



Department of Energy
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 October 26, 2021

Mr. Ricardo Maestas, Acting Chief
 Hazardous Waste Bureau
 New Mexico Environment Department
 2905 Rodeo Park Drive East, Building 1
 Santa Fe, New Mexico 87505

Subject: Transmittal of the Mine Ventilation Rate Monitoring Annual Report

Dear Mr. Maestas:

The Mine Ventilation Rate Monitoring Annual Report, required by the Waste Isolation Pilot Plant Hazardous Waste Facility Permit No. NM4890139088—TSDf, is enclosed. This report satisfies Permit Part 4, Section 4.6.4.2. and Permit Attachment O, Section O-5a requirements.

We certify under penalty of law that this document and enclosure were prepared under our direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on our inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of our knowledge and belief, true, accurate, and complete. We are aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

If you have questions regarding this submittal, please contact Mr. Michael R. Brown at (575) 706-0072.

Sincerely,

REINHARD KNERR
 Reinhard Knerr
 Manager
 Carlsbad Field Office

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SEAN DUNAGAN (Affiliate)
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Enclosure

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 *ED denotes electronic distribution

Mine Ventilation Rate Monitoring Annual Report

DOE/WIPP-21-3557

Revision 0

Effective: October 18, 2021



U. S. Department of Energy
Carlsbad Field Office
Carlsbad, New Mexico

This document supersedes DOE/WIPP-20-3557, Revision 1.

**Mine Ventilation Rate Monitoring Annual Report
DOE/WIPP-21-3557, Rev. 0**

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U. S. Department of Energy
Carlsbad Field Office
Carlsbad, New Mexico

Approved by: MICHAEL BROWN Digitally signed by MICHAEL BROWN
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Michael R. Brown
Director, Environmental Regulatory
Compliance Division

Date

**Mine Ventilation Rate Monitoring Annual Report
DOE/WIPP-21-3557, Rev. 0**

CHANGE HISTORY SUMMARY

REVISION NUMBER	DATE ISSUED	DESCRIPTION OF CHANGES
0	10/18/2021	• Initial issue.

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ABBREVIATIONS/ACRONYMS

Acronym	Term
acfm	actual cubic feet per minute
HWFP	Hazardous Waste Facility Permit
IVS	Interim Ventilation System
MVRMP	Mine Ventilation Rate Monitoring Plan
Permit	Waste Isolation Pilot Plant Hazardous Waste Facility Permit
QA	Quality Assurance
QAPD	Quality Assurance Program Description
scfm	standard cubic feet per minute
SVS	Supplemental Ventilation System
U/G	underground
UVFS	Underground Ventilation Filtration System
UVS	Underground Ventilation System
WIPP	Waste Isolation Pilot Plant

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EXECUTIVE SUMMARY

The Waste Isolation Pilot Plant (WIPP) Hazardous Waste Facility Permit (Permit), Permit Number NM4890139088-TSDF, Part 4, Section 4.6.4.1, requires the WIPP facility Permittees to implement the WIPP Mine Ventilation Rate Monitoring Plan (MVRMP) described in Permit Attachment O. Permit Part 4, Section 4.6.4.2, requires that an annual report be submitted every October with the results of the data and analysis of the MVRMP. The objective of the MVRMP is to describe how the ventilation requirements in the Permit are met. This report describes how the objective was met and documents the process by which the Permittees demonstrated compliance with the ventilation requirements in the Permit during the reporting period. The reporting period for this MVRMP is July 1, 2020, through June 30, 2021.

The underground (U/G) repository ventilation system operated in Filtration Mode for the reporting period.

Permit Attachment O, Section O-3 describes the basic processes that make up the MVRMP:

- Test and Balance, a periodic re-verification of the satisfactory performance of the entire Underground Ventilation System (UVS) and associated components.
- Monitoring of active room(s) to ensure a minimum airflow of 35,000 standard cubic feet per minute (scfm) (42,000 actual cubic feet per minute [acfm]) whenever waste disposal is taking place and workers are present in the room.
- If an active room ventilation rate of 35,000 scfm (42,000 acfm) cannot be met, actions as described in Section O-3b(1) shall be taken during waste disposal operations when workers are present.

