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**RENEWAL APPLICATION  
CHAPTER N**

**VOLATILE ORGANIC COMPOUND MONITORING PLAN**



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## Acronyms and Abbreviations

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



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

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

#### 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 ~~d~~Disposal ~~p~~Phase of the project. This plan  
17    describes how:

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

#### 30    N-2 Target Volatile Organic Compounds

31    The target VOCs for repository monitoring (Station VOC-A and VOC-B) and disposal room  
32    monitoring presented in Table N-~~4~~4.

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

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. Sampling equipment  
4 includes the WIPP VOC canister samplers both the Repository and Disposal Room VOC  
5 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 Repository VOC Monitoring

10 The initial configuration for the repository VOC monitoring stations is shown in Figure N-1. All  
11 mine ventilation air ~~which~~ that could potentially be impacted by VOC emissions from the  
12 Underground HWDUs identified as Panels 1 through 7~~8~~ 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~~ downstream from all active and closed  
18 panels throughout the term of this Permit. The second station (Station VOC-B) will always be  
19 located upstream from the open panel being filled with waste (~~starting with Panel 1 at monitoring~~  
20 ~~Station VOC-B~~ (Figure N-1). In this configuration, Station VOC-B will measure VOC  
21 concentrations attributable to releases from the upstream sources and other background sources  
22 of VOCs, but not releases attributable to open or closed panels. The location of Station VOC-B  
23 will change when disposal activities begin in the next panel. 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 closed  
30 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 underground~~  
35 ~~facility and atmospheric dispersion characteristics, any VOCs that are released~~ from ~~open or~~  
36 ~~closed panels may be difficult to detect and differentiate from other sources of VOCs at any~~  
37 ~~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 Section 310 of Public Law 108-447, the VOC monitoring of  
3 airborne VOCs in underground disposal rooms in which waste has been emplaced will be  
4 performed as follows:

- 5 1. 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 2. TRU mixed waste will be emplaced in the active disposal room.
- 8 3. When the active disposal room is filled, another sample head will be installed to  
9 the inlet of the filled active disposal room- (Figure N-23 and N-34)
- 10 4. The exhaust drift bulkhead will be removed and re-installed in the next disposal  
11 room so disposal activities may proceed.
- 12 5. A ventilation barrier will be installed where the bulkhead was located in the active  
13 disposal room's exhaust drift. Another ventilation barrier will be installed in the  
14 active disposal room's air inlet drift, thereby closing that active disposal room.
- 15 6. Monitoring of VOCs will continue in the now closed disposal room. Monitoring  
16 of VOCs will occur in the active disposal room and all closed disposal rooms in  
17 which waste has been emplaced until commencement of panel closure activities  
18 (i.e., completion of ventilation barriers in Room 1).

19 This sequence for installing sample locations will proceed in the remaining disposal rooms until  
20 the inlet air ventilation barrier is installed in disposal room 1one. ~~An inlet sampler will not be~~  
21 ~~installed in disposal room 1one because disposal room sampling proceeds to the next panel.~~

22 N-3a(3) Ongoing Disposal Room VOC Monitoring in Panels 3 through 78

23 The Permittees shall continue VOC monitoring in Room 1 of Panels 3 through 78 after  
24 completion of waste emplacement until final panel closure unless an explosion-isolation wall is  
25 installed in the panel.

26 N-3b Analytes to Be Monitored

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

32 TICs detected in 10% or more of any VOC monitoring samples (exclusive of those collected  
33 from Station VOC-B) that are VOCs listed in Appendix VIII of 20.4.1.200 NMAC  
34 (incorporating 40 Code of Federal Regulations (CFR) §261), collected over a running ~~twelve~~ 12-

1 month timeframe, will be added to the target analyte lists for both the repository and disposal  
2 room VOC monitoring programs, unless the Permittees can justify the exclusion from the target  
3 analyte list(s).

