



Department of Energy

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MAY 16 2000



Mr. Steve Zappe, WIPP Project Leader
Hazardous Waste Permits Program
Hazardous and Radioactive Materials Bureau
New Mexico Environment Department
2044-A Galisteo Street
Santa Fe, New Mexico 87505

Re: Response to a Request for Supplemental Information-Technical Adequacy Review of the WIPP Mine Ventilation Rate Monitoring Plan, EPA ID No. 4890139088

Dear Mr. Zappe:

The purpose of this letter is to submit the proposed WIPP Ventilation Rate Monitoring Plan in accordance with the WIPP Hazardous Waste Permit conditions I.J. and IV.J. On April 17, 2000, the U. S. Department of Energy, Carlsbad Area Office (CAO) received a request from the New Mexico Environment Department requesting that CAO provide supplemental information to the Mine Ventilation Rate Plan. This was in response to CAO's request on this subject, submitted to NMED November 9, 1999.

Our response is submitted as two attachments to aid in your review of amendments made. In Attachment 1, we have separately addressed each of your comments; please note that in many instances, NMED's comments have been summarized or paraphrased to shorten the length of this response. The revised WIPP Mine Ventilation Rate Monitoring Plan is provided as Attachment 2 where our responses to NMED's requests are incorporated.

If you have any questions regarding the revisions made or any of the responses to your comments, please contact Mr. Jody Plum at (505) 234-7462 or Mr. Robert Kehrman at (505) 234-7210.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision according to a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my 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 my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.



Mr. Steve Zappe

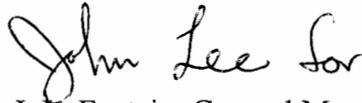
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Please contact Mr. Jody Plum at (505) 234-7462 if you have any questions regarding this data transmittal.

Sincerely,



Dr. Inés R. Triay, CAO Manager
U. S. Department of Energy



J. L. Epstein, General Manager
Westinghouse Waste Isolation Division

Enclosure

cc w/enclosure:

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ATTACHMENT 1

**Specific Responses
to
Comments**

Comment 1. Requests that the Permittees remove the added qualification "and actively emplacing wastes" as a condition for maintaining a minimum of 35,000 standard cubic feet per minute (scfm) of air flow through the active disposal room when workers are present. Comment one also requested that any language that implies that the only time that the facility must maintaining a minimum of 35,000 (scfm) of air flow through the active disposal room is when workers are present and the facility is in "Waste Disposal Mode."

Response: These qualifications and statements have been removed from the plan. Section Q-1 *Definitions*, Section Q-2, *Objectives of the Monitoring Plan*, and Section Q-4, *Design of the Monitoring Plan*, state that the Permittees will maintain a minimum of 35,000 scfm (42,000 acfm) of air through the active disposal room when workers are present in the room. The plan also defines a worker in the Section Q-1. This definition states: "It is the intent of this Plan to include all personnel and members of the public in the definition of worker as it applies to IV.E.3.b."

Comment 2. Requests that the Permittees provide additional explanation of the monitoring to be performed to demonstrate compliance with the active room ventilation requirements of Permit Condition IV.E.3.b., during the days when waste emplacement operations are not planned.

Response: Section Q-5b, *Monitoring and Calculation of the Active Waste Disposal Room Flow*, describes how the Permittees monitor the underground airflow at the near entrance to the active disposal waste room. The standard method for measurement of air flow is the use of a calibrated anemometer and full entry traverse, as described in McPherson (1993). Air flow measurements will be collected at an appropriate location near the entrance of each active disposal room. This location will be chosen by the operator to minimize airflow disturbances caused by system intersections and corners in accordance with McPherson (1993). These readings will verify a minimum of 35,000 scfm ventilation flow through the active disposal room(s). Multiple measurements are taken at each field location to assure accurate results. Field values must correlate within 10% to be acceptable. Data are collected and recorded by qualified operators, and the data verified. The facility operator will verify the minimum required ventilation at the start of each shift, any time there is an operational mode change, or if there are changes in the systems configuration that could affect the ventilation system.

Comment 3. Stated that a monthly evaluation, as required by Permit Condition IV.F.3.c., for the active disposal room airflow rate specified in Permit Condition IV.F.3.b., is not specifically acknowledged in the Plan, and concluded that the plan was incomplete.