Results of the processes that make up the MVRMP are as follows:

- Waste emplacement activities continued through the reporting period. The monthly minimum active room ventilation readings are recorded in Table 2, *Summary of Active Disposal Room Ventilation Flow Rate Monitoring Data*. The lowest active room ventilation rate for the reporting period was 42,330 acfm (35,275 scfm) occurring in June 2021.
- The active room ventilation rate of 35,000 scfm (42,000 acfm) was met for all waste emplacement evolutions for this reporting period; therefore, actions as described in Section O-3b(1) were not implemented.

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1.0 INTRODUCTION

Permit Attachment O is the MVRMP. The MVRMP contains the methods and procedures for documenting compliance with the ventilation requirements identified in Permit Part 4, Section 4.5.3.2.

Permit Part 4, Section 4.6.4.2 specifies that an annual report, which describes the implementation of the MVRMP and presents the results of the monitoring activities, be submitted to the Secretary of the New Mexico Environment Department every October. This document fulfills the annual reporting requirement for the period from July 1, 2020, through June 30, 2021.

The Underground Ventilation Filtration System (UVFS) consists of operating one of three 860 fans and the associated filtration system. The Interim Ventilation System (IVS) consists of two 960 fans and the associated filtration systems. When operating, the IVS may use one or both fans. The Supplemental Ventilation System (SVS) consists of a U/G booster fan. When operating, the SVS can exhaust a nominal 40,000 scfm of uncontaminated air up the Salt Handling Shaft while the remainder of the mine exhaust air is routed up the Exhaust Shaft and through the filtration system.

The U/G repository ventilation system operated in Filtration Mode for the reporting period. The filtration system is capable of exhausting air at a rate of 106,000 scfm. When the SVS is operating, a nominal 40,000 scfm of unfiltered exhaust air from the North and Construction Ventilation Circuits is exhausted to the surface through the Salt Handling Shaft. With the SVS in operation, the total exhaust from the U/G is nominally 146,000 scfm.

The Filtration Mode airflow quantity is compatible with the capacity of the available high-efficiency particulate air filter units. With the UVFS, IVS, and SVS in operation, four different levels of Filtration Mode ventilation provide four different airflow quantities:

- Minimum Filtration Ventilation: Filtration fans (two 960 fans or one 860 fan) operating to provide 46,000 or 60,000 scfm nominal filtered flow.
- Intermediate Filtration Ventilation: Filtration fans (one 860 fan and one 960 fan) operating to provide 83,000 scfm nominal filtered flow.
- Maximum Filtration Ventilation: Filtration fans (one 860 fan and two 960 fans) operating to provide 106,000 scfm nominal filtered flow.
- SVS Ventilation: The SVS fan will not operate unless the UVFS is operating in the Maximum Filtration Ventilation Mode. This SVS fan provides the majority of the intake air for the U/G in SVS mode. Additionally, when in the SVS mode, a nominal 40,000 scfm of uncontaminated air is exhausted unfiltered through the Salt Handling Shaft. In SVS mode the U/G exhaust airflow is nominally 146,000 scfm (106,000 scfm filtered and 40,000 scfm unfiltered).

Waste emplacement occurs during the Maximum Filtration Ventilation Mode or the SVS Ventilation Mode.

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The following sections describe the procedures that make up the MVRMP (Section 1.0), the results of the MVRMP monitoring (Section 2.0), and the Quality Assurance (QA) requirements (Section 3.0) associated with the MVRMP for the reporting period. The results of the MVRMP data analysis are contained in Section 4.0.

1.1 Ventilation Rate Monitoring in the Active Disposal Room

Ventilation rate monitoring in the active disposal room is performed to demonstrate compliance with Permit Part 4, Section 4.5.3.2, and Attachment A2, Section A2-2a(3). The Permit requires a minimum of 35,000 scfm (42,000 acfm) of airflow through each active room when waste disposal is taking place and workers are present in the room. Permit Attachment O, Section O-1, states that when using a conservative conversion factor of 1.2, that 35,000 scfm is very nearly 42,000 acfm ($1.2 \times 35,000 \text{ scfm} = 42,000 \text{ acfm}$). Permit Part 4, Section 4.6.4.3., requires compliance to be evaluated monthly for the active disposal room.

