ATTACHMENT N

VOLATILE ORGANIC COMPOUND MONITORING PLAN

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ACRONYMS, ~~AND~~ ABBREVIATIONS, AND UNITS

ARA	additional requested analyte
~~BS/BSD~~	~~blank spike/blank spike duplicate~~
CAS#	Chemical Abstracts Service registry number
CFR	Code of Federal Regulations
CH	~~C~~contact-handled
~~CLP~~	~~Contract Laboratory Program~~
~~COC~~	~~concentration of concern~~
CRQL	contract-required quantitation limit
DOE	U.S. Department of Energy
EDD	electronic data deliverable
EPA	U.S. Environmental Protection Agency
ft	feet
GC/MS	gas chromatography/mass spectrometry
HI	hazard index
HWDU	Hazardous Waste Disposal Unit
IDLH	Immediately Dangerous to Life and Health
IRIS	Integrated Risk Information System
IUR	inhalation unit risk
L	liter
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
m	meter
MDL	method detection limit
mm	millimeter
MOC	Management and Operating Contractor ~~(Permit Section 1.5.3)~~
MRL	method reporting limit
mtorr	millitorr
NIST	National Institute of Standards and Technology~~Testing~~
NMAC	New Mexico Administrative Code
NMED	New Mexico Environment Department
OSHA	Occupational Safety and Health Administration
PASK	passive air sampling kit
ppbv	parts per billion by volume
ppmv	parts per million by volume

QA	quality assurance
~~QAPD~~	~~Quality Assurance Program Description~~
QAPjP	Quality Assurance Project Plan
QC	quality control
~~RCRA~~	~~Resource Conservation and Recovery Act~~
RfC	reference concentration
RH	remote-handled
RIDS	Records Inventory and Disposition Schedule
RPD	relative percent difference
SOP	standard operating procedure
TIC	tentatively identified compound
TRU	~~T~~transuranic
VOC	volatile organic compound
WIPP	Waste Isolation Pilot Plant

ATTACHMENT N

VOLATILE ORGANIC COMPOUND MONITORING PLAN

N-1 Introduction

This Permit Attachment describes the plan for disposal phase monitoring of ~~plan for~~ volatile organic compounds (**VOCs**) at ~~emissions from mixed waste that may be entrained in the exhaust air from~~ the U.S. Department of Energy (**DOE**) Waste Isolation Pilot Plant (**WIPP**) ~~Underground Hazardous Waste Disposal Units (**HWDUs**) during the disposal phase at the facility~~. The purpose of VOC monitoring is to ensure compliance with the VOC limits specified in Permit Part 4. This VOC monitoring plan consists of two programs as follows; (1) Repository VOC Monitoring Program, which assesses compliance with the environmental performance standards in Permit Part 4, Section 4.6.2.3~~Table 4.6.2.3~~; and (2) Disposal Room VOC Monitoring Program (includes ongoing disposal room VOC monitoring), which assesses compliance with the disposal room performance standards in Permit Part 4, Table 4.6.3.2. This plan includes the monitoring design, a description of sampling and analysis procedures, quality assurance (**QA**) objectives, and reporting activities.

N-1a Background

The WIPP facility includes a mined geologic repository located approximately 2,150 feet (ft) (655 meters [m]) below ground surface within a bedded salt formation. The repository's underground structures for disposal of transuranic (**TRU**) mixed waste that may contain VOCs include the Underground Hazardous Waste Disposal Units (Underground **HWDUs**). ~~The Underground HWDUs are located 2,150 feet (ft) (655 meters [m]) below ground surface, in the WIPP underground.~~ As defined for this Permit, an Underground HWDU is a single excavated panel consisting of seven rooms and two access drifts designated for disposal of contact-handled (**CH**) and remote-handled (**RH**) TRU ~~transuranic (**TRU**)~~ mixed waste. Each disposal room is approximately 300 ft (91 m) long, 33 ft (10 m) wide, and 13 ft (4 m) high. Access drifts connect the rooms and have the same cross section. The Permittees shall dispose of TRU mixed waste in Underground HWDUs designated as Panels 1 through 10A~~8~~.

This plan addresses the following elements:

1. Rationale for the design of the VOC monitoring programs, based on:
   - Possible pathways from WIPP during the active life of the facility
   - Demonstrating compliance with the disposal room performance standards by monitoring VOCs in Underground HWDUs~~underground disposal rooms~~
   - VOC sampling operations at WIPP
   - Optimum locations for sampling ~~of the ambient mine air monitoring stations~~
2. Descriptions of the specific elements of the VOC monitoring programs, including:
   - The type of monitoring conducted

- Sampling locations~~The location of the monitoring stations~~
- The monitoring interval
- The specific hazardous constituents monitored
- ~~The implementation schedule for the~~ VOC monitoring schedule~~programs~~
- Sampling equipment~~The equipment used at the monitoring stations~~
- Sampling and analytical techniques ~~used~~
- Data recording/reporting procedures
- Action levels for remedial action ~~if limits are approached~~

The technical basis for Disposal Room VOC monitoring ~~Monitoring~~ is discussed in detail in the Technical Evaluation Report for WIPP Room-Based VOC Monitoring (Washington Regulatory and Environmental Services~~WRES~~, 2003).

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

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

- VOCs released from waste panels ~~will~~ shall be monitored to confirm that the running annual average risk to the surface worker due to ~~concentration of~~ VOCs in the air emissions from the Underground HWDUs do not exceed the risk limits ~~VOC concentrations of concern (**COC**)~~ identified in Permit Part 4, Section ~~Table~~ 4.6.2.3 and calculated from measured VOC concentrations and risk factors identified in Table 4.6.2.3. Appropriate remedial action, as specified in Permit Section 4.6.2.4, ~~will~~ shall be taken if the limits in Permit Part 4, Section ~~Table~~ 4.6.2.3 are reached.

- VOCs released from waste containers in disposal rooms of active waste panels ~~will~~ shall be monitored to confirm that the concentration of VOCs in the air of immediately adjacent closed and active rooms in active panels do not exceed the VOC disposal room limits identified in Permit Part 4, Table 4.4.1. Appropriate remedial action, as specified in Permit Part 4, Section 4.6.3.3, ~~will~~ shalll be taken if the original sample results are greater than or equal to the action levels ~~Action Levels~~ in Permit Part 4, Table 4.6.3.2~~ are reached~~

- VOCs released from waste containers ~~will~~shall be monitored in Room 1 of a filled panel that requires monitoring as described in Section N-3a(3) to confirm that the concentration of VOCs in the air do not exceed the VOC disposal room limits identified in Permit Part 4, Table 4.4.1. Appropriate remedial action, as specified in Permit Part 4, Section 4.6.3.3 and Attachment G, Section G-1d(1), ~~will~~shall be taken if the original sample results are greater than or equal to the levels specified in Permit Part 4, Table 4.6.3.2 and Permit Attachment G, Section G-1d(1).

N-2 Target VOCs~~Volatile Organic Compounds~~

The target VOCs for Repository VOC Monitoring ~~repository monitoring~~ (Station VOC-A ~~and VOC-B~~) and Disposal Room VOC Monitoring Programs ~~disposal room monitoring~~ are presented in Table N-1.

These target VOCs were selected because individually they represent more than one percent of the risk and collectively ~~together~~ they represent over 97 ~~approximately 99~~ percent of the risk due to air emissions.

N-3 Monitoring Design

Detailed design features of this plan are presented in this section. This plan uses available sampling and analysis techniques to monitor ~~measure~~ VOC concentrations in air. Subatmospheric sample collection units ~~Sampling equipment includes the WIPP VOC canister samplers~~ used in ~~both~~ the Repository ~~and Disposal Room~~ VOC Monitoring Program~~s~~ are herein referred to as a passive air sampling kit (**PASK**). A subatmospheric sampling assembly is the sample collection unit for disposal room VOC monitoring. These sample collection units are described in greater detail in Section N-4a(2).

N-3a Sampling Locations

Air samples ~~will~~ shall be collected in the WIPP facility underground to quantify airborne VOC concentrations as described in the following sections.

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

~~The initial configuration for the repository VOC monitoring stations is shown in Figure N-1. All mine~~ Mine ventilation air which could potentially be impacted by VOC emissions from the Underground HWDUs identified as Panels 1 through 10A~~8~~ ~~will~~ shall pass monitoring Station VOC-A, located in the E-300 drift as it flows to the Exhaust Shaft~~exhaust shaft~~. Air samples ~~will~~ shall be collected at VOC-A ~~two locations in the facility~~ to quantify VOCs in the ambient mine air (repository ~~airborne~~ VOC concentrations). VOC concentrations including ~~attributable to VOC~~ emissions from open and closed panels containing TRU mixed waste ~~will~~ shall be monitored ~~measured~~ by placing Station VOC-A ~~one VOC monitoring station~~ just downstream from Panel 1 ~~at VOC-A~~. The location of Station VOC-A as shown in Figure N-1 ~~will~~ shall remain the same throughout the term of this Permit. ~~The second station (Station VOC-B) will always be located upstream from the open panel being filled with waste (starting with Panel 1 at monitoring Station VOC-B (Figure N-1). In this configuration, Station VOC-B will measure VOC concentrations attributable to releases from the upstream sources and other background sources of VOCs, but not releases attributable to open or closed panels. The location of Station VOC-B will change when disposal activities begin in the next panel. Station VOC-B will be relocated to ensure that it is always upstream of the open panel that is receiving TRU mixed waste. Station VOC-A will collect the also measure upstream VOCs concentrations measured at Station VOC-B, plus any additional VOC concentrations resulting from releases from the closed and open panels. A sample will be collected from each monitoring station on designated sample days. For each quantified target VOC, the concentration measured at Station VOC-B will be subtracted from the concentration measured at Station VOC-A to assess the magnitude of VOC releases from closed and open panels.~~

~~The sampling location was locations were selected based on operational considerations. There are several different potential sources of release for VOCs into the WIPP mine ventilation air. These sources include incoming air from above ground and facility support operations, as well as open and closed waste panels. In addition, because of the ventilation requirements of the underground facility and atmospheric dispersion characteristics, any VOCs that are released from open or closed panels may be difficult to detect and differentiate from other sources of~~

~~VOCs at any underground or above ground location further downstream of Panel 1. By measuring VOC concentrations close to the potential source of release (i.e., at Station VOC-A), it will be possible to differentiate potential releases from background levels (measured at Station VOC-B).~~

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

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

1. Excluding Room 1,~~A~~ sample heads ~~will~~ shall be installed for each ~~inside the~~ disposal room behind the designated ventilation barrier ~~exhaust drift bulkhead and~~ at the exhaust and inlet side of the disposal rooms. For Room 1, a sample head ~~will~~shall be installed only at the exhaust location.