Response: Section Q-7b, *Verification of Daily and Monthly Active Disposal Room Ventilation Data*, and Section Q-8, *Reporting and Recordkeeping*, address how both daily and monthly data verifications are made for the active disposal room. Section Q-7b states: "The Permittees evaluate compliance with the minimum active ventilation rate specified in Permit condition IV.E.3.b. on a monthly basis. The facility operator will verify that proper ventilation at the start of each shift, any time there is an operational mode change, or if there is a change in the systems configuration that could affect the ventilation system. The operator records the acfm value on the log sheet. The operator shall recheck and record the airflow through the active room during the

shift whenever there is an operational mode change, or if there is a change in the systems configuration that could affect the ventilation system. Once the ventilation rate has been recorded and verified to be at least 35,000 scfm, personnel access to the room is unrestricted in accordance with normal WIPP underground operations procedures. If the required ventilation rate cannot be achieved, or cannot be supported due to operational needs, access to the room is restricted. Those periods when active disposal room access is restricted are documented on the log sheet.

This information is summarized from the Active Disposal Room Ventilation Rate Log Sheet described in Section Q-5b of the Plan. The Permittees will evaluate compliance with the minimum active room ventilation rate specified in the permit Condition IV.E.3.b. on a monthly basis. Whenever the evaluation of the mine ventilation monitoring program data identifies that the ventilation rates specified in Permit condition IV.E.3.b have not been achieved, the Permittees shall notify the Secretary in writing within five (5) working days."

Comment 4. This comment stated that the exact nature and extent of the Test and Balance was unclear, nor was it clear how data generated from this test was used to evaluate monitoring data obtained from other sources such as the fan run time logs, pre-operational disposal area inspections and quarterly flow verification checks. The comment requested clarification about how Test and Balance data is used to evaluate monitoring plan data. The comment also requested clarification if Test and Balance data will be included in the annual report.

Response: The Permittees revised the Plan to clarify the nature, purpose, and scope of the Test and Balance and describes how the Test and Balance is used to establish total mine ventilation flow rates for the specific Modes of Operation. Section Q-4, *Design of the Monitoring Plan*, addresses how the Test and Balance is one of the four basic elements in the monitoring plan, and is used as "a periodic re-verification of the satisfactory performance of the entire underground ventilation system and associated components".

Section Q-4b, *Test and Balance*, specifically addresses the engineering theory underlying the Test and Balance, the methodology used to take field measurements, reduce data, and ultimately re-establish the baseline configuration of the ventilation system. The Test and Balance is a comprehensive series of measurements and adjustments designed to assure that the system is operating within acceptable design parameters, and is the appropriate method of verifying system flow because it provides consistent results based on good engineering practices. Once completed, the Test and Balance data become the baseline for underground ventilation system operation until the next Test and Balance is performed.

Section Q-4b addresses how the Test and Balance focuses on the active disposal room so the Waste Disposal Circuit can be adjusted to assure that a minimum airflow of 35,000 scfm is achieved. Section Q-4b also addresses the periodicity of the Test and Balance, and justifies the appropriateness of that periodicity. Section Q-7a, *Evaluation of Monthly and Annual Average Total Mine Flow Data*, presents the various Modes of Operation and the associated nominal flow rates, which are used to evaluate the monthly and annual running average. This data is then included in the annual report in accordance with Permit Condition IV.F.2.b.

Comment 5. This comment stated that airflow measurements in the active disposal room will be part of pre-operational disposal inspections that will apparently be performed daily before the start of disposal operations, if such operations are to be conducted that day. The comment stated that the pre-operational inspection is not defined in the plan, and requested that the frequency of active room ventilation rate monitoring be explicitly defined in the Plan.

Response: Pre-operational disposal inspections, including verification of permit required ventilation, are still completed prior to beginning waste disposal in accordance with WIPP Waste Management Procedures. However, the Plan has been revised to delete reference to these pre-operational inspections, and defines the frequency of active room ventilation rate monitoring in Sections Q-4d *Active Disposal Room Airflow Monitoring Schedule*, and Q-5b, *Monitoring and Calculation of the Active Waste Disposal Room Flow*. These sections document that the Permittees will monitor the airflow through the Active Disposal Room(s) to verify proper ventilation at the start of each shift, any time there is an operational mode change, or if there is a change in the systems configuration that could affect the ventilation system.

Comment 6. This comment requested clarification regarding the type of equipment is used to measure airflow in the Active Disposal Room, and requested clarification regarding what procedure is to be used in measuring the airflow.

Response: Section Q-5b, *Monitoring and Calculation of the Active Waste Disposal Room Flow*, states that an anemometer and a series of full entry traverses are used to measure airflow in the active disposal room. The specific methodology for this measurement is provided in McPherson (1993). The plan also states that this is the same method used to measure airflow in the Test and Balance as described in Q.D.2., *Test and Balance*. The plan summarized how the measured value is adjusted to account for changes between standardized airflow (scfm) and actual airflow (acfm), and to compensate for instrumentation and measurement methodology inaccuracies.

