39 in all of the appropriate sample data and to maintain this record in sample logbooks. The
40 program team leader will review these forms for each sampling event.
41

42 All sample containers will be marked with identification at the time of collection of the sample.
43 A Request-for-Analysis Form will be completed to identify the sample canister number(s),
44 sample type and type of analysis requested.

1
2 All samples will be maintained, and shipped if necessary, at ambient temperatures. Collected
3 samples will be transported in appropriate containers. Prior to leaving the underground for
4 analysis, sample containers may undergo radiological screening. No potentially contaminated
5 samples or equipment will be transported to the surface. No samples will be accepted by the
6 receiving laboratory personnel unless they are properly labeled and sealed to ensure a tamper-
7 free shipment.
8

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

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

24 N-4d Sampler Maintenance

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

34 N-4e Analytical Procedures

35 Analytical procedures used in the analysis of VOC samples from canisters are based on concepts
36 contained in Compendium Method TO-15 (EPA, 1999) and in SW-846 Method 8260B (EPA,
37 1996).
38

39 Analysis of samples will be performed by a certified laboratory. Methods will be specified in
40 procurement documents and will be selected to be consistent with Compendium Method TO-15
41 (EPA, 1999) or EPA recommended procedures in SW-846 (EPA, 1996). Additional detail on
42 analytical techniques and methods will be given in laboratory standard operating procedures
43 (SOPs).
44

1 The Permittees will establish the criteria for laboratory selection, including the stipulation that
2 the laboratory follow the procedures specified in the appropriate Air Compendium or SW-846
3 method and that the laboratory follow EPA protocols. The selected laboratory shall demonstrate,
4 through laboratory SOPs, that it will follow appropriate EPA SW-846 requirements and the
5 requirements specified by the EPA Air Compendium protocols. The laboratory shall also
6 provide documentation to the Permittees describing the sensitivity of laboratory instrumentation.
7 This documentation will be retained in the facility operating record and will be available for
8 review upon request by NMED.

9
10 The SOPs for the laboratory currently under contract will be maintained in the operating record
11 by the Permittees. The Permittees will provide NMED with an initial set of applicable laboratory
12 SOPs for information purposes, and provide NMED with any updated SOPs on an annual basis.

13
14 Data validation will be performed by the Permittees. Copies of the data validation report will be
15 kept on file in the operating record for review upon request by NMED.

16 17 N-5 Quality Assurance

18 The QA activities for the VOC monitoring programs will be conducted in accordance with the
19 documents: *EPA Guidance for Quality Assurance Project Plans QA/G-5* (EPA, 2002) and ~~the~~
20 *EPA Requirements for Preparing Quality Assurance Project Plans, QA/R-5* (EPA, 2001). The
21 QA criteria for the VOC monitoring programs are listed in Table N-2~~5~~. This section addresses
22 the methods to be used to evaluate the components of the measurement system and how this
23 evaluation will be used to assess data quality. The QA limits for the sampling procedures and
24 laboratory analysis shall be in accordance with the limits set forth in the specific EPA Method
25 referenced in standard operating procedures employed by either the Permittees or the laboratory.
26 The Permittees standard operating procedures will be in the facility Operating Record and
27 available for review by NMED at anytime. The laboratory standard operating procedures will
28 also be in the facility Operating Record and will be supplied to the NMED as indicated in
29 Section N-4e.

30 31 N-5a Quality Assurance Objectives for the Measurement of Precision, Accuracy, Sensitivity, 32 and Completeness

33 QA objectives for this plan will be defined in terms of the following data quality parameters.

34
35 **Precision.** For the duration of this program, precision will be defined and evaluated by the
36 relative percent differences (RPD) values calculated between field duplicate samples and
37 between laboratory duplicate samples.

$$38$$
$$39$$
$$40 \quad RPD = \left(\frac{(A - B)}{(A + B)/2} \right) * 100 \quad (N-2)$$

41
42

1 where: A = Original sample result
2 B = Duplicate sample result
3

4 **Accuracy.** Analytical accuracy will be defined and evaluated through the use of analytical
5 standards. Because recovery standards cannot reliably be added to the sampling stream, overall
6 system accuracy will be based on analytical instrument performance evaluation criteria. These
7 criteria will include performance verification for instrument calibrations, laboratory control
8 samples, sample surrogate recoveries, and sample internal standard areas. These criteria will
9 constitute the verification of accuracy for target analyte quantitation (i.e., quantitative accuracy).
10 Evaluation of standard ion abundance criteria for **bromofluorobenzene (BFB)** will be used to
11 evaluate the accuracy of the analytical system in the identification of targeted analytes, as well as
12 the evaluation of unknown contaminants (i.e., qualitative accuracy).
13