2. TRU mixed waste will be emplaced in the active disposal room.

3. VOC monitoring ~~will~~shall begin within two weeks of waste emplacement in an active room (Figures N-3 and N-4).

~~3. When the active disposal room is filled, another sample head will be installed to the inlet of the filled active disposal room. (Figure N-3 and N-4)~~

~~4. The exhaust drift bulkhead will be removed and re-installed in the next disposal room so disposal activities may proceed.~~

4~~5~~. When an active room is filled, a~~A~~ ventilation barrier ~~will~~ shall be installed ~~where the bulkhead was located~~ in the active disposal room's exhaust drift. Another ventilation barrier ~~will~~ shall be installed in the active disposal room's air inlet drift, thereby closing that active disposal room. VOC monitoring ~~will~~shall begin at the inlet side of the disposal room within two weeks of closure as required by Permit Attachment N, Section N-3d(2).

5~~6~~. ~~Monitoring of VOCs will continue in the now closed disposal room.~~ Monitoring of VOCs ~~will~~ shall occur in the active disposal rooms and immediately adjacent ~~all~~ closed disposal rooms in which waste has been emplaced until commencement of panel closure activities (i.e., completion of ventilation barriers in Room 1) as described in Permit Attachment G, Section G-1d(1).

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

N-3a(3) Sampling Locations for Ongoing Disposal Room VOC Monitoring ~~in Panels 3 through 8~~

The Permittees shall continue VOC monitoring in Room 1 of a filled panel ~~Panels 3 through 8 after completion of waste emplacement~~ until final panel closure unless an explosion-isolation wall is installed in the panel.

N-3b Analytes to Be Monitored

The ~~nine~~ VOCs that have been identified for repository and disposal room VOC monitoring are listed in Table N-1. The analysis ~~will~~ shall focus on routine detection and quantification of these target analytes ~~compounds~~ in collected samples. As part of the analytical evaluations, the presence of other compounds (i.e., non-target VOCs) ~~will~~ shall also be monitored~~investigated~~. Some non-targets may be included on the laboratory's target analyte list as additional requested analytes (**ARAs**) to gain a better understanding of potential concentrations and associated risk. The analytical laboratory ~~will~~ shall be directed to calibrate for ARAs when requested and classify and report other non-target VOCs ~~all of these compounds~~ as ~~T~~tentatively ~~I~~identified ~~C~~compounds (**TICs**) if tentative identification can be made. The evaluation of TICs in original samples ~~will~~shall include those concentrations that are ≥10 percent of the relative internal standard. The evaluation of ARAs only includes concentrations that are ≥ the method reporting limit (**MRL**). The required MRLs for ARAs ~~will~~shall be U.S. Environmental Protection Agency (**EPA**)-specified levels of quantitation proposed for EPA contract laboratories that analyze canister samples by gas chromatography/mass spectrometry (**GC/MS)** (EPA, 1991).

~~TICs~~ Non-targets classified as ARAs or TICs that meet the following criteria: (1) are VOCs listed in Appendix VIII of 40 Code of Federal Regulations (**CFR)** Part 261 (incorporated by reference in 20.4.1.200 New Mexico Administrative Code **(NMAC**), and (2) are detected in 10 percent~~%~~ or more of any original VOC monitoring samples ~~(exclusive of those collected from Station VOC-B) that are VOCs listed in Appendix VIII of 20.4.1.200 NMAC (incorporating 40 CFR §261)~~, collected over a ~~running~~ 12-month timeframe, ~~will~~ shall be added to the analytical laboratory target analyte lists for both the repository and disposal room VOC monitoring programs, unless the Permittees can justify the exclusion from the target analyte list(s). Non-target VOCs reported as "unknown" by the analytical laboratory are not evaluated due to indeterminate identifications.

Additional requested analytes and TICs detected in the repository and disposal room VOC monitoring programs ~~will~~ shall be placed in the WIPP Operating Record and reported to New Mexico Environment Department (**NMED**) in annual reports ~~the Semi-Annual VOC Monitoring Report~~ as specified in Permit Part 4, Section 4.6.2.2. As applicable, the Permittees ~~will~~shall also report the justification for exclusion from the target analyte list(s) (e.g., the compound does not contribute to more than one percent of the risk) as well as justification for exclusion of some non-target TICs from the laboratory's target analyte list as ARAs. If new target analytes are not required, the Permittees ~~will~~shall state such in the annual report provided in October of each year. If new target analytes are required, the Permittees ~~will~~shall submit a Class 1 Permit Modification Notification (**PMN**) annually in accordance with 20.4.1.900 NMAC (incorporating 40 CFR 270.42(a)) to update Tables 4.4.1, 4.6.2.3, and 4.6.3.2 ~~to include the~~whenever new analytes are identified and ~~associated recommended~~ EPA updates the risk ~~values~~factors for the inhalation unit risk (**IUR**) and reference concentration (**RfC**). This PMN ~~will~~shall be submitted with the annual report. Added compounds ~~will~~shall be included in the risk assessment described in Section N-3e(1).

In summary, the criteria that a new compound must meet to become a target analyte are:

1. The evaluation of TICs in original samples shall include those concentrations that are ≥10 percent of the relative internal standard.
2. The TIC concentration shall be ≥ the method reporting limit (MRL).
3. A TIC must be detected in 10% or more of the VOC samples excluding VOC-B within a 12 month time period.

4. The compound must be listed in Appendix VIII of 40 Code of Federal Regulations (CFR) Part 261.
5. To be included in the target analyte list the TICs must be detected in the original samples (duplicates are not included in the evaluation)
6. The compound will be added to the target analyte list if it meets the above criteria and contributes to greater than or equal to 1% of the total risk unless justification can be made to exclude it.

N-3c Sampling and Analysis Methods

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

The sampling methods used for repository and disposal room VOC monitoring are ~~sampling is~~ based on the concept of subatmospheric ~~pressurized~~ sample collection contained in the U.S. ~~Environmental Protection Agency (~~EPA~~)~~ Compendium Method TO-15 (EPA, 1999). The TO-15 sampling concept uses 6-liter ~~SUMMA®~~ passivated ~~(or equivalent)~~ stainless-steel canisters to collect 24-hour time integrated or time-weighted average air samples at Station VOC-A and short duration time-integrated samples for disposal room VOC monitoring~~each sample location~~. This ~~conceptual~~ method ~~will~~ shall be used as a reference for collecting the samples at WIPP. The samples ~~will~~ shall be analyzed using GC/MS ~~gas chromatography/mass spectrometry (**GC/MS**)~~ under an established QA/quality control (**QC**) program. Laboratory analytical procedures have been developed based on the concepts contained in both TO-15 and 8260B. Section N-5 contains additional QA/QC information for this project.

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

Sample collection units operate ~~The field sampling systems will be operated~~ in the subatmospheric ~~pressurized~~ mode. ~~In this mode, air is drawn through the inlet and sampling system with a pump. The air is pumped into~~ A sample is collected into an initially evacuated ~~SUMMA®~~ passivated ~~(or equivalent)~~ canister. When the canister is opened to the atmosphere, the differential pressure causes the sample to flow into the canister. Flow rate and duration are regulated with a flow-restrictive inlet and/or mechanical or electronic flow controllers. The air ~~will~~shall pass through two particulate filters installed in dual in-line filter holders to prevent sample and equipment contamination and for radiation assessment of sampling equipment, as needed. The use of passive tubing and canisters for VOC sampling inhibits adsorption of compounds on the surfaces of the equipment. ~~by the sampler, which regulates the rate and duration of sampling. The treatment of tubing and canisters used for VOC sampling effectively seals the inner walls and prevents compounds from being retained on the surfaces of the equipment. By the end of each sampling period, the canisters will be pressurized to about two atmospheres absolute. In the event of shortened sampling periods or other sampling conditions, the final pressure in the canister may be less than two atmospheres absolute. Sampling duration will be approximately six hours, so that a complete sample can be collected during a single work shift.~~

~~The canister sampling system and GC/MS analytical method are particularly appropriate for the VOC Monitoring Programs because a relatively large sample volume is collected, and multiple dilutions and reanalyses can occur to ensure identification and quantification of target VOCs within the working range of the method. The~~ For repository VOC monitoring, the contract-required quantitation limits (**CRQL**) ~~for Repository Monitoring~~ are 5 parts per billion by volume (**ppbv**) or less for the ~~nine~~ target VOCs~~compounds~~. Consequently, low concentrations can be measured. CRQLs are the EPA-specified levels of quantitation proposed for EPA contract laboratories that analyze canister samples by GC/MS~~.~~ (EPA, 1991). The CRQLs for disposal room VOC monitoring are 500 (ppbv) (0.5 parts per million-volume (ppmv)) to allow for sub-ppmv quantitation. For the purpose of this plan, the CRQLs ~~will~~ shall be defined as the MRL ~~method reporting limits (**MRL**)~~. The MRL is a function of instrument performance, sample preparation, sample dilution, and all steps involved in the sample analysis process. ~~The MRL for Disposal Room Monitoring is 500 ppbv or less for the nine target compounds.~~

Disposal room VOC monitoring ~~system in open panels will~~ shall employ ~~the same canister sampling method as used in the repository VOC monitoring~~ sample collection units that ~~will~~ shall provide a subatmospheric sample within a short duration. Passivated or equivalent sampling lines ~~will~~ shall be installed in the disposal room as described in Section N-3a(2) and maintained once the room is closed until the panel associated with the room is closed. The independent lines ~~will~~ shall run from the sample inlet point to a sampling manifold ~~the individual sampler~~ located in an area accessible to sampling personnel~~the access drift to the disposal panel. The air will pass through dual particulate filters to prevent sample and equipment contamination~~.