Section Q-6, *Equipment Calibration and Maintenance*, and Table Q-1 provides a summary of the type of equipment used to conduct the Test and Balance, Active Disposal Room Measurements, and Quarterly Flow Verification Checks.

Comment 7. This comment states that the quarterly flow verification check procedure, the location(s) where the flow check will be performed, data evaluation, recordkeeping and reporting are not explained in the Plan. This comment also requests that the Plan be revised to include this information.

Response: Section Q-7c, *Evaluation of Data for Quarterly Flow Verification Check*, states that data generated from the Quarterly Flow Verification Check will be evaluated in accordance with Table D-1 of Attachment D of the permit. Table D-1 establishes identifies the procedure, data sheet, and verification criteria for conducting quarterly flow verification checks at the site. Because Attachment Q is a permit attachment and not a stand alone document, the Permittees referenced the detailed quarterly flow measurement criteria contained in Attachment D.

Comment 8. Stated that the requirements of Permit Condition IV.F.3 were partially incorporated into the Plan, and requested that the Plan be revised to fully incorporate the requirements of Permit Condition IV.F.3.

Response: A brief summary of requirements of Permit Condition IV.F.3. include a requirement to implement the Plan within thirty (30) calendar days of approval by the Secretary; a requirement to describe the implementation and present the results of the data and analysis of the Plan in the Annual Report to the Secretary; and the requirement to calculate the running annual average mine ventilation exhaust rate on a monthly basis and evaluate compliance with the minimum active disposal room ventilation rate on a monthly basis. This section also requires the Permittees to notify the Secretary within five (5) working days if the ventilation rates specified in Permit Condition IV.E.3.b. have not been achieved.

Compliance with the requirements of IV.F.3.a, of the Permit can be found in Section Q-3, *Plan Implementation And Approval*. This section documents that the Permittees will implement this plan within 30 days of approval by the Secretary, and maintain the plan until certified closure of all Underground Hazardous Waste Disposal Units (HWDUs). Section Q-8, *Reporting and Recordkeeping*, documents that as a part of the annual report to the Secretary required under Permit Condition IV.F.2.b., the Permittees will describe the implementation and present the results of the data and analysis of the Mine Ventilation Rate Monitoring Plan. In accordance with these requirements, the Permittees will submit to the Secretary an annual report, beginning twelve (12) months after issuance of the permit, October 27, 1999. In the years that the Test and Balance is performed, the Permittees will also provide the results in the Annual Report.

Compliance with the requirements of IV.F.3.c, of the Permit can be found in Section Section Q-5a, *Monitoring and Calculation of Monthly and Annual Ventilation Rate for Total Mine Flow*, and Section Q-5b, *Monitoring and Calculation of the Active Waste Disposal Room Flow*, describe the methodologies, monitoring frequencies, and documentation processes to calculate total mine exhaust flow and verify required ventilation flow in the active disposal room when workers are present.

Section Q-8, *Reporting and Recordkeeping*, documents compliance with the requirements of Permit Condition IV.E.3.b. This section documents that the Permittees will notify the Secretary within five (5) working days if the ventilation rates specified in Permit Condition IV.E.3.b., are not achieved.

Comment 9. Please correct the deficiencies noted in Comments 1-8 and 10-13, and submit a modified plan within thirty (30) calendar days from receipt of these comments.

Response: The U.S. Department of Energy, Carlsbad Area Office received your comments on April 17, 2000. The attached revised plan addresses the deficiencies outlined in your comments and has been submitted within 30 calendar days of receiving your comments.

Comment 10. The Plan states that the Permittees will implement the plan "...30 days after approval..." This is a minor difference, and not a significant concern. The daily monitoring data (fan run time and pre-operational disposal room readings) are apparently already being routinely collected. There seems to be no reason to neglect the data already collected since Permit issuance, especially the active disposal room air flow measurements. In order to maximize the data available for demonstrating compliance with the Permit Conditions, the Permittees may use data collected from the effective date of the Permit (November 26, 1999). This early monitoring data collection start date is not required, but the Plan must be implemented no later than 30 calendar days following the date of Plan approval. Please specify the Permit issuance date as the starting date for data collection, or provide an explanation for waiting for Plan approval.