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

### 7 N-3c Sampling and Analysis Methods

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

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

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 The field sampling systems will be operated in the pressurized mode. In this mode, air is drawn  
26 through the inlet and sampling system with a pump. The air is pumped into an initially  
27 evacuated SUMMA<sup>®</sup> passivated (or equivalent) canister by the sampler, which regulates the rate  
28 and duration of sampling. 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 Monitoring Programs because a relatively large sample volume is collected, and  
37 multiple dilutions and reanalyses can occur to ensure identification and quantification of target  
38 VOCs within the working range of the method. The contract-required quantitation limits  
39 (CRQL) are 5 five parts per billion by volume (ppbv) or less for the nine target compounds.  
40 Consequently, low concentrations can be measured. CRQLs are the EPA-specified levels of

1 quantitation proposed for EPA contract laboratories that analyze canister samples by GC/MS.  
2 For the purpose of this plan, the CRQLs will be defined as the method reporting limits (MRL).  
3 The MRL is a function of instrument performance, sample preparation, sample dilution, and all  
4 steps involved in the sample analysis process.

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

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

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

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

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

34 Beginning with Panel 3, disposal room sampling in filled panels will occur monthly until final  
35 panel closure unless an explosion-isolation wall is installed. The Permittees will sample VOCs  
36 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 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  
 12 VOC-A 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 the  
 14 mine ventilation rates during typical operational conditions, the Permittees will measure and/or  
 15 record the overall mine ventilation rate and the ventilation rate in the E-300 Drift at Station  
 16 VOC-A that are in use during each sampling event. The Permittees shall also measure and  
 17 record temperature and pressure conditions during the sampling event to allow all ventilation  
 18 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  
 24 HWDU 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  
 27 normalized to the typical operating conditions. This will be accomplished using the mine  
 28 ventilation rates in use during the sampling event and the following equation:

29 
$$NVOC_{AB} = VOC_{ab} * \left( \frac{425,000_{scfm} / 130,000_{scfm}}{V_{O\ scfm} / V_{E-300\ scfm}} \right) \quad (N-1)$$

30 Where:  $NVOC_{AB}$  = Normalized target VOC concentration from Stations VOC-  
 31 A or VOC-B

32  $VOC_{AB}$  = Concentration of the target VOC detected at Station  
 33 VOC-A or VOC-B under non-typical mine ventilation rates

34 scfm = Standard cubic feet per minute



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

2 When the Permittees receive laboratory analytical data from an air sampling event, the data will  
3 be validated as specified in Section N-5a, within ~~fourteen~~ (14) calendar days of receiving the  
4 laboratory analytical data. After obtaining validated data from an air sampling event, the data  
5 will be evaluated to determine whether the VOC concentrations in the air of any closed room, the  
6 active open room, or the immediately adjacent closed room exceeded the Action Levels for  
7 Disposal Room Monitoring specified in Table N-3 ~~Permit Module IV, Table IV.F.3.b.~~

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

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

14 N-4 Sampling and Analysis Procedures

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

17 N-4a Sampling Equipment

18 The sampling equipment that will be used includes the following: 6-liter (L) stainless-steel  
19 SUMMA<sup>®</sup> canisters, VOC canister samplers, treated stainless steel tubing, and a dual filter  
20 housing. A discussion of each of these items is presented below.

21 N-4a(1) SUMMA<sup>®</sup> Canisters

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

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

30 A conceptual diagram of a VOC sample collection unit is provided in Figure N-~~42~~. Such units  
31 will be used at monitoring Stations VOC-A and VOC-B and at sampling locations for disposal  
32 room measurements. The sampling unit consists of a sample pump, flow controller, sample inlet,  
33 inlet filters in series to remove particulate matter, vacuum/pressure gauge, electronic timer, inlet  
34 purge vent, two sampling ports, and sufficient collection canisters so that any delays attributed to  
35 laboratory turnaround time and canister cleaning and certification will not result in canister  
36 shortages. Knowledge of sampler flow rates and duration of sampling will allow calculation of

1 sample volume. The set point flow rate will be verified before and after sample collection from  
2 the mass flow indication. Prior to their initial use and annually thereafter, the sample collection  
3 units will be tested and certified to demonstrate that they are free of contamination above the  
4 reporting limits of the VOC analytical method (see Section N-5). Ultra-high purity humidified  
5 zero air will be pumped through the inlet line and sampling unit and collected in previously  
6 certified canisters as sampler blanks for analysis. The cleaning and certification procedure is  
7 derived from concepts contained in the EPA Compendium Method TO-15 (EPA, 1999).