14 **Sensitivity.** Sensitivity will be defined by the required MRLs for the program. Attainment of
15 required MRLs will be verified by the performance of statistical method detection limit (**MDL**)
16 studies in accordance with 40 **CFR** *Code of Federal Regulations* § 136. The MDL represents the
17 minimum concentration that can be measured and reported with 99 percent confidence that the
18 analyte concentration is greater than zero. An MDL study will be performed by the program
19 analytical laboratory prior to sampling and analysis, and annually thereafter.
20

21 **Completeness.** Completeness will be defined as the percentage of the ratio of the number of
22 valid sample results received (i.e., those ~~which~~ **that** meet data quality objectives) versus the total
23 number of samples collected. Completeness may be affected, for example, by sample loss or
24 destruction during shipping, by laboratory sample handling errors, or by rejection of analytical
25 data during data validation.
26

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

28 Laboratory sample duplicates and blank spike/blank spike duplicates (**BS/BSD**) will be used to
29 evaluate laboratory precision. QA objectives for laboratory precision are listed in Table N-25,
30 and are based on precision criteria proposed by the EPA for canister sampling programs (EPA,
31 1994⁹). These values will be appropriate for the evaluation of samples with little or no matrix
32 effects. Because of the potentially high level of salt-type aerosols in the WIPP underground
33 environment, the analytical precision achieved for WIPP samples may vary with respect to the
34 EPA criteria. **The** RPDs for BS/BSD analyses will be tracked through the use of control charts.
35 RPDs obtained for laboratory sample duplicates will be compared to those obtained for BS/BSDs
36 to ascertain any sample matrix effects on analytical precision. BS/BSDs and laboratory sample
37 duplicates will be analyzed at a frequency of 10 percent; or one per analytical lot, whichever is
38 more frequent.
39

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

41 Field duplicate samples will be collected at a frequency of **5five** percent for both monitoring
42 locations. The data quality objective for field precision is 35 percent for each set of duplicate
43 samples.
44

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

2 Quantitative analytical accuracy will be evaluated through performance criteria on the basis of
3 (1) relative response factors generated during instrument calibration, (2) analysis of laboratory
4 control samples (LCS), and (3) recovery of internal standard compounds. The criteria for the
5 initial calibration (5-point calibration) is ≤ 30 percent relative standard deviation for target
6 analytes. After the successful completion of the 5-point calibration, it is sufficient to analyze
7 only a midpoint standard for every 12 hours of operation. The midpoint standard will pass a
8 30 percent difference acceptance criterion for each target compound before sample analysis may
9 begin.

10
11 A blank spike or LCS is an internal QC sample generated by the analytical laboratory by spiking
12 a standard air matrix (humid zero air) with a known amount of a certified reference gas. The
13 reference gas will contain the target VOCs at known concentrations. Percent recoveries for the
14 target VOCs will be calculated for each LCS relative to the reference concentrations. Objectives
15 for percent recovery are listed in Table N-25, and are based on accuracy criteria proposed by the
16 EPA for canister sampling programs (EPA, 1994⁹). LCSs will be analyzed at a frequency of
17 10 percent, or one per analytical lot, whichever is more frequent.

18
19 Internal standards will be introduced into each sample analyzed, and will be monitored as a
20 verification of stable instrument performance. In the absence of any unusual interferences, areas
21 should not change by more than 40 percent over a 12-hour period. Deviations larger than
22 40 percent are an indication of a potential instrument malfunction. If an internal standard area in
23 a given sample changes by more than 40 percent, the sample will be reanalyzed. If the
24 40 percent criterion is not achieved during the reanalysis, the instrument will undergo a
25 performance check and the midpoint standard will be reanalyzed to verify proper operation.
26 Response and recovery of internal standards will also be compared between samples, LCSs, and
27 calibration standards to identify any matrix effects on analytical accuracy.

28
29 N-5a(4) Evaluation of Sensitivity

30 The presence of aerosol salts in underground locations may affect the MDL of the samples
31 collected in those areas. The intake manifold of the sampling systems will be protected
32 sufficiently from the underground environment to minimize salt aerosol interference.