Response: Section Q-3, *Plan Implementation and Approval*, states that Permittees will implement this plan within 30 days of approval by the Secretary, and maintain the plan until certified closure of all Underground Hazardous Waste Disposal Units (HWDUs). Since the effective date of the permit, November 26, 1999, the Permittees have calculated the monthly ventilation rate for total mine flow. As described in Section Q-8, *Reporting and Recordkeeping*, that data is maintained as an operating record by Facility Operations. Similarly, monthly verification checks have been maintained in accordance with the requirements of Attachment D, and those operating records are maintained by Maintenance Operations. Because the Permittees proposed in the November 2, 1999, Ventilation Rate Monitoring Plan to only monitor active disposal room ventilation flow rates when wastes were actively being emplaced, the Permittees have not collected active disposal room ventilation data. In accordance with Permit Condition IV.F.3.a., the Permittees will implement active disposal room monitoring within thirty (30) calendar day of approval of the plan by the Secretary. This will allow the Permittees adequate time to modify procedures and qualify personnel to effectively implement this requirement.

Comment 11. Required Reports and Notification section of the proposed plan does not clarify whether any of the details of ventilation rate monitoring activities (implementation) will be provided in the annual reports, or which data and analyses will be reported. The absence of specifications may lead to future misunderstanding as to the expected content of future reports. Please revise the Plan to indicate whether the annual report will include descriptions of implementation, data and evaluation from all four types of ventilation rate monitoring.

Response: As provided in Section Q-8, *Reporting and Recordkeeping*, in the annual report to the Secretary required under Permit Condition IV.F.2.b., the Permittees will describe the implementation and present the results of the data and analysis of the Mine Ventilation Rate Monitoring Plan. In accordance with these requirements, the Permittees will submit to the Secretary an annual report, beginning twelve (12) months after issuance of the permit, October 27, 1999. In the years that the Test and Balance is performed, the Permittees will also provide the results in the Annual Report.

Comment 12. The Plan does not explain that the annual ventilation monitoring report will be part of the air monitoring report required by Permit Condition IV.F.2.b. Please revise the Plan to explicitly include the requirements of Permit Condition IV.F.3.b.

Response: As described in the response to comment 11, the plan has been revised in Section Q-8 to assure that the annual ventilation monitoring report required under Permit Condition IV.F.3.b., will be included as a part of the annual report to the Secretary required by Permit Condition IV.F.2.b.

Comment 13. As noted in Comment 3, the Plan does not acknowledge the requirement to evaluate compliance with the minimum active room ventilation rate on a monthly basis. Since the Plan apparently includes daily airflow measurement in active disposal room(s), using calibrated instrumentation, as well as additional quarterly verification flow checks and less frequent Test and Balance assessments, there should be no need for additional monitoring efforts. However, it is not yet clear whether the quarterly checks and the Test and Balance will include any measurements in active rooms, or if the data from these monitoring activities will be compared with the pre-operational inspection measurements, or the fan run time data. Please revise the Plan to include monthly evaluation of compliance with the minimum active room ventilation rate requirement, and an explanation of how this evaluation will be performed.

Response: As noted in the response to Comment 3, the Permittees will evaluate compliance with the minimum active ventilation rate specified in Permit condition IV.E.3.b. on a monthly basis. The facility operator will verify that proper ventilation at the start of each shift, any time there is an operational mode change, or if there is a change in the systems configuration that could affect the ventilation system. The response to Comment 4, Section Q-4b specifically addresses how the Test and Balance focuses on the Waste Disposal Circuit, in particular the active disposal room, to assure that a minimum airflow of 35,000 scfm is achieved. Section Q-4b(1) also addresses the periodicity of the Test and Balance, and justifies the appropriateness of that periodicity. Section Q-7a, *Evaluation of Monthly and Annual Average Total Mine Flow Data*, presents the various Modes of Operation and the associated nominal flow rates, which are used to evaluate the monthly and annual running average.

ATTACHMENT 2

WIPP Mine Ventilation Rate Monitoring Plan

WIPP MINE VENTILATION RATE MONITORING PLAN
Attachment Q

Q-1 DEFINITIONS

Consistent with their use in the Permit, the following terms are defined:

- Actual cubic feet per minute (acfm) compared to standard cubic feet per minute (scfm): The Active Disposal Room Ventilation Rate Log Sheet used to document ventilation flow rates is in acfm. The acfm reading is used because the vane anemometer measures actual air velocity. The top of the log sheet provides the minimum acfm flow needed to verify that there is 35,000 scfm in the active disposal room. The acfm to scfm conversion is needed to account for psychrometric changes in the air between sea level and the WIPP repository horizon. A 10% contingency is included in the converted value to account for accuracy of the instrumentation and sampling methodology. Based on these conversion calculations, and the addition of an additional 10% contingency, the acfm calculation must be at least 42,000 acfm to achieve the minimum 35,000 scfm flow rate required in the active disposal room(s). This conversion number allows the underground engineer to quickly determine if adequate flow is available in the room.
- Restricted Access: If the required ventilation rate cannot be achieved, or cannot be supported due to operational needs, access to the room is restricted. If access is restricted workers will not be allowed in the active disposal room until the minimum ventilation rate has been verified. Access can be restricted in a number of ways. Barriers, sign and postings, or the posting of an individual(s) to restrict access are all appropriate methods for restricting access to the active disposal room when ventilation rates are below 35,000 scfm. Those periods when active disposal room access are restricted are documented on the log sheet.
- Shift: Those work shifts when there is normal access to the WIPP underground.
- Worker: It is the intent of this Plan to include all personnel, including members of the public in the definition of worker as it applies to IV.E.3.b.