N-3d Sampling Schedule

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

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

Repository VOC sampling at Station~~s~~ VOC-A began ~~and VOC-B will begin~~ with initial waste emplacement in Panel 1. Sampling ~~will~~ shall continue until the certified closure of the last Underground HWDU. Routine collection of a 24-hour time-integrated sample ~~sampling will~~ shall be conducted once ~~two times~~ per week.

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

Disposal ~~The disposal~~ room VOC monitoring ~~sampling~~ in open panels ~~will~~ shall occur once every two weeks, unless the need to increase the frequency to weekly occurs in accordance with Permit Part 4, Section 4.6.3.3.

Ongoing ~~Beginning with Panel 3,~~ disposal room VOC monitoring ~~sampling~~ in filled panels ~~will~~ shall occur monthly until final panel closure unless an explosion-isolation wall is installed. The Permittees ~~will~~ shall sample VOCs in Room 1 of ~~each filled~~ panels requiring monitoring.

N-3e Data Evaluation and Reporting

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

When the Permittees receive laboratory analytical data from an air sampling event, the data ~~will~~ shall be validated as specified in Section N-5d. After obtaining validated data from an original Repository VOC Monitoring sample obtained during an air sampling event, the data ~~will~~ shall be evaluated to determine whether the VOC emissions from the Underground HWDUs exceed the risk limits ~~COCs. The COCs for each of the nine target VOCs are presented~~ in Permit Part 4, Section ~~Table~~ 4.6.2.3. The values are presented in terms of risk of excess cancer death for compounds believed to be carcinogenic and hazard index (**HI**) for non-carcinogens~~micrograms per cubic meter (µg/m^3) and ppbv~~.

The ~~COCs~~ risk and HI are calculated as follows:

Determine the concentration at Station VOC-A in mg/m^3 for each VOC. This measurement represents the emissions from all closed and open panels and is $C_{E\text{-}300VOC_j}$ in equation (N-1).

Calculate the concentration at the top of the Exhaust Shaft based on the ratio of actual flow rate at Station VOC-A and the total Exhaust Flow Rate:

$$C_{ES_{VOC_j}} = C_{E-300_{VOC_j}} \times \frac{V_{E-300}}{V_{ES}} \quad \text{(N-1)}$$

Where:

$C_{ES_{VOC_j}}$ = Concentration of VOC_j at the top of the Exhaust Shaft in mg/m^3

$C_{E-300_{VOC_j}}$ = Concentration of VOC_j at E-300 in mg/m^3

$V_{E\text{-}300}$ = E-300 ventilation flow rate in ft^3/min

V_{ES} = Exhaust Shaft ventilation flow rate in ft^3/min

Apply the Air Dispersion Factor (0.0114) to determine the concentration at the receptor:

$$Conc_{VOC_j} = C_{ES_{VOC_j}} \times 0.0114 \quad \text{(N-2)}$$

Where:

$Conc_{VOC_j}$ = Concentration VOC_j at the receptor (mg/m^3)

Calculate the carcinogenic risk (for each VOC) using the following equation:

$$R_{VOCj} = \frac{Conc_{VOCj} \times EF \times ED \times IUR_{VOCj} \times 1000}{AT} \quad \text{(N-3)}$$

Where:

R_{VOCj} = Risk due to exposure to VOC_j

$Conc_{VOC_j}$ = Concentration VOC_j at the receptor (mg/m^3)

EF = Exposure frequency (hours/year), = 1,920 hours per year

ED = Exposure duration, years, = 10 years

IUR_{VOCj} = Inhalation risk factor from EPA Integrated Risk Information System (**IRIS**) database $(ug/m^3)^{-1}$ (from Table 4.6.2.3)

AT = Averaging time for carcinogens, = 613,200 hours based on 70 years

1,000 = ug/mg

The total risk is then the sum of the risk due to each carcinogenic VOC:

$$\text{Total Risk} = \sum_{j=1}^{m} R_{VOC_j} \qquad \text{(N-4)}$$

Where:

Total Risk must be less than 10^{-5}

m = the number of carcinogenic VOCs

The formula for non-carcinogenic hazard is similar:

$$HI_{VOC_j} = \frac{Conc_{VOC_j} \times EF \times ED}{AT \times RfC_{VOC_j}} \qquad \text{(N-5)}$$

Where:

HI_{VOC_j} = Hazard Index for exposure to VOC_j

$Conc_{VOC_j}$ = Concentration VOC_j at the receptor (mg/m^3)

EF = Exposure frequency (hours/year), = 1,920 hours per year

ED = Exposure duration, years, = 10 years

RfC_{VOC_j} = Reference concentration from EPA IRIS database (mg/m^3)

AT = Averaging time for non-carcinogens, = 87,600 hours, based on exposure duration

The total hazard is then the sum of the hazard index due to each non-carcinogenic VOC:

$$\text{Hazard Index} = \sum_{j=1}^{m} HI_{VOC_j} \qquad \text{(N-6)}$$

Where:

Hazard Index must be less than 1.0

m = the number of non-carcinogenic VOCs

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

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

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

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

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

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

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

~~scfm = Standard cubic feet per minute~~

~~Vo = Sampling event overall mine ventilation rate (in standard cubic feet per minute)~~

~~VE-300 = Sampling event mine ventilation rate through the E-300 Drift (in standard cubic feet per minute)~~

~~The normalized concentration of each target VOC detected at Station VOC-B will be subtracted from the normalized concentration detected at Station VOC-A. The resulting concentration represents the Underground HWDU VOC emission concentration.~~

The summed risk and HI calculated from the Underground HWDU VOC emission concentrations ~~for each target VOC that is calculated for each sampling event will~~ shall be compared directly to the limits in ~~its COC listed in~~ Permit Part 4, Section ~~Table~~ 4.6.2.3. This will establish whether any of the concentrations of VOCs in the emissions from the Underground HWDUs exceeded the risk and HI limits ~~COCs~~ at the time of the sampling.

As specified in Permit Part 4, the Permittees shall notify the Secretary in writing, within seven calendar days of obtaining validated analytical results, whenever the risk or HI ~~concentrations of any target VOC listed in~~ exceeds the limits ~~concentration of concern~~ specified in Permit Part 4, Section ~~Table~~ 4.6.2.3.

The Underground HWDU VOC emission concentration for each target VOC that is calculated for each sampling event ~~will~~ shall then be averaged with the Underground HWDU VOC emission concentrations calculated for the air sampling events conducted during the previous 12 months. This ~~will~~ shall be considered the running annual average concentration for each target VOC. The risk and HI at the location of the surface worker ~~will~~shall be calculated using the methodology above for the running annual average concentrations. ~~For the first year of air sampling, the running annual average concentration for each target VOC will be calculated using all of the previously collected data.~~

As specified in Permit Part 4, the Permittees shall notify the Secretary in writing, within seven calendar days of obtaining validated analytical results, whenever the running annual average risk or HI ~~concentration~~ (calculated after each sampling event) ~~for any target VOC~~ exceeds the limits ~~concentration of concern~~ specified in Permit Part 4, Section ~~Table~~ 4.6.2.3.

If the results obtained from an individual air sampling event do not trigger the notification requirements of Permit Part 4, then the Permittees ~~will~~ shall maintain a database with the VOC air sampling data and the results ~~will~~ shall be reported to the Secretary as specified in Permit Part 4.

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

When the Permittees receive laboratory analytical data from an air sampling event, the data ~~will~~ shall be validated as specified in Section N-5d~~5a~~, within 14 calendar days of receiving the laboratory analytical data. After obtaining validated data from an air sampling event, the data ~~will~~ shall be evaluated to determine whether the VOC concentrations in the air of an~~any closed room, the~~ active open room and~~, or~~ the immediately adjacent closed room are greater than or equal to the action levels ~~exceeded the Action Levels~~ for ~~D~~disposal ~~R~~room ~~M~~monitoring specified in Permit Part 4, Table 4.6.3.2.

The Permittees shall notify the Secretary in writing, within seven calendar days of obtaining validated analytical results, whenever the concentration of any VOC specified in Permit Part 4, Table 4.4.1 is greater than or equal to ~~exceeds~~ the action levels specified in Permit Part 4, Table 4.6.3.2. Remedial action ~~will~~shall be taken as specified in Section N-1b.

The Permittees shall report disposal room VOC monitoring results ~~submit~~ to the Secretary in the annual reports as ~~the Semi-Annual VOC Monitoring Report~~ specified in Permit Part 4, Section 4.6.2.2 ~~that also includes results from disposal room VOC monitoring~~.

N-3e(3) Calculation of Disposal Room Monitoring Limits

Whenever the TIC process described in Section N-3b identifies a target analyte that is to be added to the Permit, the Permittees shall calculate a Disposal Room Limit and Action Levels for addition to Tables 4.4.1 and 4.6.3.2 respectively. The calculation shall be based as follows:

$Conc_{VOC} = 48 \times IDLH$ (N-7)

Where $Conc_{VOC}$ is the concentration of concern to be added to Table 4.4.1 in parts per million (volume) ;

48 is a factor calculated according the process found in Attachment 1 of Appendix D9 of the Permittees 1996 RCRA Permit Application; and

Immediately Dangerous to Life and Health (**IDLH**) is the concentration of the VOC that is determined by Occupational Safety and Health Administration (**OSHA**) to be immediately dangerous to life and health.