33
34 The MDL for each of the nine target compounds will be evaluated by the analytical laboratories
35 before sampling begins. The initial and annual MDL evaluation will be performed in accordance
36 with 40 ~~CFR Code of Federal Regulations~~ §136 and with ~~EPA/530-SW-90-021, as revised and~~
37 ~~retitled, "Quality Assurance and Quality Control" (Chapter 1 of SW-846) (EPA, 1996).~~

38
39 N-5a(5) Completeness

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

1 N-5b Sample Handling and Custody Procedures

2 Sample packaging, shipping, and custody procedures are addressed in Section N-4c.

3
4 N-5c Calibration Procedures and Frequency

5 Calibration procedures and frequencies for analytical instrumentation are listed in Section N-4e.

6
7 N-5d Data Reduction, Validation, and Reporting

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

13
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
18 Electronic ~~D~~ata ~~D~~eliverables (EDDs) are provided by the laboratory prior to receipt of hard
19 copy data packages. EDDs will be evaluated within five ~~(5)~~ calendar days of receipt to
20 determine if VOC concentrations are at or above action levels in ~~Table N-3~~ ~~Table IV.F.3.b~~ for
21 disposal room monitoring data or concentrations of concern in ~~Table N-1~~ ~~Table IV.F.2.e~~ for
22 repository monitoring data. If the EDD indicates that VOC concentrations are at or above these
23 action levels or concentrations, the hard copy data package will be validated within five ~~(5)~~
24 calendar days as opposed to the ~~fourteen (14)~~ calendar day time frame provided by Section
25 N-3e(2).

26
27 Data will be reported as specified in Section N-3(e) ~~and Permit Module IV.~~

28
29 Acceptable data for this VOC monitoring plan will meet stated precision and accuracy criteria.
30 The QA objectives for precision, accuracy, and completeness as shown in ~~Table N-2~~ ~~5~~ can be
31 achieved when established methods of analyses are used as proposed in this plan and standard
32 sample matrices are being assessed.

33
34 N-5e Performance and System Audits

35 System audits will initially address start-up functions for each phase of the project. These audits
36 will consist of on-site evaluation of materials and equipment, review of canister and sampler
37 certification, review of laboratory qualification and operation and, at the request of the QA
38 officer, an on-site audit of the laboratory facilities. The function of the system audit is to verify
39 that the requirements in this plan have been met prior to initiating the program. System audits
40 will be performed at or shortly after ~~to~~ the initiation of the VOC monitoring programs and on an
41 annual basis thereafter.

42

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

10 11 N-5f Preventive Maintenance

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

14 15 N-5g Corrective Actions

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

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

30
31 The laboratory results for samples, duplicate analyses, LCSs, and blanks should routinely be
32 within the QC limits. If results exceed control limits, the reason for the nonconformances and
33 appropriate corrective action must be identified and implemented.

34 35 N-5h Records Management

36 The VOC Monitoring Programs will require administration of record files (both laboratory and
37 field data collection files). The records control systems will provide adequate control and
38 retention for program-related information. Records administration, including QA records, will
39 be conducted in accordance with applicable DOE, management and operating contractor
40 (MOC), and WIPP requirements.

41
42 Unless otherwise specified, VOC monitoring plan records will be retained as lifetime records.
43 Temporary and permanent storage of QA records will occur in facilities that prevent damage
44 from temperature, fire, moisture, pressure, excessive light, and electromagnetic fields. Access to

1 stored VOC Monitoring Program QA Records will be controlled and documented to prevent
2 unauthorized use or alteration of completed records.
3

4 Revisions to completed records (i.e., as a result of audits or data validation procedures) may be
5 made only with the approval of the responsible program manager and in accordance with
6 applicable QA procedures. Original and duplicate or backup records of project activities will be
7 maintained at the WIPP site. Documentation will be available for inspection by internal and
8 external auditors.
9

10 N-6 Sampling and Analysis Procedures for Disposal Room VOC Monitoring in Filled Panels

11 Disposal room VOC samples in filled panels will be collected using the subatmospheric pressure
12 grab sampling technique described in Compendium Method TO-15 (EPA, 1999). This method
13 uses an evacuated SUMMA[®] passivated canister (or equivalent) that is under vacuum (0.05 mm
14 Hg) to draw the air sample from the sample lines into the canister. The sample lines will be
15 purged prior to sampling to ensure that a representative sample is collected. The passivation of
16 tubing and canisters used for VOC sampling effectively seals the inner walls and prevents
17 compounds from being retained on the surfaces of the equipment. By the end of each sampling
18 period, the canisters will be near atmospheric pressure.
19

20 The analytical procedures for disposal room VOC monitoring in filled panels are the same as
21 specified in Section N-4e.