Q-2 OBJECTIVE OF THE MONITORING PLAN

The objective of this plan is to document the process by which the Permittees demonstrate compliance with the following ventilation requirements described in Module IV. E.3.b., and Attachment M2-2a(3):

- Maintain an annual running average of 260,000 standard cubic feet of air per minute (scfm) through the underground repository.
- Maintain a minimum of 35,000 scfm (42,000 acfm) of air through the active disposal room when workers are present in the room.

In accordance with Module IV.J.2., this plan contains the following elements: Objectives of the Monitoring Plan, Plan Implementation and Approval, Design of the Monitoring Plan, Monitoring Procedures, Equipment Calibration and Maintenance, Data Evaluation, Reporting and Recordkeeping, and Quality Assurance.

Q-3 PLAN IMPLEMENTATION AND APPROVAL

The Permittees will implement this plan within 30 days of approval by the Secretary, and maintain the plan until certified closure of all Underground Hazardous Waste Disposal Units (HWDUs). When the Secretary approves the Mine Ventilation Rate Monitoring Plan, the Secretary will modify the permit in accordance with Permit Condition I.B.1.

Q-4 DESIGN OF THE MONITORING PLAN

This section of the WIPP Ventilation Rate Monitoring Plan provides an overview of the four basic processes that make up the mine ventilation rate monitoring plan. These processes are:

- Test and Balance, which serves as a periodic re-verification of the satisfactory performance of the entire underground ventilation system and associated components.
- Monitoring and calculation of the Running Annual Average of the Total Mine Airflow to assure that it exceeds the 260,000 scfm minimum requirement.
- Monitoring of active disposal room(s) to assure a minimum flow of 35,000 scfm whenever workers are present in the room.
- Quarterly flow verification of the total mine air flow.

Q-4a Ventilation System Description

The WIPP ventilation system and the underground ventilation modes of operation are described in Permit Attachment M2-2a(3).

Q-4b Test and Balance

The Permittees verify underground ventilation system performance by conducting a periodic Test and Balance. The Test and Balance is a comprehensive series of measurements and adjustments designed to assure that the system is operating within acceptable design parameters. The Test and Balance is an appropriate method of verifying system flow because it provides consistent

results based on good engineering practices. The Test and Balance is conducted on 12 to 18-month intervals.

Once completed, the Test and Balance data become the baseline for underground ventilation system operation until the next Test and Balance is performed. Test and Balance results are used by the Permittees to accommodate varying operational conditions and to provide adequate airflow in the mine.

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

The "Test" portion of the process involves measuring the pressure drop and air quantity of every underground entry excluding alcoves or other dead end drifts. In addition, the tests verify resistance curves for each of the ventilation system's main regulators, measure shaft resistance, and measure main fan pressure and quantity. This is done at the highest achievable airflow to facilitate accurate measurements. From these measurements the frictional resistance of the system is determined. The testing of underground ventilation systems is described in McPherson, 1993.

Pressure is measured using the Gage-and-Tube method. This method measures the pressure drop between two points using a calibrated pressure recording device and Pitot tubes. The resistance of the shafts is measured either by calibrated barometers at the top and bottom of shafts or by the gage and tube method. Airflow is measured using a calibrated vane anemometer to take a full entry traverse between system junctions. Fan pressure is measured using a calibrated pressure recording device and Pitot tube to determine both static and velocity pressure components for various settings of the fan inlet vanes.

Multiple measurements are taken at each field location to assure accurate results. Field values must correlate within 5% to be acceptable. These data are verified during the testing process to establish that:

- The sum of air flows entering and leaving a junction is equal to zero.
- The sum of pressure drops around any closed loop is equal to zero.

Once the measurements are taken, data are used to calculate the resistance of every underground drift, as well as shafts and regulators. This is done using Atkinson's Square Law:

$$P=RQ^2$$

Where the pressure drop of an entry is equal to a resistance (R) times the square of the quantity of air flowing (Q) through the circuit.