#### 8 N-4a(3) Sample Tubing

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

#### 12 N-4b Sample Collection

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

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

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

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

1 N-4c Sample Management

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

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

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

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

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

29 N-4d Sampler Maintenance

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

1 N-4e Analytical Procedures

2 Analytical procedures used in the analysis of VOC samples from canisters are based on concepts  
3 contained in Compendium Method TO-15 (EPA, 1999) and in SW-846 Method 8260B (EPA,  
4 1996).

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

10 The Permittees will establish the criteria for laboratory selection, including the stipulation that  
11 the laboratory follow the procedures specified in the appropriate Air Compendium or SW-846  
12 method and that the laboratory follow EPA protocols. The selected laboratory shall demonstrate,  
13 through laboratory SOPs, that it will follow appropriate EPA SW-846 requirements and the  
14 requirements specified by the EPA Air Compendium protocols. The laboratory shall also  
15 provide documentation to the Permittees describing the sensitivity of laboratory instrumentation.  
16 This documentation will be retained ~~in the facility operating record~~ on file at the WIPP facility  
17 and will be available for review upon request by NMED.

18 The SOPs for the laboratory currently under contract will be maintained ~~in the operating record~~  
19 on file at the WIPP facility by the Permittees. The Permittees will provide NMED with an initial  
20 set of applicable laboratory SOPs for information purposes, and provide NMED with any  
21 updated SOPs on an annual basis.

22 Data validation will be performed by the Permittees. Copies of the data validation report will be  
23 kept on file ~~in the operating record~~ on file at the WIPP facility for review upon request by  
24 NMED.

25 N-5 Quality Assurance

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

1 N-5a Quality Assurance Objectives for the Measurement of Precision, Accuracy, Sensitivity,  
2 and Completeness

3 QA objectives Quality Assurance Objectives for this plan will be are defined in terms of the  
4 following data quality parameters and are listed in Table N-5.

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

8 
$$RPD = \left( \frac{(A - B)}{(A + B) / 2} \right) * 100 \quad (N-2)$$

9 where: A = Original sample result  
10 B = Duplicate sample result

11 **Accuracy.** Analytical accuracy will be defined and evaluated through the use of analytical  
12 standards. Because recovery standards cannot reliably be added to the sampling stream, overall  
13 system accuracy will be based on analytical instrument performance evaluation criteria. These  
14 criteria will include performance verification for instrument calibrations, laboratory control  
15 samples, sample surrogate recoveries (when required by method or laboratory SOPs), and sample  
16 internal standard areas. Use of the appropriate criteria as determined by the analytical method  
17 performed, will constitute the verification of accuracy for target analyte quantitation  
18 (i.e., quantitative accuracy). Evaluation of standard ion abundance criteria for  
19 bromofluorobenzene (BFB) will be used to evaluate the accuracy of the analytical system in the  
20 identification of targeted analytes, as well as the evaluation of unknown contaminants (i.e.,  
21 qualitative accuracy).

22 **Sensitivity.** Sensitivity will be defined by the required MRLs for the program. Attainment of  
23 required MRLs will be verified by the performance of statistical method detection limit (MDL)  
24 studies in accordance with 40 CFR Code of Federal Regulations §-136, Appendix B, Definition  
25 and Procedure for the Determination of the Method Detection Limit. The MDL represents the  
26 minimum concentration that can be measured and reported with 99 percent confidence that the  
27 analyte concentration is greater than zero. An MDL study will be performed by the program  
28 analytical laboratory prior to sampling and analysis, and annually thereafter.

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

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

35 Laboratory sample duplicates and blank spike/blank spike duplicates (**BS/BSD**) will be used to  
36 evaluate laboratory precision. QA Quality Assurance Objectives for laboratory precision are

1 listed in Table N-2<sup>5</sup>, and are based on precision criteria proposed by the EPA for canister  
2 sampling programs (EPA, 1994<sup>9</sup>). These values will be appropriate for the evaluation of  
3 samples with little or no matrix effects. Because of the potentially high level of salt-type  
4 aerosols in the WIPP underground environment, the analytical precision achieved for WIPP  
5 samples may vary with respect to the EPA criteria. **The** RPDs for BS/BSD analyses will be  
6 tracked through the use of control charts. RPDs obtained for laboratory sample duplicates will  
7 be compared to those obtained for BS/BSDs to ascertain any sample matrix effects on analytical  
8 precision. BS/BSDs and laboratory sample duplicates will be analyzed at a frequency of  
9 10 percent, or one per analytical lot, whichever is more frequent.