A full-entry traverse using a calibrated anemometer, as described in McPherson (1993), *Subsurface Ventilation and Environmental Engineering*, is the standard method for measurement of airflow in the active waste disposal room. Airflow measurements are collected at an established location near the entrance of each active disposal room. The location is chosen by the operator to minimize airflow disturbances caused by system intersections and corners in accordance with McPherson (1993). The readings are used to verify that a minimum 35,000 scfm (42,000 acfm) ventilation flow rate has been achieved through the active room prior to waste disposal taking place with workers present in the room. Multiple measurements are taken at each field location to ensure accurate results, and correlated within 10 percent for acceptability. Data are collected, recorded, and verified by qualified operators. Additionally, the operator verifies proper ventilation flow rates any time there is an operational mode change or change in the U/G ventilation system configuration that could affect the active room ventilation flow rate. A momentary reduction in U/G ventilation caused by the realignment or switching of U/G ventilation fans is not an operational mode change and does not require verification of airflow in the active disposal room.

Once the ventilation flow rate is verified, the operator records the measured acfm value on the Underground Active Disposal Room and Regulator 74-B-308 Ventilation Log Sheet. The operator compares the recorded acfm value with the minimum required acfm value provided at the top of the log sheet. As described in Permit Attachment O, 42,000 acfm is the minimum value needed to ensure that the 35,000 scfm minimum requirement is met. The operator checks and records the airflow through the active room during the shift whenever there is an operational mode change or a change in system configuration that could affect the active room ventilation flow rate. If the required ventilation rate is not achieved or cannot be supported due to operational needs, the Permittees will either restrict access to the room or take measures as described in Permit Attachment O, Section O-3b(1).

1.2 Test and Balance

The Test and Balance is a comprehensive series of measurements and adjustments designed to ensure that the U/G ventilation system is operating within acceptable design parameters. The Test and Balance is an appropriate method of verifying U/G ventilation system flow because it provides consistent results based on good engineering practices. In accordance with Permit Attachment O, Section O-3a(2), the Test and Balance is conducted on a 12- to 18-month interval, but in no case shall the interval between consecutive Test and Balance performances exceed 18 months.

Once completed, the Test and Balance data become the baseline for U/G ventilation system operations until the next Test and Balance is performed. Test and Balance results are used to accommodate varying operational conditions in the U/G.

The Test and Balance interval is sufficient to account for changes in the mine configuration and to verify system performance. Minor system modifications that occur between tests produce small changes to the ventilation system resistance in comparison to the overall ventilation system resistance. Historic data indicate airflow changes can be attributed to additional or reduced linear feet of mined passage (i.e., mining new entries, closure of formerly ventilated portions of the mine, or reduction in drift size due to salt creep).

The most recent Test and Balance of the mine ventilation system was performed in July 2020. A summary of the results of the July 2020 Test and Balance is presented in Table 1 - Ventilation Operating Modes and Associated Flow Rates, in accordance with Permit Attachment O, Section O-5a. Correlated results compare predicted values against measured values expressed as a percentage (e.g. the model is 4.2% accurate for airflow). The next Test and Balance is scheduled to be performed in October 2021.

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Table 1 – Ventilation Operating Modes and Associated Flow Rates

Mode of Operation	Flow Rate (scfm) – Nominal Values	Test and Balance Summary (% difference) (July 2020)
Normal (two main** fans) [not in use]	425,000	N/A*
Alternate (one main** fan) [not in use]	260,000	N/A*
Maintenance Bypass parallel operation of main** fan(s) and filtration*** fan(s) [not in use]	260,000 to 425,000	N/A*
Reduced (two filtration***) [not in use]	120,000	N/A*
Minimum (one filtration fan or one IVS fan)	60,000	N/A*
Filtration (one filtration fan or one IVS fan***)	60,000 or 23,000	8.4
Filtration (one filtration and one IVS fan or two IVS fans***)	83,000 or 46,000	7.0
Filtration (one filtration fan and two IVS fans***)	106,000	5.1
Filtration & Upcast (one filtration fan, two IVS fans***, and SVS fan)	146,000	4.2

* Note: Testing and balancing of this mode of operation was not performed during the July 2020 Test and Balance because it was not in use during the reporting period.

** Note: The main fans are also referred to as the 700 fans. The use of these fans is controlled by WIPP Operations; the Hazardous Waste Facility Permit (HWFP) does not restrict the use of these fans.

*** Note: The filtration fans are also referred to as the 860 fans; the IVS fans are also referred to as the 960 fans.

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2.0 MINE VENTILATION RATE MONITORING RESULTS

This section presents the data from implementation of the MVRMP for the reporting period. The data presented were collected in accordance with Permit Attachment O.