1 N-7 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
5 U.S. Environmental Protection Agency. 1996. SW-846, *Test Methods for Evaluating Solid*
6 *Waste, Physical/Chemical Methods*. 3rd Edition. Office of Solid Waste and Emergency
7 Response, Washington, D.C.
8
9 U.S. Environmental Protection Agency. 1999 Compendium Method TO-15: Determination of
10 Volatile Organic Compounds (VOCs) In Air Collected in Specially Prepared Canisters and
11 Analyzed by Gas Chromatography/Mass Spectrometry, EPA 625/R-96/010b. Center for
12 Environmental Research Information, Office of Research and Development, Cincinnati, OH,
13 January 1999.
14
15 ~~U.S. Environmental Protection Agency. 2000. *Guidance for the Data Quality Objectives*~~
16 ~~*Process*, QA/G-4. EPA 600/R-96/055, August 2000, Washington, D.C.~~
17
18 U.S. Environmental Protection Agency. 2004². *EPA Guidance for Quality Assurance Project*
19 *Plans*, QA/G⁵, EPA 240/B-01/003, March 2004², Washington, D.C.
20
21 U.S. Environmental Protection Agency. 2002¹. *EPA Requirements for Preparing Quality*
22 *Assurance Project Plans*, QA/R-5, EPA 240/R-01/009, December 2002, Washington, D.C.
23
24 ~~Washington Regulatory and Environmental Services, 2004. Technical Evaluation Report for~~
25 ~~WIPP Room-Based VOC Monitoring.~~

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TABLES

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TABLE N-1
VOC CONCENTRATIONS OF CONCERN

<u>Compound</u>	<u>Drift E-300 Concentration</u>	
	<u>μ/m3</u>	<u>ppbv</u>
<u>Carbon Tetrachloride</u>	<u>1050</u>	<u>165</u>
<u>Chlorobenzene</u>	<u>1015</u>	<u>220</u>
<u>Chloroform</u>	<u>890</u>	<u>180</u>
<u>1,1-Dichloroethene</u>	<u>410</u>	<u>100</u>
<u>1,2-Dichloroethane</u>	<u>175</u>	<u>45</u>
<u>Methylene Chloride</u>	<u>6700</u>	<u>1930</u>
<u>1,1,2,2-Tetrachloroethane</u>	<u>350</u>	<u>50</u>
<u>Toluene</u>	<u>715</u>	<u>190</u>
<u>1,1,1-Trichloroethane</u>	<u>3200</u>	<u>590</u>

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TABLE N-2
VOC ROOM-BASED LIMITS

<u>Compound</u>	<u>VOC Room-Based Concentration Limit (PPMV)</u>
<u>Carbon Tetrachloride</u>	<u>9625</u>
<u>Chlorobenzene</u>	<u>13000</u>
<u>Chloroform</u>	<u>9930</u>
<u>1,1-Dichloroethene</u>	<u>5490</u>
<u>1,2-Dichloroethane</u>	<u>2400</u>
<u>Methylene Chloride</u>	<u>100000</u>
<u>1,1,2,2-Tetrachloroethane</u>	<u>2960</u>
<u>Toluene</u>	<u>11000</u>
<u>1,1,1-Trichloroethane</u>	<u>33700</u>

1
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TABLE N-3
ACTION LEVELS FOR DISPOSAL ROOM MONITORING

<u>Compound</u>	<u>50% Action Level for VOC Constituents of Concern in Any Closed Room, ppmv</u>	<u>95% Action Level for VOC Constituents of Concern in Active Open or Immediately Adjacent Closed Room, ppmv</u>
<u>Carbon Tetrachloride</u>	<u>4,813</u>	<u>9,145</u>
<u>Chlorobenzene</u>	<u>6,500</u>	<u>12,350</u>
<u>Chloroform</u>	<u>4,965</u>	<u>9,433</u>
<u>1,1-Dichloroethene</u>	<u>2,745</u>	<u>5,215</u>
<u>1,2-Dichloroethane</u>	<u>1,200</u>	<u>2,280</u>
<u>Methylene Chloride</u>	<u>50,000</u>	<u>95,000</u>
<u>1,1,2,2-Tetrachloroethane</u>	<u>1,480</u>	<u>2,812</u>
<u>Toluene</u>	<u>5,500</u>	<u>10,450</u>
<u>1,1,1-Trichloroethane</u>	<u>16,850</u>	<u>32,015</u>