#### 10 N-5a(2) Evaluation of Field Precision

11 Field duplicate samples will be collected at a frequency of 5<sup>five</sup> percent for both monitoring  
12 locations. The data quality objective for field precision is 35 percent for each set of duplicate  
13 samples.

#### 14 N-5a(3) Evaluation of Laboratory Accuracy

15 Quantitative analytical accuracy will be evaluated through performance criteria on the basis of  
16 (1) relative response factors generated during instrument calibration, (2) analysis of laboratory  
17 control samples (**LCS**), and (3) recovery of internal standard compounds. The criteria for the  
18 initial calibration (5-point calibration) is  $\leq 30$  percent relative standard deviation for target  
19 analytes. After the successful completion of the 5-point calibration, it is sufficient to analyze  
20 only a midpoint standard for every 12 hours of operation. The midpoint standard will pass a  
21 30 percent difference acceptance criterion for each target compound before sample analysis may  
22 begin.

23 A blank spike or LCS is an internal QC sample generated by the analytical laboratory by spiking  
24 a standard air matrix (humid zero air) with a known amount of a certified reference gas. The  
25 reference gas will contain the target VOCs at known concentrations. Percent recoveries for the  
26 target VOCs will be calculated for each LCS relative to the reference concentrations. Objectives  
27 for percent recovery are listed in Table N-2<sup>5</sup>, and are based on accuracy criteria proposed by the  
28 EPA for canister sampling programs (EPA, 1994<sup>9</sup>). LCSs will be analyzed at a frequency of  
29 10 percent, or one per analytical lot, whichever is more frequent.

30 Internal standards will be introduced into each sample analyzed, and will be monitored as a  
31 verification of stable instrument performance. In the absence of any unusual interferences, areas  
32 should not change by more than 40 percent over a 12-hour period. Deviations larger than  
33 40 percent are an indication of a potential instrument malfunction. If an internal standard area in  
34 a given sample changes by more than 40 percent, the sample will be reanalyzed. If the  
35 40 percent criterion is not achieved during the reanalysis, the instrument will undergo a  
36 performance check and the midpoint standard will be reanalyzed to verify proper operation.  
37 Response and recovery of internal standards will also be compared between samples, LCSs, and  
38 calibration standards to identify any matrix effects on analytical accuracy.

1 N-5a(4) Evaluation of Sensitivity

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

5 The MDL for each of the nine target compounds will be evaluated by the analytical laboratories  
6 before sampling begins. The initial and annual MDL evaluation will be performed in accordance  
7 with 40 ~~CFR~~ *Code of Federal Regulations* 136, Appendix B, Definition and Procedure for the  
8 Determination of the Method Detection Limit and with EPA/530-SW-90-021, as revised and  
9 retitled, “Quality Assurance and Quality Control” (Chapter 1 of SW-846) (EPA, 1996).

10 N-5a(5) Completeness

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

13 N-5b Sample Handling and Custody Procedures

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

15 N-5c Calibration Procedures and Frequency

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

17 N-5d Data Reduction, Validation, and Reporting

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

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

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

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

1 Acceptable data for this VOC monitoring plan will meet stated precision and accuracy criteria.  
2 The QA objectives for precision, accuracy, and completeness as shown in Table N-25 can be  
3 achieved when established methods of analyses are used as proposed in this plan and standard  
4 sample matrices are being assessed.

#### 5 N-5e Performance and System Audits

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

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

#### 22 N-5f Preventive Maintenance

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

#### 25 N-5g Corrective Actions

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

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

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

#### 4 N-5h Records Management

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

10 Unless otherwise specified, VOC monitoring plan records will be retained as lifetime records.  
11 Temporary and permanent storage of QA records will occur in facilities that prevent damage  
12 from temperature, fire, moisture, pressure, excessive light, and electromagnetic fields. Access to  
13 stored VOC Monitoring Program QA Records will be controlled and documented to prevent  
14 unauthorized use or alteration of completed records.