Table 2 provides a summary of the minimum measured flow rate by month for the active disposal room during waste disposal operations when workers were present. All additional measured active disposal room flow rates are above the minimum measured flow rate shown in Table 2.

Table 2 – Summary of Active Disposal Room Ventilation Flow Rate Monitoring Data

Month/Year	Active Disposal Room Ventilation Flow Data Minimum Value* (acfm)	Active Disposal Room Ventilation Flow Data Minimum Value* (scfm)
Jul. 20	47,304	39,420
Aug. 20	52,340	43,617
Sep. 20	45,450	37,875
Oct. 20	46,462	38,718
Nov. 20	49,247	41,039
Dec. 20	44,550	37,125
Jan. 21	44,496	37,080
Feb. 21	49,486	41,238
Mar. 21	0**	0**
Apr. 21	44,496	37,080
May 21	44,187	36,822
Jun. 21	42,330	35,275

* Minimum Value is the minimum flow rate recorded during the month for the active disposal room during waste disposal operations when workers are present.

**No waste disposal occurred during planned Site maintenance activities.

2.1 Active Disposal Room Ventilation Rate

Transuranic mixed waste handling activities continued throughout the reporting period. Table 1 provides the measured monthly minimum flow rate for an active disposal room during waste disposal operations when workers were present for the reporting period.

An active room ventilation rate of 35,000 scfm (42,000 acfm) was consistently maintained during the reporting period; therefore, actions described in Permit Attachment O, Section O-3b(1), were not required to be taken.

2.2 Test and Balance

The most recent Test and Balance of the mine ventilation system was performed July 19 - 23, 2020. The results of the Test and Balance are provided in Table 1 under the *Test and Balance Summary* column. The results show the average percent difference of the model generated flows relative to the measured flows, ranging from 4.2 to 8.4%. A percent difference of around 5% is considered good. The results indicate it is more difficult to achieve lower percent differences when the total flow is reduced (e.g., Filtration [one filtration fan or one IVS fan]) due to the difficulty in obtaining accuracy in U/G flow measurements when the flow and air velocity are lower. The next Test and Balance is due no later than January 23, 2022, in accordance with Permit Attachment O, Section O-3a(2). The next Test and Balance is scheduled for October 2021.

3.0 QUALITY ASSURANCE PROGRAM

This section describes the Quality Assurance Program as it relates to the MVRMP.

3.1 Description of Mine Ventilation Rate Monitoring Quality Assurance Program

Quality Assurance associated with the MVRMP consists of several elements and shall comply with the requirements of the Nuclear Waste Partnership LLC Quality Assurance Program Description, WP 13-1 (QAPD). The qualifications of personnel conducting ventilation flow measurements are maintained through a training qualification process. The ventilation simulation software program is controlled in accordance with the QAPD and the computer software QA plans.

Data generated by the MVRMP, as well as records and procedures to support the MVRMP, are maintained and managed in accordance with the QAPD. Nonconformance or conditions adverse to quality are addressed and corrected in accordance with applicable QA procedures.

Instrumentation used to implement the MVRMP is of known precision and accuracy. The information regarding precision and accuracy is recorded in the instrumentation calibration documentation.

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4.0 SUMMARY OF MINE VENTILATION RATE MONITORING

Mine ventilation rate monitoring of the U/G repository and active disposal rooms is conducted at predetermined frequencies. The following is an analysis of the data from this program:

- A Test and Balance of the UVS incorporating the SVS was conducted in July 2020. The next Test and Balance is scheduled for October 2021.
- The monthly minimum active room ventilation readings are recorded in Table 2. The lowest monthly minimum active room ventilation rate of 42,330 acfm (35,275 scfm) occurred in June 2021.
- The active room ventilation rate of 35,000 scfm (42,000 acfm) was met for all waste emplacement evolutions for this reporting period; therefore, actions as described in Section O-3b(1) were not implemented.

5.0 REFERENCES

DOCUMENT NUMBER AND TITLE
Waste Isolation Pilot Plant Hazardous Waste Facility Permit, EPA Identification No. NM4890139088-TSDF
McPherson, Malcolm J., 1993, Subsurface Ventilation and Environmental Engineering, Chapman & Hall, London, First Edition