The "Balance" portion of the process involves adjusting the settings of the system fans and regulators to achieve the desired airflow distribution in all parts of the facility for each mode of operation. Particular emphasis is given to the active disposal room in the Waste Disposal Circuit to assure that a minimum airflow of 35,000 scfm is achieved. The system's baseline settings for the current Balance are established from the previous Test and Balance. Adjustments are then made to account for changes in system resistance due to salt creep, approved system modifications, or operational changes.

The Permittees use a commercially available ventilation simulator to process Test and Balance field data. The simulator uses the Hardy-Cross Iteration Method (McPherson, 1993) to reduce field data into a balanced ventilation network, including the appropriate settings necessary to achieve proper airflow distribution for the various operating modes. These same models can also be used to project future development and evaluate system modification before they are implemented.

The Test and Balance and subsequent modeling provide the information necessary to update ventilation system operating procedures. Once procedures have been updated and the underground regulators set appropriately for any given mode of operation, the system will self balance. These procedures provide the operator sufficient flexibility to adjust system settings to accommodate varying psychrometric conditions and assure that airflow distribution is adequate to support daily operational needs.

Q-4b(1) Test and Balance Schedule

Based on changes within the WIPP mine, the Permittees will evaluate the need for and schedule another Test and Balance within 12 to 18 months of the previous Test and Balance. The Permittees will select the specific time to conduct the Test and Balance based on the following operational considerations:

- Available testing window
- Ongoing operational considerations
- Ongoing or upcoming system modification considerations
- Scheduling of testing personnel

Additional tests will be scheduled and conducted every 12 to 18 months thereafter. In no case shall the time between Test and Balance performance be greater than 18 months.

The Test and Balance process culminates in a final report which is retained in the site Engineering File Room. Within 60 days of the receipt of the final Test and Balance Report, the Permittees revise the WIPP surface and underground ventilation system procedures to incorporate any required changes to the ventilation system configuration defined in the Test and

Balance Report. The Test and Balance data are used to adjust the operating range of fan controls, waste tower pressure, auxiliary air intake tunnel regulator settings, underground regulator louver settings, and door configurations. The model data and procedure changes are used to establish normal configuration settings to achieve the desired airflow in the underground. These settings may be modified by operations personnel throughout the year to compensate for system fluctuations caused by seasonal changes in the air psychrometric properties, and meet specific operations needs. This assures that the facility is operated at the design airflow rate for each ventilation mode.

Q-4c Total Mine Airflow Monitoring Schedule

As defined in Section Q.E.1., the Permittees will monitor the Total Mine Airflow daily and whenever operating modes change, and calculate the Monthly average and the Running Annual Average to assure that there is a minimum of 260,000 scfm as required in IV.F.3.c.

Q-4d Active Disposal Room Airflow Monitoring Schedule

As defined in Section Q.E.2., the Permittees will monitor the airflow through the Active Disposal Room(s) to verify proper ventilation at the start of each shift, any time there is an operational mode change, or if there is a change in the systems configuration that could affect the ventilation system to assure that there is a minimum of 35,000 scfm flow whenever workers are present as required in IV.E.3.b., and IV.F.3.c.

Q-4e Quarterly Airflow Verification Check

The Permittees will perform a Quarterly Airflow Verification Check of the Total Mine Airflow to assure that rates established by the Test and Balance for various operational modes are accurate. These checks are required by Permit Attachment D, Table D-1, and are performed as indicated in Table D-1.

Q-5 MONITORING PROCEDURES

Q-5a Monitoring and Calculation of Monthly and Annual Ventilation Rate for Total Mine Flow

Compliance with Module IV.F.3.c., requires the Permittees to compute the running annual average mine ventilation rate on a monthly basis to assure that it meets the established value of 260,000 scfm.

The Permittees calculate this running annual average based on monthly averages using data from the Central Monitoring Room Operator's (CMRO) Log. Run-times for WIPP's various modes of operation are tabulated in the CMRO Log. For example, if the CMRO Log indicates that the ventilation system was configured for Alternate Mode (one - 600 hp fan) at 8:00 am, and that this

configuration was maintained until 11:30 am, a total of 3.5 hours of run-time would be recorded. Run times are recorded to the nearest quarter hour. The Permittees record this information each time the ventilation system configuration is changed, including periods when there is no ventilation.

Q-5b Monitoring and Calculation of the Active Waste Disposal Room Flow

The Permittees monitor the underground airflow at the entrance to the active disposal waste room to assure compliance with Module IV.E.3.b., and Attachment M.2-2a(3) , which requires a minimum of 35,000 scfm of air flow through the active waste room when workers are present. Module IV.F.3.c. requires the Permittees to assess compliance on a monthly basis for the active disposal room.