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

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

21 Disposal room VOC samples in filled panels will be collected using the subatmospheric pressure  
22 grab sampling technique described in Compendium Method TO-15 (EPA, 1999). This method  
23 uses an evacuated SUMMA<sup>®</sup> passivated canister (or equivalent) that is under vacuum (0.05 mm  
24 Hg) to draw the air sample from the sample lines into the canister. The sample lines will be  
25 purged prior to sampling to ensure that a representative sample is collected. The passivation of  
26 tubing and canisters used for VOC sampling effectively seals the inner walls and prevents  
27 compounds from being retained on the surfaces of the equipment. By the end of each sampling  
28 period, the canisters will be near atmospheric pressure.

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

N-7-References

- 1
- 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 (EPA). 1996. SW-846, *Test Methods for Evaluating*  
5 *Solid Waste, Physical/Chemical Methods*. 3rd ~~Third~~ Edition. Office of Solid Waste and  
6 Emergency Response, Washington, D.C.
- 7 U.S. Environmental Protection Agency. 1999 Compendium Method TO-15: Determination of  
8 Volatile Organic Compounds (VOCs) In Air Collected in Specially Prepared Canisters and  
9 Analyzed by Gas Chromatography/Mass Spectrometry, EPA 625/R-96/010b. Center for  
10 Environmental Research Information, Office of Research and Development, Cincinnati, OH,  
11 January 1999.
- 12 ~~U.S. Environmental Protection Agency. 2000. *Guidance for the Data Quality Objectives*~~  
13 ~~*Process*, QA/G-4. EPA 600/R-96/055, August 2000, Washington, D.C.~~
- 14 U.S. Environmental Protection Agency. 2004~~2~~. *EPA Guidance for Quality Assurance Project*  
15 *Plans*, QA/G~~5~~, EPA 240/B-01/003, March 2004~~2~~, Washington, D.C.
- 16 U.S. Environmental Protection Agency. 2002~~1~~. *EPA Requirements for Preparing Quality*  
17 *Assurance Project Plans*, QA/R-5, EPA 240/R-01/009, December 2002, Washington, D.C.
- 18 ~~Washington Regulatory and Environmental Services, 2004. *Technical Evaluation Report for*~~  
19 ~~*WIPP Room Based VOC Monitoring*.~~

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**

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

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**TABLE N-3**  
**ACTION LEVELS FOR DISPOSAL ROOM MONITORING**

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

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

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

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

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

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

Compound	Accuracy (Percent Recovery)	Precision (RPD) Laboratory Field		Sensitivity	Completeness (Percent)
				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