1 **TABLE N-14**
2 **TARGET ANALYTES AND METHODS FOR REPOSITORY VOC (STATION VOC-A**
3 **AND VOC-B) MONITORING AND DISPOSAL ROOM MONITORING**
4

Target Analyte	EPA Standard Analytical Method
Carbon tetrachloride	EPA-TO-15 ^a EPA-8260B ^b
Chlorobenzene	
Chloroform	
1,1-Dichloroethylene	
1,2-Dichloroethane	
Methylene chloride	
1,1,2,2-Tetrachloroethane	
Toluene	
1,1,1-Trichloroethane	

5
6 ^a U.S. Environmental Protection Agency, 1999, Compendium of Methods for the Determination
7 of Toxic Organic Compounds in Ambient Air- Second Edition,
8 <http://www.epa.gov/ttn/amtic/airtox.html>

9
10 ^b U.S. Environmental Protection Agency, 1996, SW-846 Test Methods for Evaluation Solid
11 Wastes, Chemical and Physical Methods, <http://www.epa.gov/epaoswer/hazwaste/test/main.htm>
12

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TABLE N-25
QUALITY ASSURANCE OBJECTIVES FOR ACCURACY, PRECISION,
SENSITIVITY, AND COMPLETENESS

Compound	Accuracy (Percent Recovery)	Precision (RPD)		Sensitivity	Completeness (Percent)
		Laboratory	Field	Required MRL (ppbv)	
Carbon tetrachloride	60 to 140	25	35	2	95
Chlorobenzene	60 to 140	25	35	2	95
Chloroform	60 to 140	25	35	2	95
1,1-Dichloroethylene	60 to 140	25	35	5	95
1,2-Dichloroethane	60 to 140	25	35	2	95
Methylene chloride	60 to 140	25	35	5	95
1,1,2,2-Tetrachloroethane	60 to 140	25	35	2	95
Toluene	60 to 140	25	35	5	95
1,1,1-Trichloroethane	60 to 140	25	35	5	95