Under no conditions shall $Conc_{VOC}$ be greater than the lower explosive limit for the VOC. The values for Table 4.6.3.2 will be calculated as $Conc_{VOC}$ times 0.5 and $Conc_{VOC}$ times 0.95.

N-4 Sampling and Analysis Procedures

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

N-4a Sampling Equipment

The sampling equipment that ~~will~~ shall be used includes the following: 6-liter (L) stainless-steel passivated ~~SUMMA®~~ canisters, sample collection units, passivated ~~VOC canister samplers, treated~~ stainless-steel tubing, and ~~a~~ dual in-line stainless-steel filter holders~~housing~~. A discussion of each of these items is presented below.

N-4a(1) Sample ~~SUMMA®~~ Canisters

Six-liter, stainless-steel canisters with ~~SUMMA®~~ passivated interior surfaces ~~will~~ shall be used to collect and store all ambient air and disposal room ~~gas~~ samples for VOC analyses collected as part of the monitoring processes. These canisters will be cleaned and certified (batch certification acceptable) prior to their use, in a manner similar to that described by Compendium Method TO-15. The canisters ~~will~~ shall be certified clean to below 0.2 ppbv ~~the required reporting limits for the VOC analytical method~~ for the target VOCs ~~(see Table N-2)~~. The vacuum of certified clean canisters ~~samplers will~~ shall be verified as adequate ~~at the sampler~~ upon initiation of a sample cycle as described in standard operating procedures (**SOPs**). The sample canisters ~~are~~shall be initially evacuated at the analytical laboratory to <0.05 mm Hg (50 mtorr).

N-4a(2) Sample Collection Units~~Volatile Organic Compound Canister Samplers~~

The sample collection unit for Station VOC-A samples is a commercially available sample train (herein referred as PASK) comprised of components that regulate the rate and duration of sampling into a sample canister. It can be operated unattended using a programmable timer or manually using canister valves.

The sample collection unit for disposal room VOC monitoring samples is a designed subatmospheric sampling assembly that regulates the rate and duration of sampling into a sample canister (Figure N-2). The design of the subatmospheric sampling assembly also allows for purging of sample lines to ensure that a representative sample is collected.

Sample collection units ~~will~~shall use passivated components for the sample flow path. This effectively seals the inner walls and prevents sample constituents from being retained on the surfaces of the equipment. When sample canisters installed on sample collection units are opened to the atmosphere, the differential pressure causes the sample to flow into the canister at a regulated rate. By the end of each sampling period, the canisters ~~will~~shall be near atmospheric pressure. Additional detail on sample collection ~~will~~shall be given in SOPs.

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

N-4a(3) Sample Tubing

Passivated ~~Treated~~ stainless~~-~~steel tubing is used as a sample path, from the desired sample point to the sample collection unit. This tubing is passivated ~~treated~~ to prevent the inner walls from adsorbing sample constituents ~~absorbing contaminants~~ when they are pulled from the sample point to the sample collection unit.

N-4b Sample Collection

Sample collection for VOCs in the WIPP repository ~~will~~shall be conducted in accordance with written SOPs that are kept on file at the facility. These SOPs ~~will~~shall specify the steps necessary to assure the collection of samples that are of acceptable quality to meet the applicable data quality objectives in Section 5 of this Attachment.

Samples collected from Station VOC-A ~~will~~shall be 24~~Six~~-hour time-integrated samples for ~~will be collected on~~ each sampling event~~sample day~~. Alternative sampling durations may be defined

for assessment ~~experimental~~ purposes and to meet the data quality objectives. ~~The VOC canister sampler at each location will sample ambient air on the same programmed schedule. The sample pump will be programmed to sample continuously over a six-hour period during the workday. The units will sample at a nominal flow rate of 33.3 actual milliliters per minute over a six-hour sample period. This schedule will yield a final sample volume of approximately 12 L. Flow rates and sampling duration may be modified as necessary for experimental purposes and to meet the data quality objectives.~~

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

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

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

N-4c Sample Management

Field sampling logbooks and data sheets will be used for ~~to document the sampler conditions under which~~ each sample ~~is~~ collected as specified in SOPs for VOC sampling. These data sheets are included in the SOPs and have been developed specifically for VOC monitoring at the WIPP facility. Logbooks are used to document sampler information as required by SOPs. The individuals assigned to collect the specific samples will be required to fill in all of the appropriate sample data ~~and to maintain this record in sample logbooks~~. A cognizant ~~individual The program team leader~~ will review these forms for each sampling event and the completed data sheets will be maintained in with the departmental Records Inventory and Disposition Schedule (**RIDS**).

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

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

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

Individuals collecting samples ~~will~~ shall be responsible for the initiation of custody procedures. The chain of custody ~~will~~ shall include documentation as to the canister certification, location of sampling event, sample collection ~~time,~~ date, and individual(s) handling the samples. Unintentional procedure deviations, equipment malfunctions, and other problems that do not conform to established requirements are nonconformances. The disposition and documentation of nonconformances ~~will~~shall be handled according to QA requirements. ~~Deviations from procedure will be considered variances. Variances must be preapproved by the program manager and recorded in the project files. Unintentional deviations, sampler malfunctions, and other problems are nonconformances. Nonconformances must be documented and recorded in the project files. All field logbooks/data sheets must be incorporated into WIPP's records management program.~~

N-4d ~~Sampler~~ Maintenance of Sample Collection Units

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

N-4e Analytical Procedures

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

Analysis of samples shall be performed by a laboratory that the Permittees select and approve through established QA processes. ~~Analysis of samples will be performed by a certified laboratory.~~ Analytical m~~M~~ethods ~~will~~ shall be specified in procurement documents and ~~will~~ shall be selected to be consistent with Compendium Method TO-15 (EPA, 1999) or EPA recommended procedures in SW-846 (EPA, 1996). Additional detail on analytical techniques and methods ~~will~~ shall be given in laboratory SOPs.

The Permittees ~~will~~ shall establish the criteria for laboratory selection, including the stipulation that the laboratory follow the procedures specified in the appropriate Air Compendium or SW-846 method and that the laboratory follow EPA protocols. The selected laboratory shall demonstrate, through laboratory SOPs, that it will follow appropriate EPA SW-846 requirements and the requirements specified by the EPA Air Compendium protocols. The laboratory shall also

provide documentation to the Permittees describing the sensitivity of laboratory instrumentation. This documentation ~~will~~ shall be retained in the facility operating record and ~~will~~ shall be available for review upon request by NMED.

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

Data validation ~~will~~ shall be performed by ~~cognizant~~ qualified individuals~~the Permittees~~. Copies of the data validation records ~~report will~~ shall be kept on file in the operating record for review upon request by NMED.

N-5 Quality Assurance

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

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

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

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

$$\text{~~RPD~~} = \left(\frac{(A-B)}{(A+B)/2} \right) * \text{~~100~~} \quad RPD = \left(\frac{|A-B|}{(A+B)/2} \right) * 100 \qquad \text{(N-~~7~~8~~2~~)}$$

where: A = Original sample result

B = Duplicate sample result

Accuracy. Analytical accuracy ~~will~~ shall be defined and evaluated through the use of analytical standards. Because recovery standards cannot reliably be added to the sampling stream, overall system accuracy ~~will~~ shall be based on analytical instrument performance evaluation criteria. These criteria ~~will~~ shall include performance verification for instrument calibrations, laboratory control samples, sample surrogate recoveries (when required by method or

laboratory SOPs), and sample internal standard areas. Use of the appropriate criteria as determined by the analytical method performed, ~~will~~ shall constitute the verification of accuracy for target analyte quantitation (i.e., quantitative accuracy). Evaluation of standard ion abundance criteria for bromofluorobenzene Chemical Abstract Service (CAS# 460-00-4) ~~BFB~~ ~~will~~ shall be used to evaluate the accuracy of the analytical system in the identification of targeted analytes, as well as the evaluation of unknown constituents ~~contaminants~~ (i.e., qualitative accuracy).

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

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

N-5a(1) Evaluation of Laboratory Precision

Laboratory sample duplicates and laboratory control sample/laboratory control sample ~~blank spike/blank spike~~ duplicates (**LCS/LCSD**~~**BS/BSD**~~) ~~will~~ shall be used to evaluate laboratory precision. QA objectives for laboratory precision are listed in Table N-2, and are based on precision criteria proposed by the EPA for canister sampling programs (EPA, 1991~~1994~~). These values ~~will~~ shall be appropriate for the evaluation of samples with little or no matrix effects. Because of the potentially high level of salt-type aerosols in the WIPP underground environment, the analytical precision achieved for WIPP samples may vary with respect to the EPA criteria. RPDs for LCS/LCSD ~~BS/BSD~~ analyses ~~will~~ shall be tracked by the analytical laboratory through the use of control charts. RPDs obtained for laboratory sample duplicates ~~will~~ shall be compared to those obtained for LCS/LCSD ~~BS/BSDs~~ to ascertain any sample matrix effects on analytical precision. LCS/LCSD ~~BS/BSDs~~ and laboratory sample duplicates ~~will~~ shall be analyzed at a frequency of 10 percent, or one per analytical lot, whichever is more frequent.

N-5a(2) Evaluation of Field Precision

Field duplicate samples ~~will~~ shall be collected at a frequency of at least 5 percent for each VOC ~~both~~ monitoring program~~locations~~. The data quality objective for field precision is 35 percent for each set of field duplicate samples.

N-5a(3) Evaluation of Laboratory Accuracy

Quantitative analytical accuracy ~~will~~ shall be evaluated through performance criteria on the basis of (1) relative response factors generated during instrument calibration, (2) analysis of LCS~~laboratory control samples (**LCS**)~~, and (3) recovery of internal standard compounds. The criterion ~~criteria~~ for the initial calibration (minimum 5-point calibration) is ≤ 30 percent relative standard deviation for target analytes. After the successful completion of the ~~5-point~~ calibration, it is sufficient to analyze only a midpoint standard for every 24 hours of operation. The midpoint

standard ~~will~~ shall pass a ≤ 30 percent difference acceptance criterion for each target VOC ~~compound~~ before sample analysis may begin.