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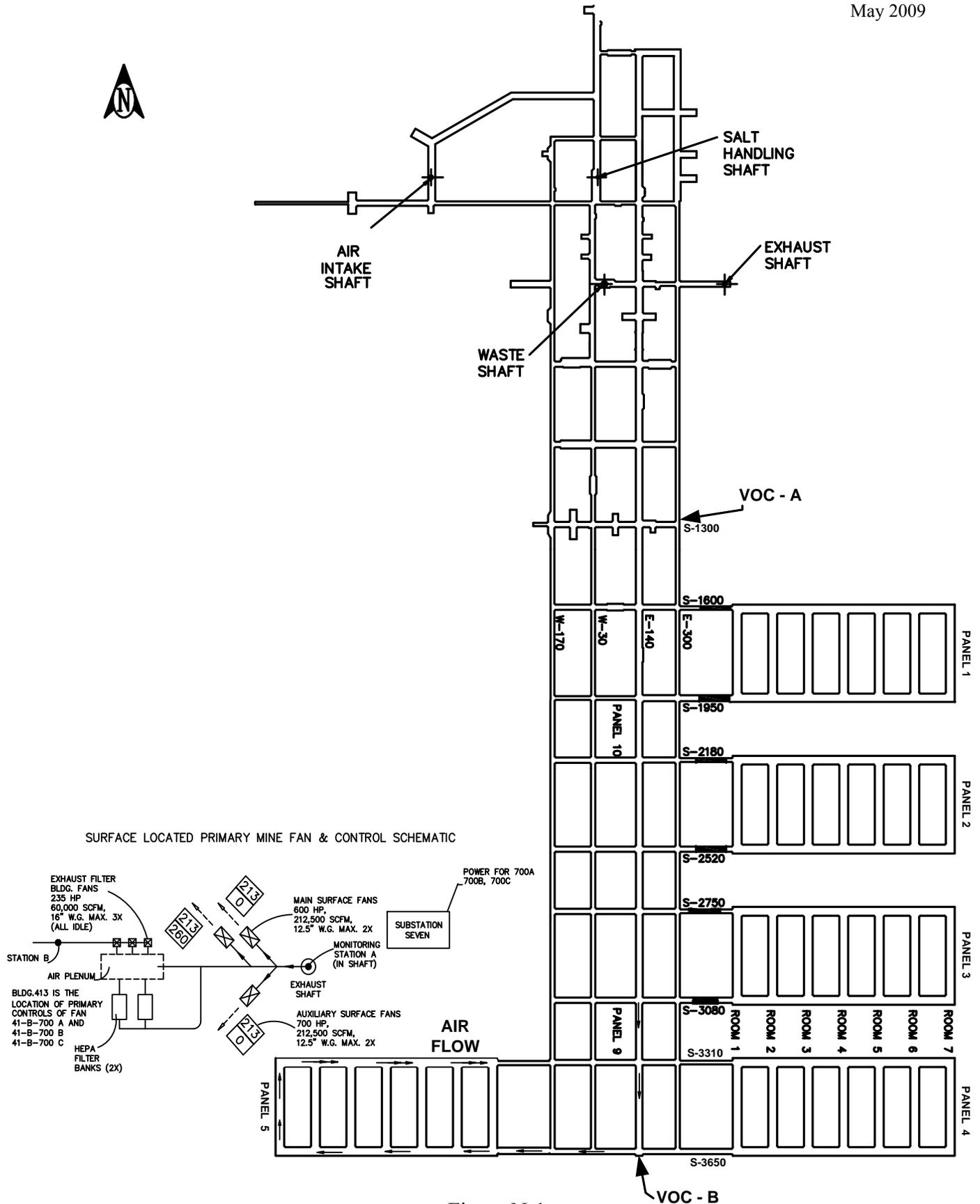
MRL method reporting limit  
 RPD relative percent difference