5
6
7

MRL method reporting limit
 RPD relative percent difference

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1

FIGURES

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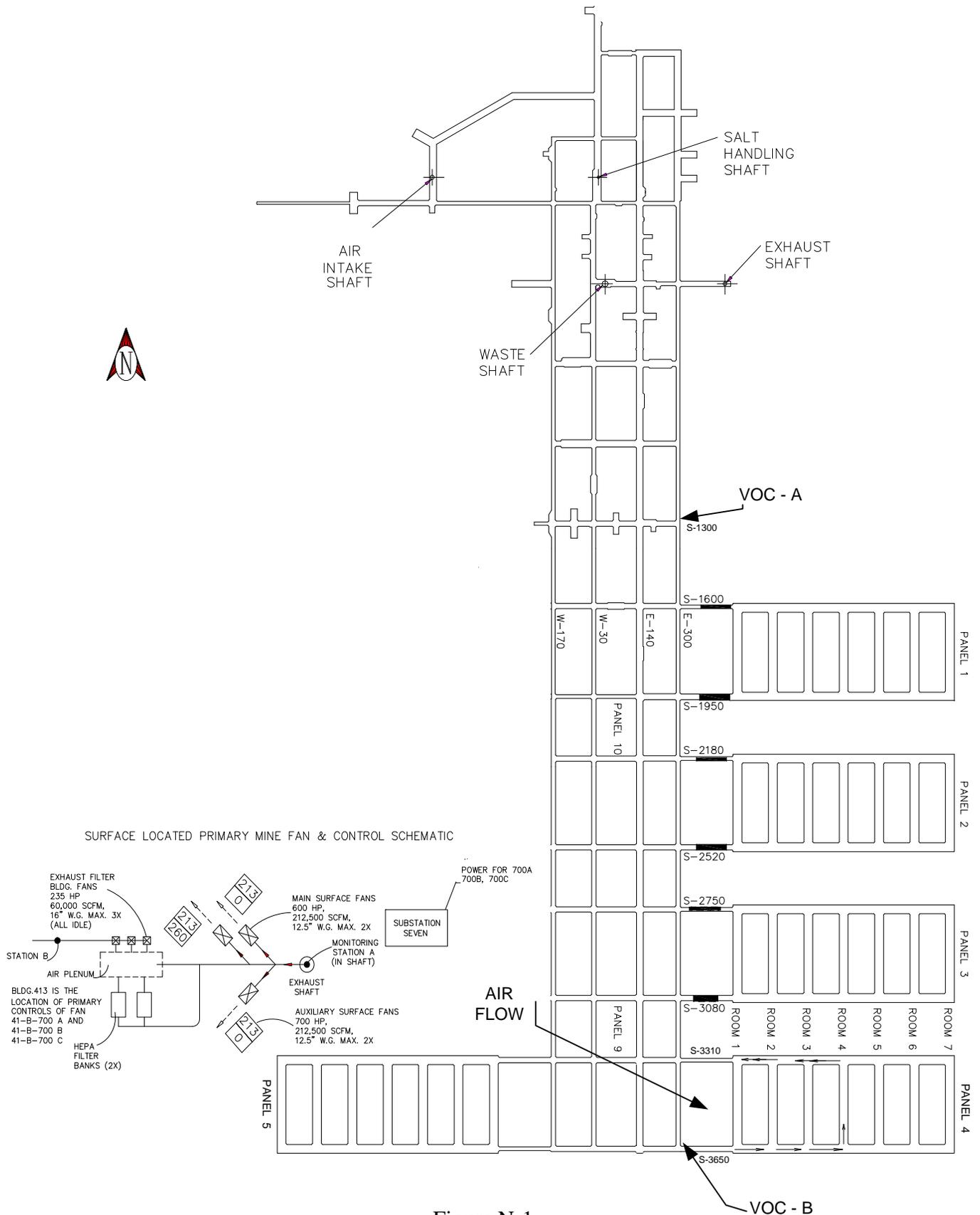
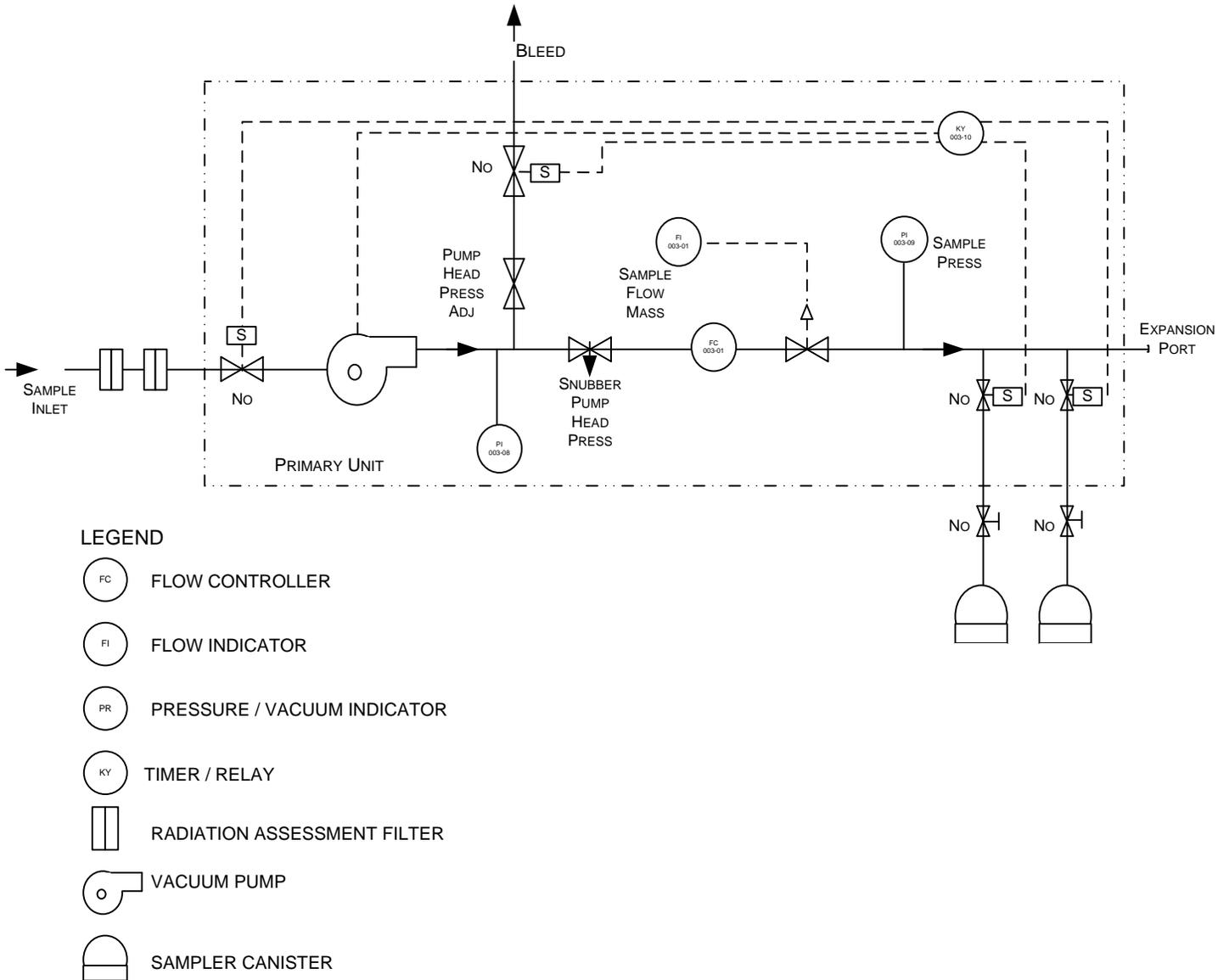