An ~~blank spike or~~ LCS is an internal QC sample generated by the analytical laboratory by spiking a standard air matrix (humid zero air or ultra-high purity nitrogen) with a known amount of a certified reference gas. The reference gas ~~will~~ shall contain the target VOCs at known concentrations. Percent recoveries for the target VOCs ~~will~~ shall be calculated for each LCS relative to the reference concentrations. Objectives for percent recovery are listed in Table N-2, and are based on accuracy criteria proposed by the EPA for canister sampling programs (EPA, 1991~~1994~~). LCSs ~~will~~ shall be analyzed at a frequency of 10 percent, or one per analytical lot, whichever is more frequent.

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

N-5a(4) Evaluation of Sensitivity

The presence of aerosol salts in underground locations may affect the MDL of the samples collected in those areas. The sample inlet of the sample collection units ~~intake manifold of the sampling systems will~~ shall be protected sufficiently from the underground environment to minimize salt aerosol interference. Two filters inert to VOCs ~~will~~shall be installed in dual in-line filter holders in the sample flow path to minimize particulate interference.

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

N-5a(5) Completeness

The expected completeness for this program is greater than or equal to 95 percent. Data completeness ~~will~~ shall be tracked monthly.

N-5b Sample Handling and Custody Procedures

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

N-5c Calibration Procedures and Frequency

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

N-5d Data Reduction, Validation, and Reporting

Field sampling data sheets and equipment logbooks ~~A dedicated logbook will be maintained by the operators. This logbook will~~ shall contain documentation of all pertinent data for the sampling according to applicable SOPs. ~~Sample collection conditions, maintenance, and calibration activities will be included in this logbook.~~ Additional data collected by other groups at WIPP, such as ventilation airflow, temperature, barometric pressure, and relative humidity~~etc.~~, ~~will~~ shall be obtained to document the sampling conditions.

Data validation procedures ~~will~~ shall include at a minimum, a check of all field data sheets/equipment/logbooks ~~forms and sampling logbooks will be checked~~ for completeness and correctness according to the applicable SOP. Sample custody and analysis records ~~will~~ shall be reviewed ~~routinely~~ by the analytical laboratory QA officer and the analytical laboratory supervisor at a frequency of at least 10 percent.

Electronic d~~D~~ata d~~D~~eliverables (**EDDs**) ~~are~~ shall be provided by the laboratory prior to receipt of hard copy data packages. EDDs ~~will~~ shall be evaluated within five calendar days of receipt to determine if VOC concentrations are at or above action levels in Permit Part 4, Table 4.6.3.2 for disposal room VOC monitoring data or the action levels specified in Permit Part 4, Section ~~concentrations of concern in Table~~ 4.6.2.3 for repository monitoring data. If the EDD indicates that VOC concentrations are at or above these action levels ~~or concentrations~~, the hard copy data package ~~will~~ shall be validated within five calendar days as opposed to the fourteen (14) calendar day time frame provided by Section N-3e(2).

Data ~~will~~ shall be reported as specified in Section N-3(e) and Permit Part 4.

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

N-5e Performance and System Audits

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

Performance audits ~~will~~ shall be accomplished as necessary through the evaluation of analytical QC data by performing periodic site audits throughout the duration of the project, and through the introduction of third-party audit cylinders (laboratory blinds) into the analytical sampling stream. Performance audits ~~will~~ shall also include a surveillance/review of data associated with canister ~~and sampler~~ certifications and measurement and test equipment, a project-specific technical audit of field operations, and a laboratory performance audit. ~~Field logs, logbooks, and data sheets will be reviewed weekly.~~ Blind-audit canisters ~~will~~ shall be introduced once during the sampling period. Details concerning scheduling, personnel, and data quality evaluation are addressed in the Quality Assurance Project Plan (**QAPjP**).

N-5f Preventive Maintenance

Maintenance of sample collection units ~~Sampler maintenance~~ is described briefly in Section N-4d. Maintenance of analytical equipment ~~will~~ shall be addressed in the analytical laboratory SOP.

N-5g Corrective Actions

If the required completeness of valid data (≥ 95 percent) is not maintained, corrective action may be required. Corrective action for field sampling activities may include maintenance ~~recertification and cleaning~~ of sample collection units~~samplers~~, reanalysis of samples, additional training of personnel, modification to field and laboratory procedures, and recalibration of measurement and test equipment.

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

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

N-5h Records Management

The VOC Monitoring Programs ~~will~~ shall require administration of record files (both laboratory and field data collection files). The records control systems ~~will~~ shall provide adequate control and retention for program-related information. Records administration, including QA records, ~~will~~ shall be conducted in accordance with applicable DOE, Management and Operating Contractor (**MOC**), and WIPP requirements.

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

Revisions to completed records (i.e., as a result of audits or data validation procedures) may be made only with the approval of the responsible program manager and in accordance with applicable QA procedures. Records associated with the VOC Monitoring Program ~~will~~shall be maintained as specified in VOC program SOPs. Electronic records that cannot be altered by the user and capable of producing a paper copy shall be deemed to be a written record. Records required to be retained by VOC program SOPs ~~will~~shall be maintained at or readily accessible from the WIPP site. ~~Original and duplicate or backup records of project activities will be~~

~~maintained at the WIPP site.~~ Documentation ~~will~~ shall be available for inspection by internal and external auditors.

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

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

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

N-67 References

40 CFR Part 136, "Guidelines Establishing Test Procedures for the Analysis of Pollutants."

Section 310 of Public Law 108-447 of the Consolidated Appropriations Act of 2005.

U.S. Environmental Protection Agency, 1991. Contract Laboratory Program, Volatile Organics Analysis of Ambient Air in Canisters (Draft), EPA540/R-94-085, December 1991, Washington, D.C.

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

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

~~U.S. Environmental Protection Agency. 2000. *Guidance for the Data Quality Objectives Process*, QA/G-4. EPA 600/R-96/055, August 2000, Washington, D.C.~~

U.S. Environmental Protection Agency. 2001. *EPA Requirements ~~Guidance~~ for Quality Assurance Project Plans, QA/R-5~~G~~*, EPA 240/B-01/003, March 2001, Washington, D.C.

U.S. Environmental Protection Agency. 2002. *EPA Guidance ~~Requirements~~ for ~~Preparing~~ Quality Assurance Project Plans*, QA/G~~R~~-5, EPA 240/R-02~~01~~/009, December 2002, Washington, D.C.

Washington Regulatory and Environmental Services, 2003~~2004~~. *Technical Evaluation Report for WIPP Room-Based VOC Monitoring*.

TABLES

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Table N-1
Target Analytes and Methods for Repository VOC ~~(Station VOC-A and VOC-B)~~ Monitoring (Station VOC-A) and Disposal Room VOC Monitoring

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	
Trichloroethylene	

[a] 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

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

Table N-2
Quality Assurance Objectives for Accuracy, Precision, Sensitivity, and Completeness

Target VOC~~Compound~~	Accuracy (Percent Recovery)	Precision (RPD) Laboratory	Precision (RPD) Field	Required Repository Monitoring MRL (ppbv)	Required Disposal Room MRL (ppbv)	Completeness (Percent)
Carbon tetrachloride	60 to 140	25	35	2	500	95
~~Chlorobenzene~~	~~60 to 140~~	~~25~~	~~35~~	~~2~~	~~500~~	~~95~~
Chloroform	60 to 140	25	35	2	500	95
~~1,1-Dichloroethylene~~	~~60 to 140~~	~~25~~	~~35~~	~~5~~	~~500~~	~~95~~
1,2-Dichloroethane	60 to 140	25	35	2	500	95
~~Methylene chloride~~	~~60 to 140~~	~~25~~	~~35~~	~~5~~	~~500~~	~~95~~
1,1,2,2-Tetrachloroethane	60 to 140	25	35	2	500	95
~~Toluene~~	~~60 to 140~~	~~25~~	~~35~~	~~5~~	~~500~~	~~95~~
1,1,1-Trichloroethane	60 to 140	25	35	5	500	95
Trichloroethylene	60 to 140	25	35	5	500	95

MRL maximum method reporting limit for undiluted samples

RPD relative percent difference, allowances for conditions that may produce non-representative RPD values will be specified in SOPs