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**FIGURES**

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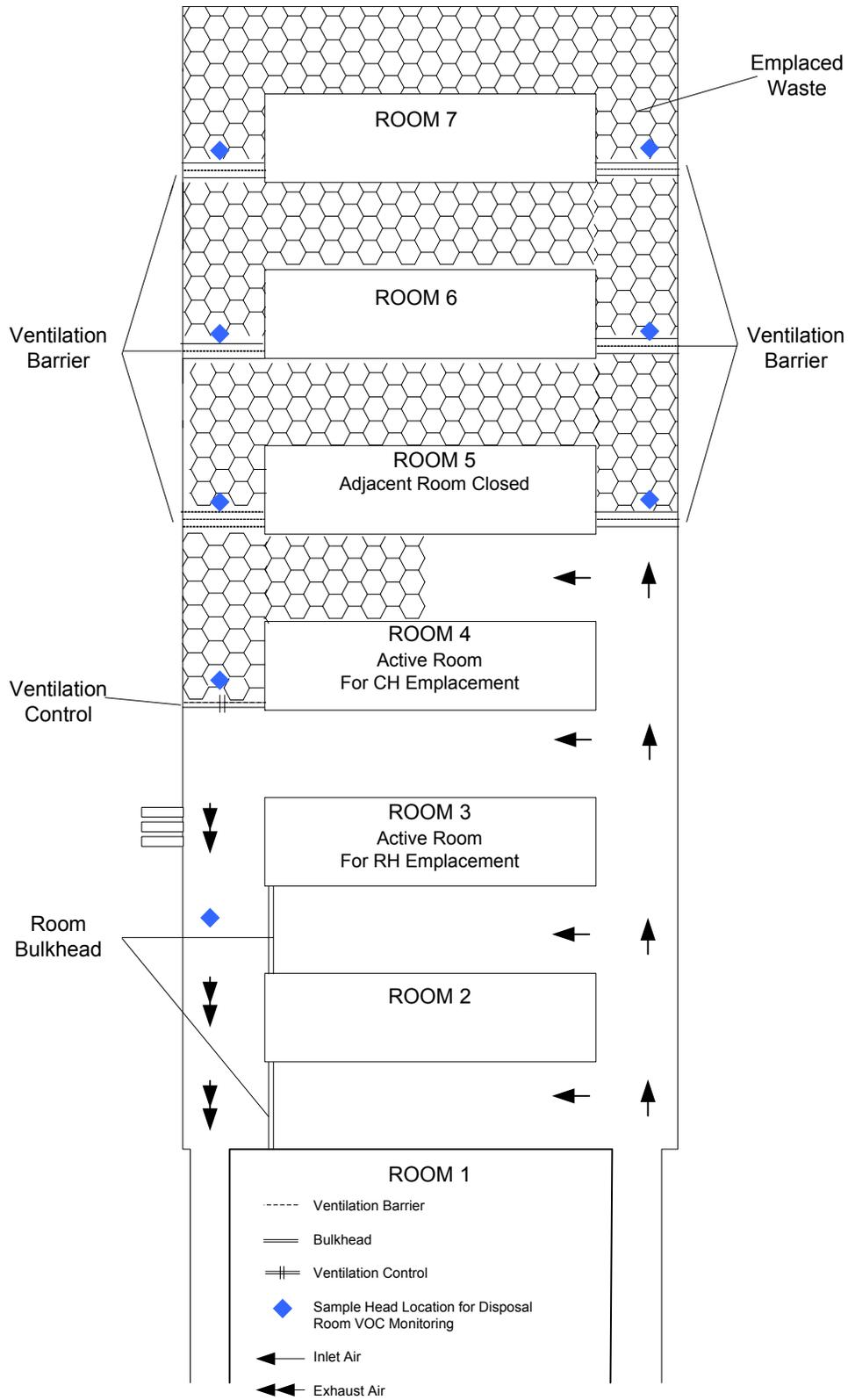