The standard method for measurement of air flow using a calibrated anemometer and full entry traverse are described in McPherson (1993). Air flow measurements will be collected at an appropriate location near the entrance of each active disposal room. This location will be chosen by the operator to minimize airflow disturbances caused by system intersections and corners in accordance with McPherson (1993). This method uses a calibrated anemometer and the completion of a full entry traverse as described in Section Q.D.2. These readings will verify a minimum of 35,000 scfm ventilation flow through the active disposal room(s). Multiple measurements are taken at each field location to assure accurate results. Field values must correlate within 10% to be acceptable. Data are collected and recorded by qualified operators, and the data is verified. The facility operator will verify that proper ventilation at the start of each shift, any time there is an operational mode change, or if there is a change in the systems configuration that could affect the ventilation system.

Once the ventilation has been verified, the operator records the acfm value on the log sheet. The operator compares the recorded acfm value with the minimum acfm value provided at the top of the Active Disposal Room Ventilation Rate Log Sheet. The actual airflow must be at least 42,000 acfm to meet the 35,000 scfm minimum requirement. The operator shall recheck and record 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 ventilation system. Once the ventilation rate has been recorded and verified to be at least 35,000 scfm, personnel access to the room is unrestricted in accordance with normal underground operating procedures. If the required ventilation rate cannot be achieved, or cannot be supported due to operational needs, access to the room is restricted. Those periods when active disposal room access is restricted are documented on the log sheet(s) for each active waste disposal room.

Q-6 EQUIPMENT CALIBRATION AND MAINTENANCE

Equipment used for the periodic Test and Balance, quarterly flow verification checks (on the main fans), and daily verification of active disposal room flow rate is calibrated in accordance with

WIPP Calibration and Control of Measurement and Data Collection Procedure, WP 10-AD3029 (see Attachment P for current version). In the event that the Test and Balance is conducted by a subcontract vendor, any equipment they provide shall be calibrated in accordance with Section Q.I. of this plan. Equipment is inspected before each use to assure that it is functioning properly and that the equipment calibration is current. Maintenance of equipment is completed by qualified individuals or by qualified off-site service vendors.

Equipment used to conduct the Test and Balance, Quarterly Flow Verification Checks on surface fans, and to measure the airflow through the active disposal room(s) are provided in Table Q-1.

Table Q-1. Mine Ventilation Rate Testing Equipment

Equipment Used to Conduct Test	Ventilation Test Performed		
	Test and Balance	A c t i v e D i s p o s a l Room(s)	Quarterly Flow Verification Check
Calibrated Anemometer	X	X	
Calibrated Differential Pressure Sensor	X		X
Pitot Tubes	X		X
Tubing	X		X
Temperature Sensing Device	X		X
Relative Humidity Sensor	X		X
Calibrated Barometers	X		X-

Q-7 DATA EVALUATION

Q-7a Evaluation of Monthly and Annual Average Total Mine Airflow Data

The Permittees will calculate the running average flow rate on a monthly basis as required in Module IV.F.3.c. After one year, the calculations that encompass the previous 12 months data become the running annual average. The operator will use the logged runtime data for various modes of operation (as described in Section Q.E.1.) multiplied by the flow-rates for the different modes presented in Table Q-2 to calculate the average monthly and annual flow rate for the facility.

Table Q2. Ventilation Operating Modes and Associated Flow Rates

Mode of Operation	Flow Rate (scfm) - Nominal Values
Normal (two 600 hp. fans)	425,000
Alternate (one 600 hp. fan)	260,000
Maintenance Bypass [parallel operation of 600 hp fan(s) and 235 hp. Fan(s)]	260,000 to 425,000
Reduced (two 235 hp. fans)	120,000
Minimum (one 235 hp. fan)	60,000
Filtration (one 235 hp. fan)	60,000

Calculation of the running average annual flow rate shall be computed monthly using the times entered in the CMRO log in accordance with the following formula:

Monthly Average Flow Rate = {(Normal Mode Run-time (hrs.) x 425,000 scfm) + [Alternate Mode Run-time (hrs.) x 260,000 scfm] + [Maintenance Bypass Run-time (hrs.) x 260,000 scfm minimum] + [(Reduced Mode Run-time (hrs.) x 120,000 scfm) + [Minimum Mode Run Time (hrs.) x 60,000 scfm] + [Filtration Mode Run-time (hrs.) x 60,000 scfm]}/ 730 Hours per month.