FIGURES

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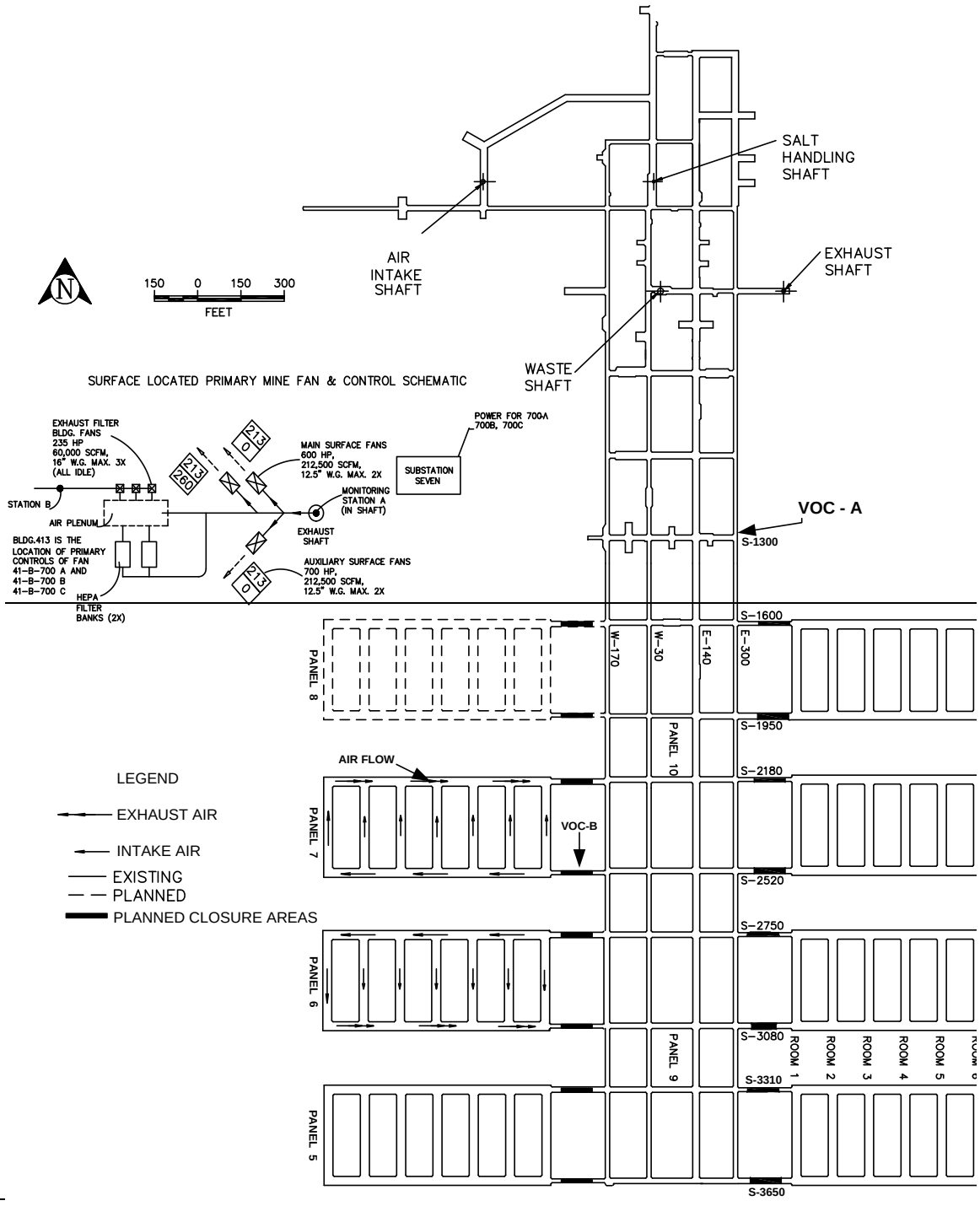


~~Figure N-1~~
~~Panel Area Flow~~

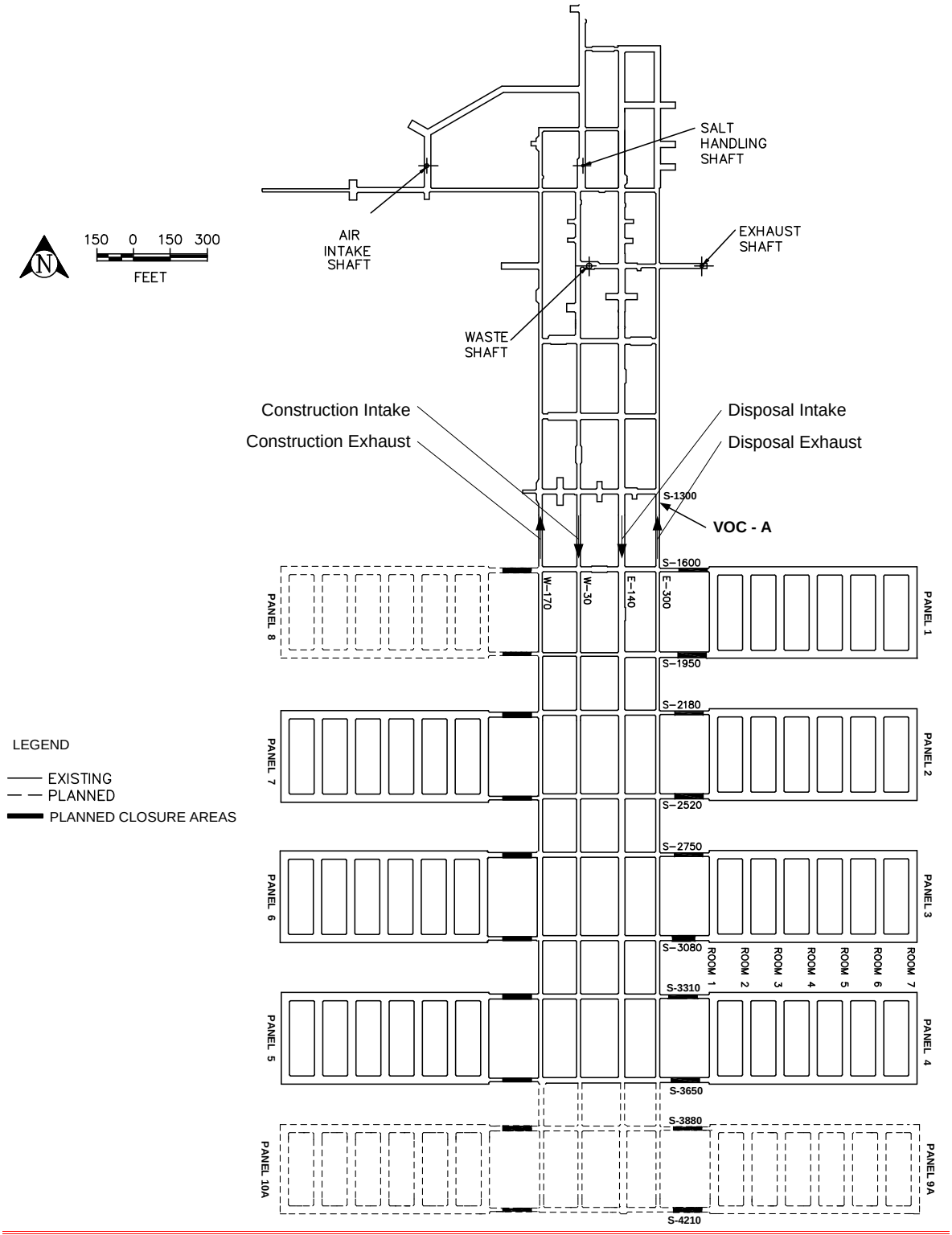
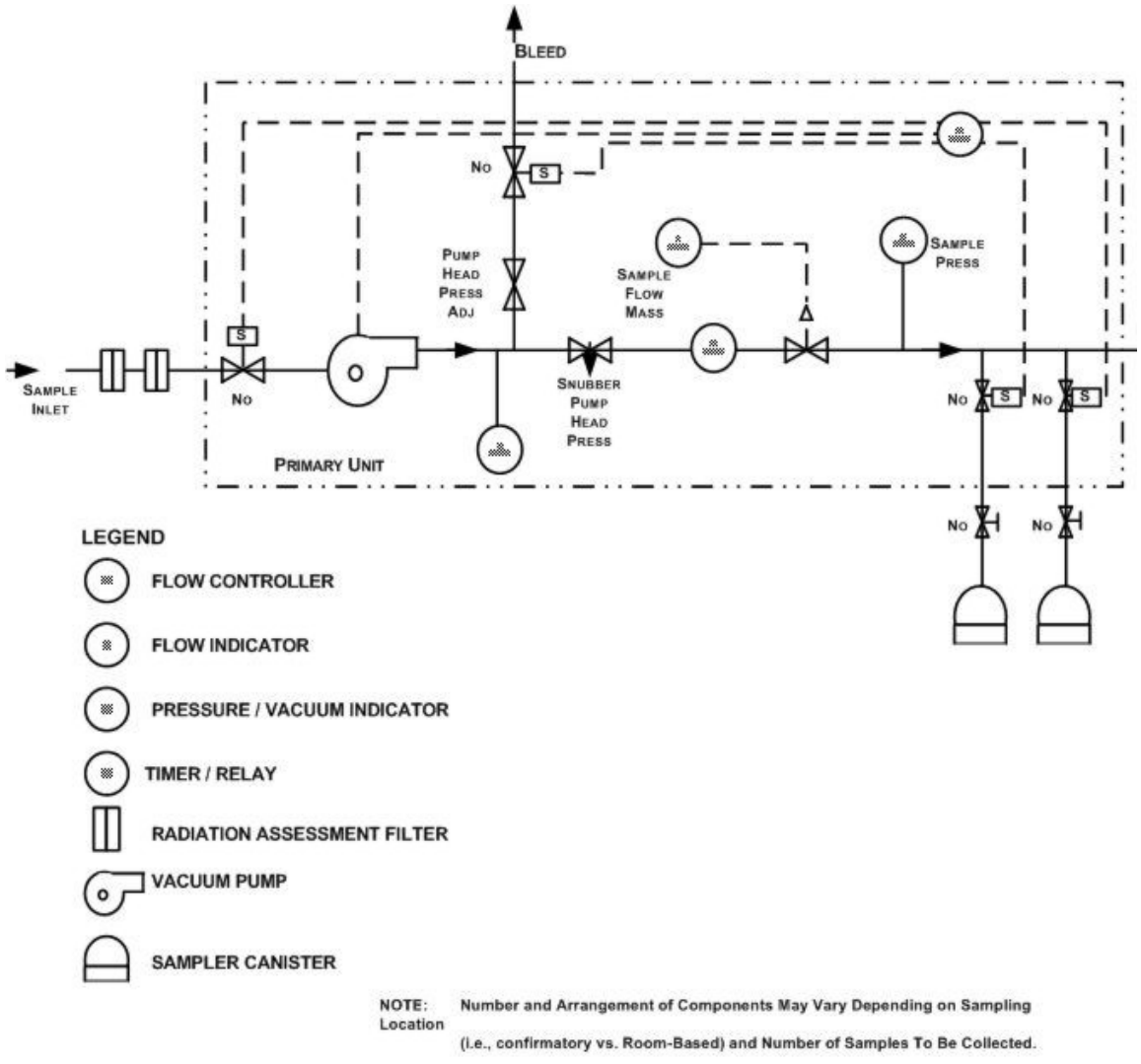