Figure N-1
 Panel Flow Area



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

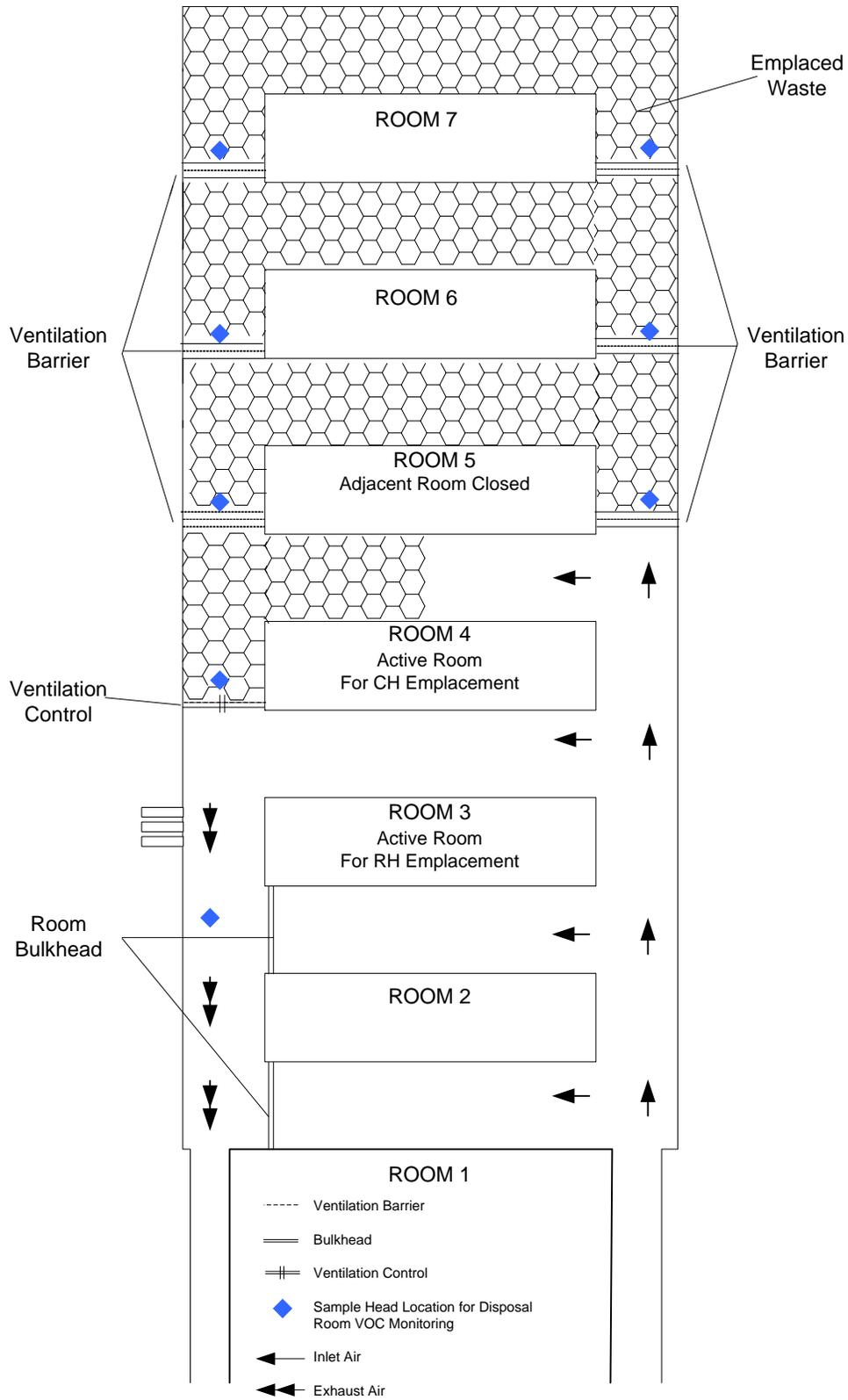


Figure N-3