Figure N-23  
 Disposal Room VOC Monitoring

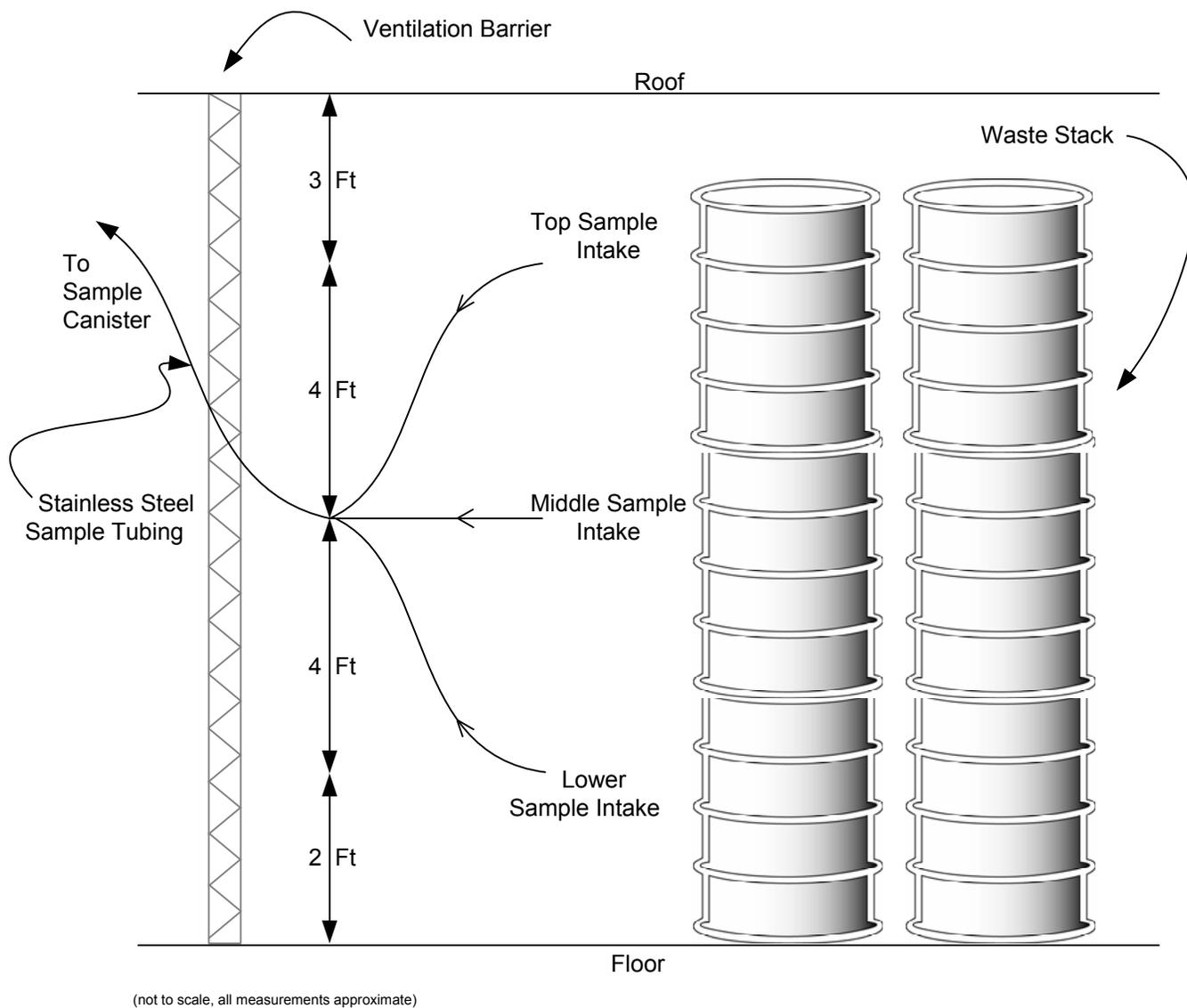
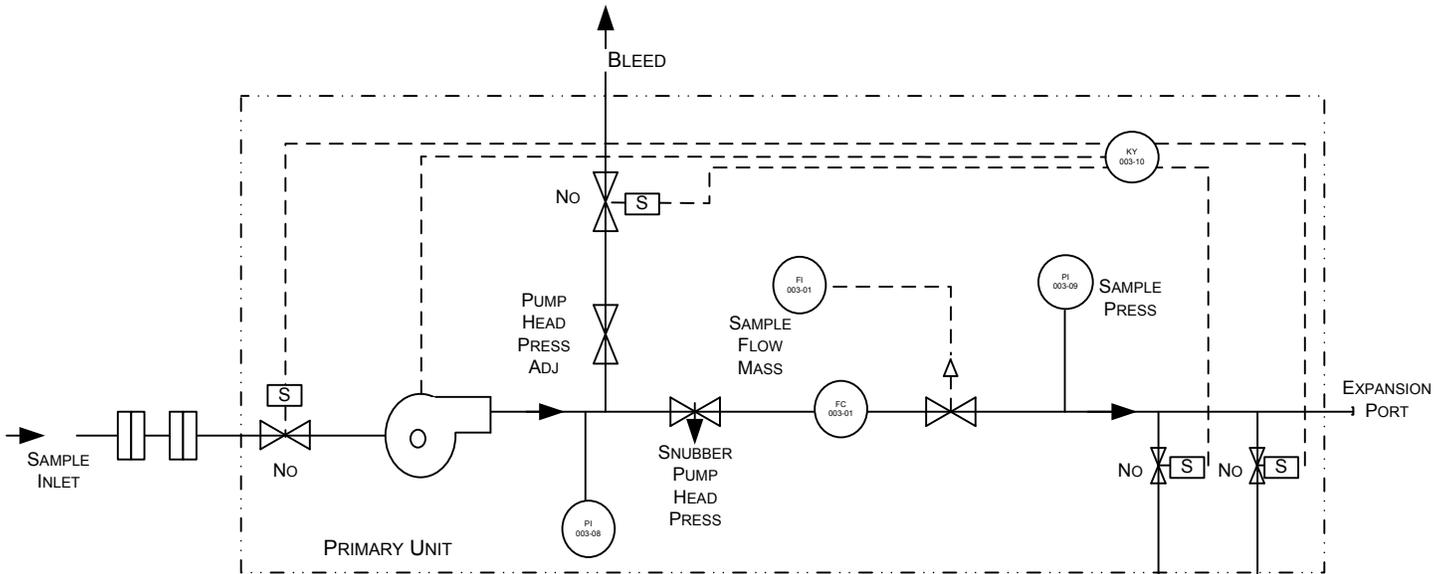


Figure N-34  
Typical Sample Head Arrangement For Disposal Room  
Monitoring



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-42  
 VOC Monitoring System Design