The annual average flow rate shall be computed using the times entered in the CMRO log by the following formula:

Annual Average Flow Rate = \sum Monthly Average for Previous 12 Months / 12*

*The average flow rate is calculated on a monthly basis as required in Module IV.F.3.c. During the first year of operation under this plan, this number will be the actual number of months of operation. Hours are calculated to the nearest 0.25 hour for this calculation. All hours are calculated from the times entered in the CMRO Log.

Q-7b Verification of Daily and Monthly Active Disposal Room Ventilation Data

The Permittees evaluate compliance with the minimum active ventilation rate specified in Permit condition IV.E.3.b. on a monthly basis. The facility operator will verify that proper ventilation at the start of each shift, any time there is an operational mode change, or if there is a change in the systems configuration that could affect the ventilation system. The operator records the acfm value on the log sheet. The operator shall recheck and record the airflow through the active room during the shift whenever there is an operational mode change, or if there is a change in the systems configuration that could affect the ventilation system. Once the ventilation rate has been

verified to be at least 35,000 scfm and recorded, personnel access to the room is unrestricted in accordance with normal WIPP underground operations procedures. If the required ventilation rate cannot be achieved, or cannot be supported due to operational needs, access to the room is restricted. Those periods when active disposal room access is restricted are documented on the log sheet. This information is summarized from the Active Disposal Room Ventilation Rate Log Sheet as described in Section Q.E.2. of this Plan. The Permittees shall evaluate compliance with the minimum active room ventilation rate specified in the permit Condition IV.E.3.b. on a monthly basis. Whenever the evaluation of the mine ventilation monitoring program data identifies that the ventilation rates specified in Permit condition IV.E.3.b have not been achieved, the Permittees shall notify the Secretary in writing within five (5) working days.

Q-7c Evaluation of Data for Quarterly Flow Verification Check

The data generated from the Quarterly Flow Verification Check will be evaluated in accordance with Table D-1 of Attachment D of the Permit.

Q-8 REPORTING AND RECORDKEEPING

As required by IV.F.3.b., as a part of the annual report to the Secretary required under Permit Condition IV.F.2.b., the Permittees shall describe the implementation and present the results of the data and analysis of the Mine Ventilation Rate Monitoring Plan. In accordance with these requirements, the Permittees will submit to the Secretary an annual report, beginning twelve (12) months after issuance of the permit, October 27, 1999. In the years that the Test and Balance is performed, the Permittees will provide the results in the Annual Report.

As required by IV.F.3.c., the Permittees shall calculate the running annual average mine ventilation exhaust rate on a monthly basis. A quarterly check of total mine flow will be performed to assure that the system is functioning as anticipated. In addition, the Permittees shall evaluate compliance with the minimum active room ventilation rate specified in the permit Condition IV.E.3.b. on a monthly basis. Whenever the evaluation of the mine ventilation monitoring program data identifies that the ventilation rates specified in Permit condition IV.E.3.b have not been achieved, the Permittees shall notify the Secretary in writing within five (5) working days.

The Permittees retain information in a number of documents that are a part of the Operating Record to implement this plan. These Operating Records include:

- The CMRO Log documents the ventilation system operating mode, and is retained as an operating record by Facility Operations.
- The underground facility flow rate readings are maintained as an operating record by Facility Operations.

- Active disposal room ventilation flow rate readings are documented on the Active Disposal Room Ventilation Rate Log Sheet, and are maintained as an operating record by Underground Operations.
- The quarterly flow verification check and associated documentation are maintained as an operating record by Maintenance Operations.

These records will be maintained at the facility for a period of three years.

Q-9 QUALITY ASSURANCE

Quality assurance associated with the Mine Ventilation Rate Monitoring Plan consists of several elements. The Permittees verify the qualification of personnel conducting ventilation flow measurements. The instrumentation used for monitoring both underground and active disposal is calibrated in accordance with the applicable provisions of the WIPP Quality Assurance Program Description (QAPD). See Attachment P for the most current version of the QAPD. The software used to calculate the monthly and annual running averages and the ventilation simulation software programs are controlled in accordance with the WIPP QAPD and WIPP computer software quality assurance plans.

Data generated by this plan, as well as records, and procedures to support this plan are maintained and managed in accordance with the WIPP QAPD. Nonconformance or conditions adverse to quality as identified in this plan will be addressed and corrected as necessary in accordance with applicable WIPP Quality Assurance Procedures.

Instrumentation used in this Plan will be of known precision and accuracy. This information will be recorded in the instrumentation calibration documentation.

Q-10 REFERENCES

**McPherson, Malcolm J. "Subsurface Ventilation and Environmental Engineering"
Chapman & Hall, London, First Edition, 1993.**

Test and Balance of the WIPP Underground Ventilation System, January 2000.

Active Disposal Room Ventilation Rate Log Sheet