 Disposal Room VOC Monitoring

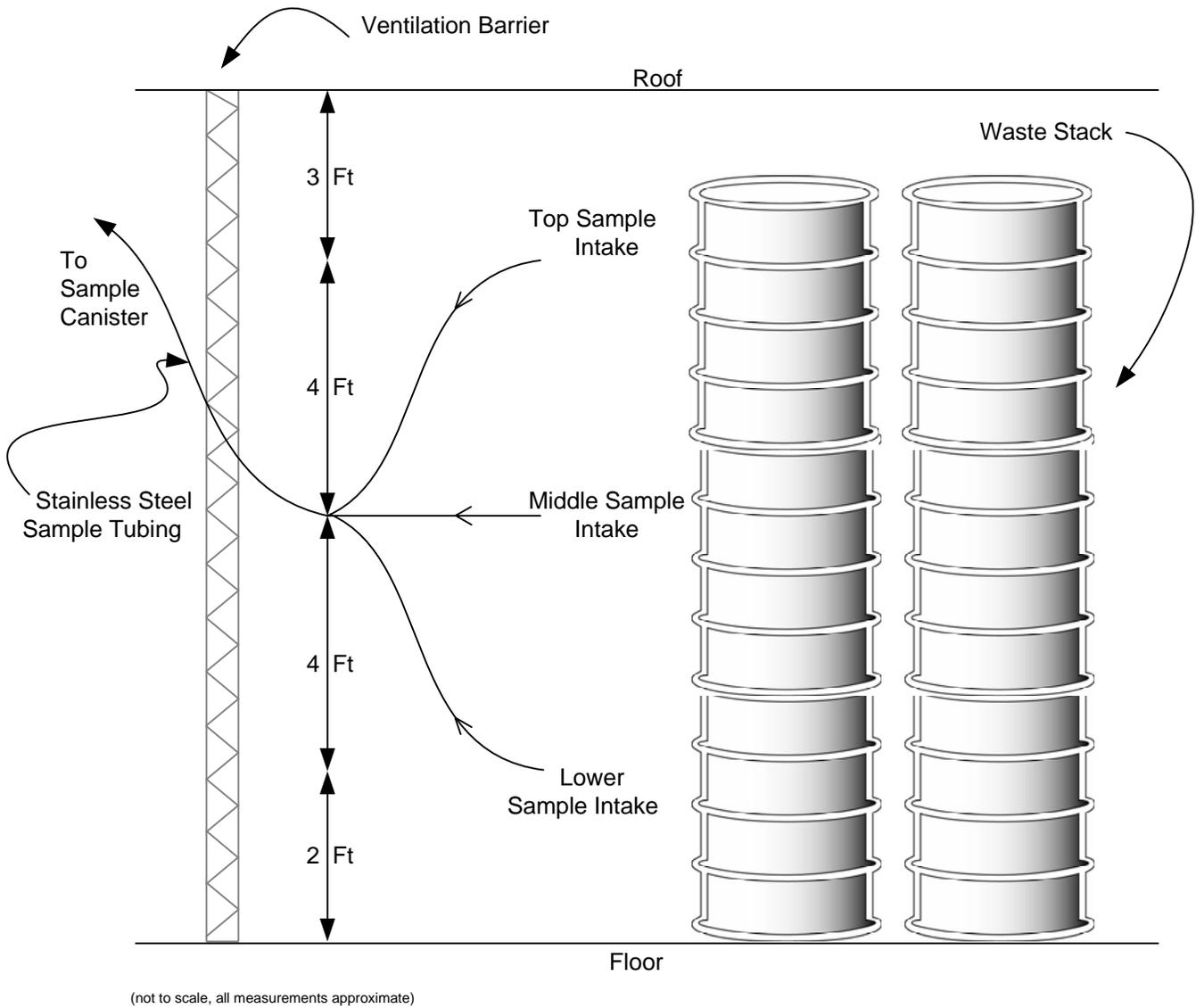


Figure N-4
Typical Sample Head Arrangement For Disposal Room
Monitoring