Figure N-1
Location of Station VOC-A



~~Figure N-2~~
~~VOC Monitoring System Design~~

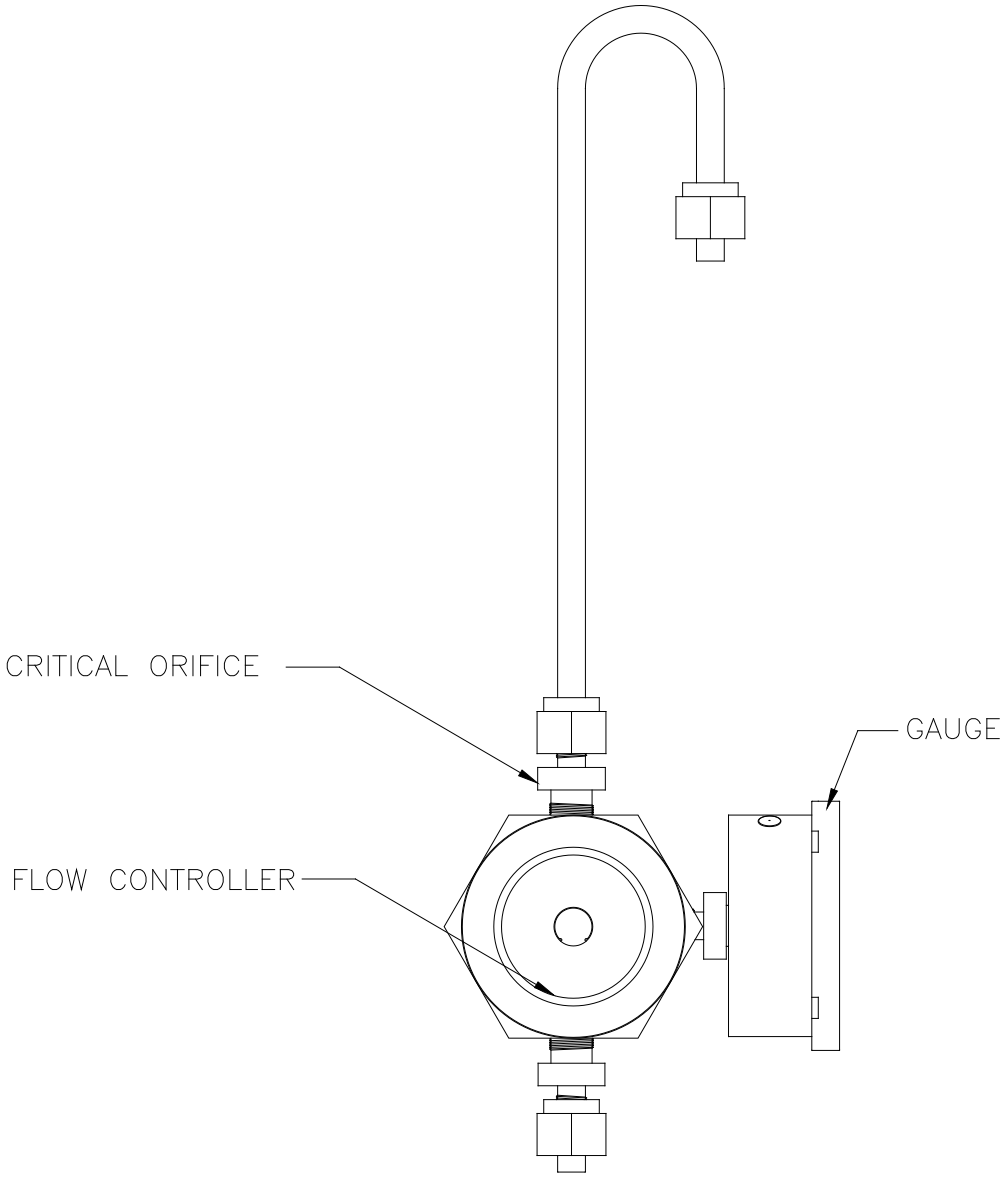
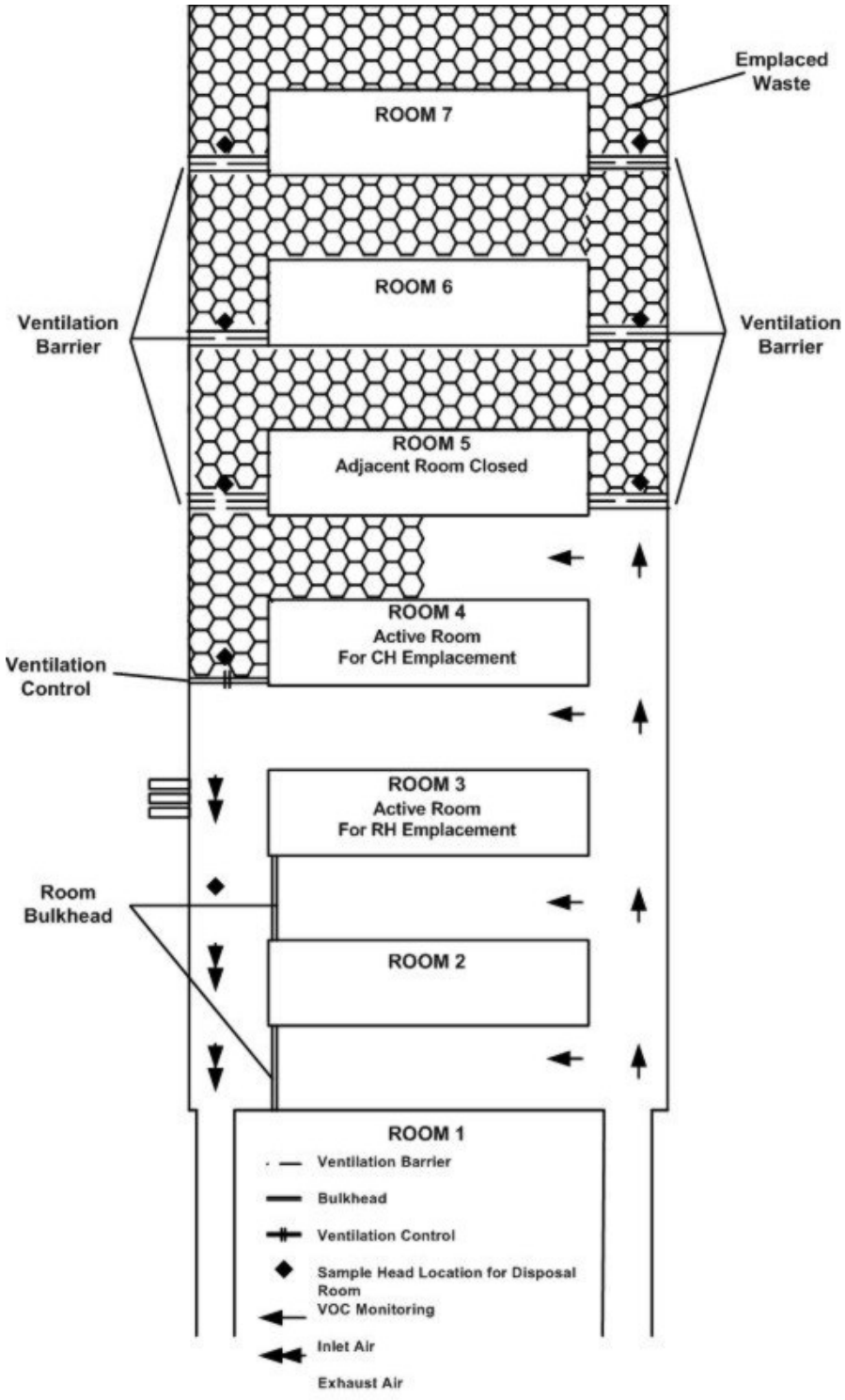


Figure N-2
Subatmospheric VOC Monitoring System



~~Figure N-3~~
~~Disposal Room VOC Monitoring~~

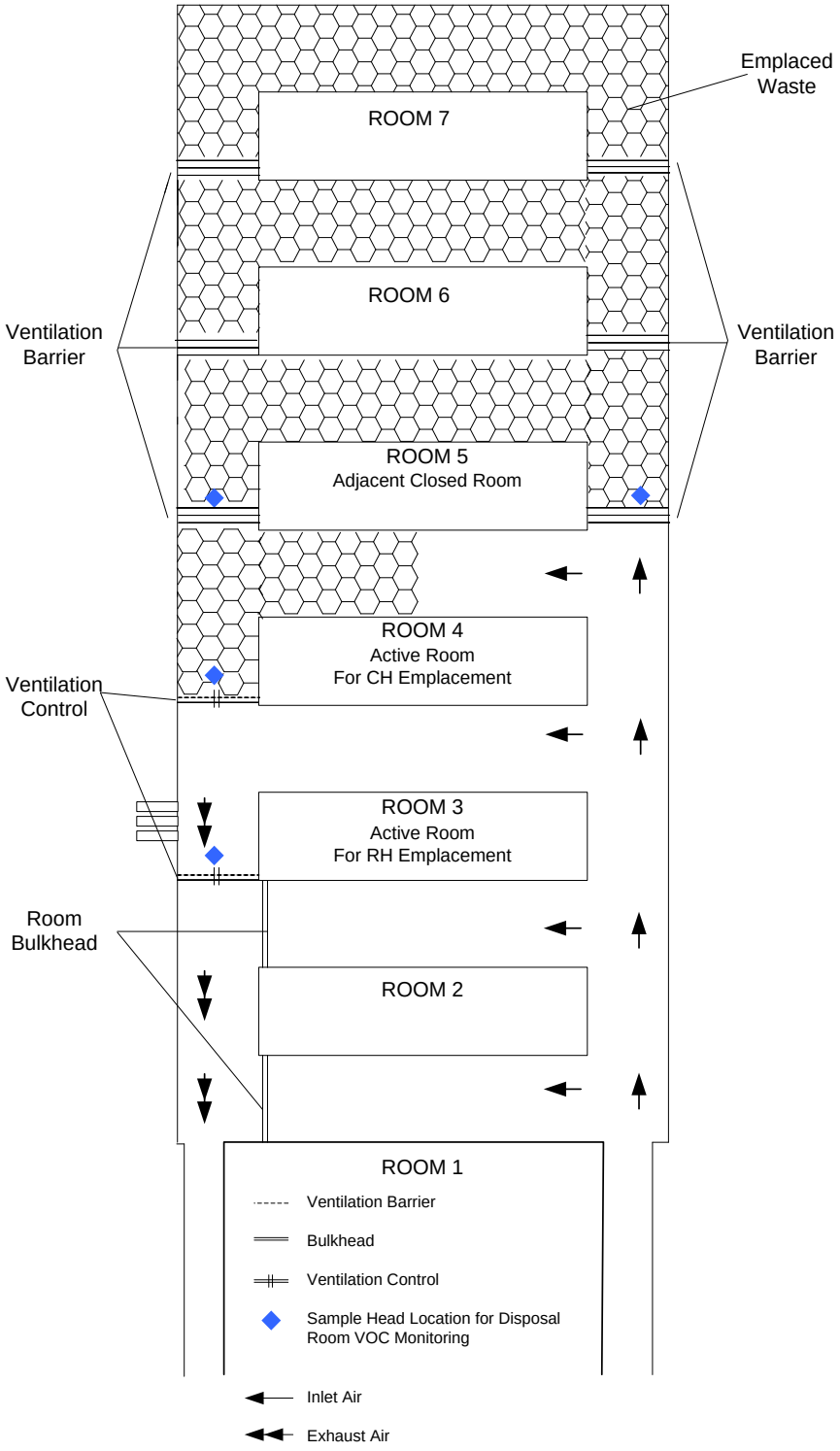
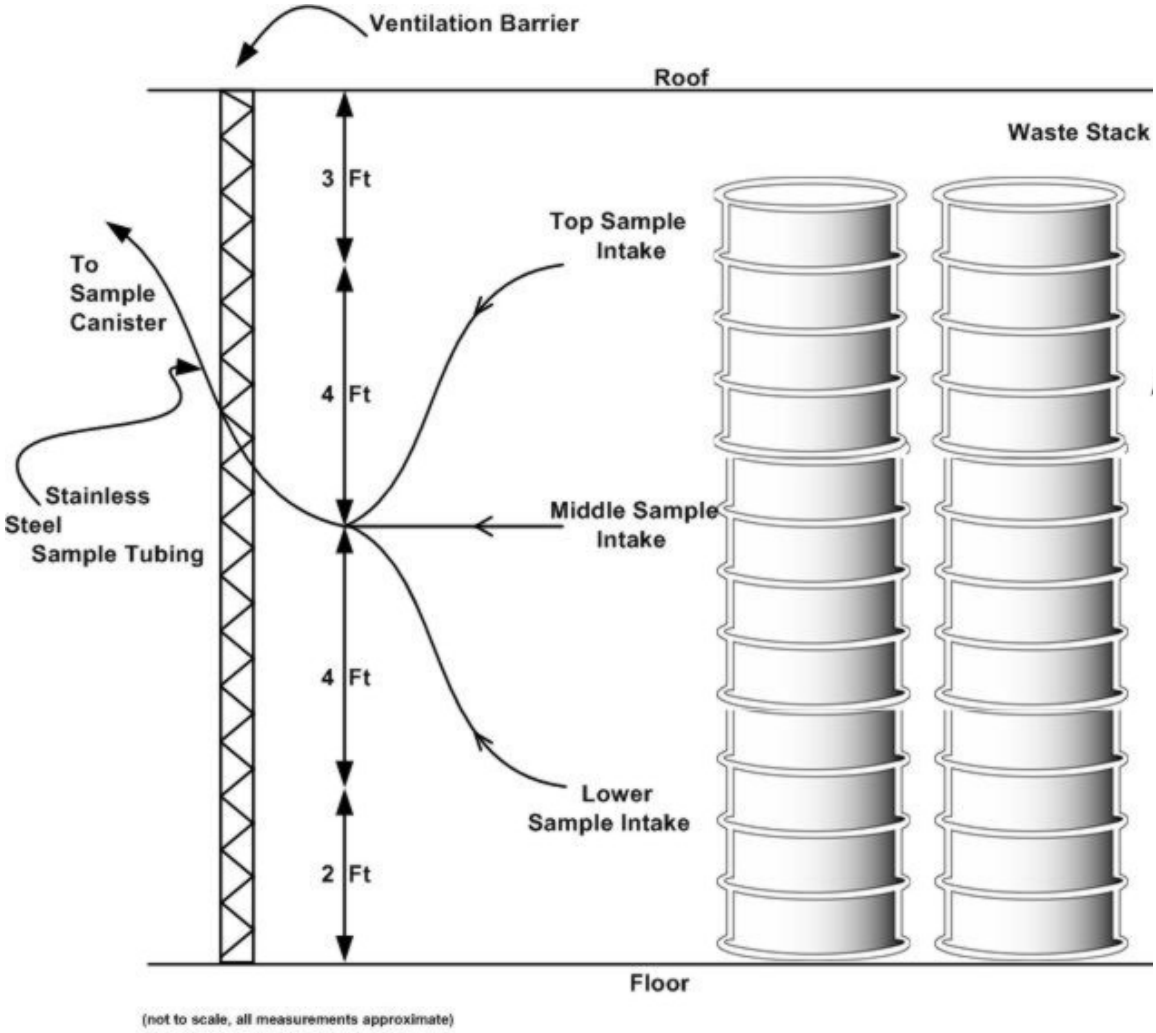


Figure N-3
Typical Disposal Room VOC Monitoring Locations and Path of Ventilation Air Flow



~~Figure N-4~~
~~VOC Sample Head Arrangement~~

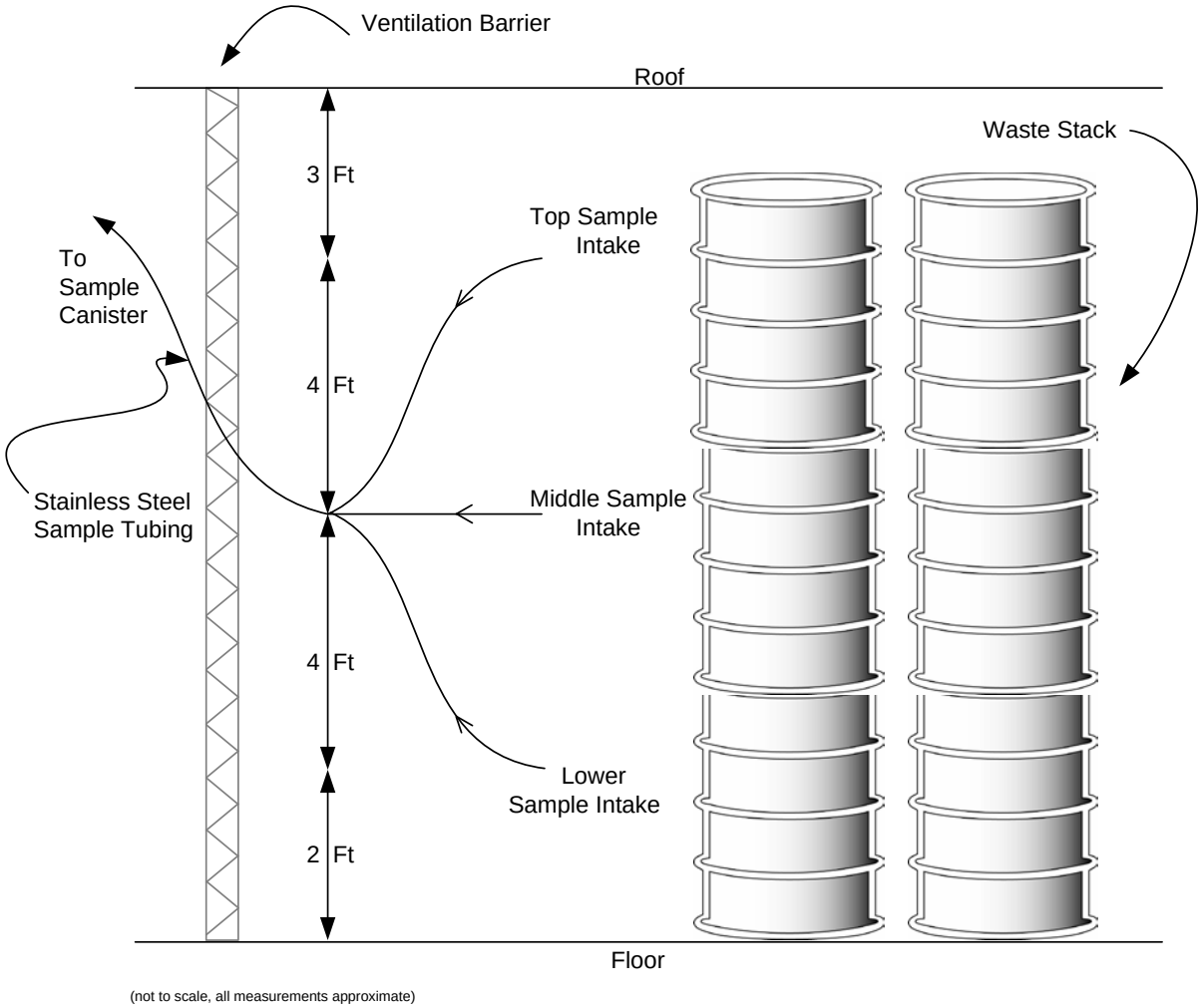


Figure N-4
Disposal Room VOC Sample Head Arrangement

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