Department of Energy
Carlsbad Area Office
P. O. Box 3090
Carlsbad, New Mexico 88221

Mr. John Kieling
Hazardous Waste Permits Program Manager
Hazardous and Radioactive Materials Bureau
New Mexico Environment Department
P.O. Box 26110
Santa Fe, New Mexico 87502-6110

Subject: Transmittal of the Waste Isolation Pilot Plant (WIPP) Mine Ventilation Rate Monitoring Plan – WIPP Hazardous Waste Permit, Permit Number NM4890139088 Attachment Q

Dear Mr. Kieling:

The U. S. Department of Energy, Carlsbad Area Office and the Westinghouse Government Environmental Services Company, Waste Isolation Division submit for your review the WIPP Mine Rate Ventilation Monitoring Plan. This plan was developed in accordance with the requirements contained in WIPP hazardous waste permit module IV.J. The objective of the plan is to document the process the permittees will use to demonstrate compliance with the ventilation requirements of Module IV.E.3.b, and Attachment M2-2a(3) of the hazardous waste permit. The permit requires the permittees to maintain an annual running average of 260,000 standard cubic feet of air per minute through the underground repository. A minimum of 35,000 standard cubic feet of air per minute is required through an active disposal room when workers are present in the room and are actively emplacing waste.

In accordance with Permit Module VII.B.5, we have attached two paper copies and one 3.5" IBM compatible disk copy of the proposed Ventilation Rate Monitoring Plan. The DOE-CAO and Westinghouse Waste Isolation Division look forward to discussing the proposed plan with you and your staff

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with 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 fines and imprisonment for knowing violations.

If you have any questions regarding the plan or require any additional information, please contact Ms. Cynthia Zvonar, Acting Compliance Team Leader at (505) 234-7495.

Sincerely,

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

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

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WIPP MINE VENTILATION RATE MONITORING PLAN
Attachment Q

1.0 OBJECTIVE OF THE MONITORING PLAN

The objective of this plan is to document the process by which the Permittees will demonstrate compliance with the ventilation requirements described in Module IV E.3.b and Attachment M2-2a(3). The permit identifies a requirement to maintain an annual running average of 260,000 standard cubic feet of air per minute (scfm) through the underground repository. The permit also establishes a requirement to maintain a minimum of 35,000 actual cubic feet of air per minute through the active disposal room when workers are present in the room and actively emplacing waste.

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 Record Keeping, and Quality Assurance. The Permittees will provide the Mine Ventilation Rate Monitoring Plan to the Secretary within ninety (90) calendar day of issuance of the permit.

2.0 PLAN IMPLEMENTATION AND APPROVAL

The Permittees will implement this plan 30 days after approval of the Secretary and maintain the plan until certified closure of all Underground HWDUs. After the Permittees submit the Mine Ventilation Rate Monitoring Plan, the Secretary may approve, disapprove, or modify and approve the Mine Ventilation Rate Monitoring Plan in writing.

If the Secretary approves the Mine Ventilation Rate Monitoring Plan, the Secretary will modify the permit in accordance with Permit Condition I.B.1. In the event of disapproval (in whole or in part) of the Mine Ventilation Rate Monitoring Plan, the Secretary shall specify deficiencies in writing. The Permittees shall correct these deficiencies and modify the Mine Ventilation Rate Monitoring Plan within thirty (30) calendar days of such written notification to the Secretary for review.

3.0 DESIGN OF THE MONITORING PLAN

3.1 Ventilation System Description

Primary ventilation through the underground facility is supplied by running either one or two of three available 600 horsepower (hp) centrifugal main fans. The centrifugal fans used at WIPP are a mining industry standard design with a backward curved fan blade. This type of fan impeller has a very steeply shaped Pressure-Quantity curve

(McPherson, pg. 334). Because of the impeller design, the quantity of air through these fans experiences little fluctuation even though there may be large pressure changes. The ventilation system is designed to comply with the Mine Safety and Health Act requirements contained in 30 CFR 57.8520, Subpart G, Underground Ventilation for Metal/Non-metal Class IV mines. The ventilation system is configured to support waste emplacement, mining and other operational activities. The following operational modes are available to support these activities. During concurrent full mining and waste disposal operations, two of the 600 hp fans operate in parallel to provide 425,000 scfm (Normal Mode). The facility may operate at a reduced rate, and ventilation flows may be decreased to one 600 hp fan, resulting in airflow of 260,000 scfm (Alternate Mode). Maintenance mode provides the facility the ability to conduct necessary maintenance and/or calibration on the 235 hp filtration fans without hampering underground operations. In this mode, one or two main fans and one or two filtration fans are operated in parallel to provide a minimum of 260,000 scfm. The facility may also be ventilated with one or two - 235 hp filtration fans in by-pass mode. Two - 235 hp filtration fans operated in parallel (Reduced Mode) will provide 120,000 scfm. One - 235 hp filtration fan will provide 60,000 scfm. Waste handling or mining activities in these configurations is limited.

In the unlikely event of an underground radioactive materials release, the ventilation system is shifted to "Filtration Mode", where the airflow is reduced to 60,000 cfm. This airflow is achieved by turning off the running fans, and starting one of the 235 hp centrifugal stand-by filtration fans. A series of isolation dampers divert the air through the filtration system, which consists of a series of High Efficiency Particulate Air (HEPA) filters. Flow rates resulting from each mode of operation are described in Section 4.1.

The underground ventilation system is configured in accordance with WIPP procedures to an established operating mode to support specific underground activities. Airflow into the Disposal Area is established by adjusting the regulator that controls airflow into the Disposal Area air circuit. When workers are present in the room and actively emplacing waste, the airflow distribution through the active disposal panel is adjusted to provide a minimum of 35,000 cubic feet of air per minute in the active disposal room.

3.2 Test and Balance

The Permittees monitor underground ventilation performance by conducting a periodic ventilation system Test and Balance. Once Test and Balance data has been analyzed and modeled, the results of testing are incorporated into approved operating procedures. The procedures provide the operator the flexibility to accommodate varying operational needs and changing psychrometric conditions.

The Test and Balance involves measuring the pressure drop and quantity of every underground entry. Pressure is measured using the Gage-and-tube method which involves measuring the pressure drop between two points using a calibrated pressure recording device and pitot tubes (McPherson, pg. 193). Airflow is measured using a calibrated

anemometer to take full entry traverses between system junctions (McPherson Pg. 178) Multiple traverses are taken at each location and field correlated to assure accurate results. Field values must correlate within 10% to be acceptable. This data is verified during the testing process according to Kirchhoff's laws (McPherson, pg. 211):

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

Once the measurements are taken the data is used to calculate the resistance in every underground drift and shaft. This is done using Atkinson's square law:

$$P=RQ^2$$

Where the pressure drop (P) for an entry is equal to a resistance factor (R) times the quantity of air flowing (Q) through the entry squared (McPherson, pg. 135). In addition, the resistance curves for each of the key underground louver style regulators are tested and measured using the same relationship.

The Permittees use a commercially available ventilation simulator to process the Test and Balance field data. The simulator uses the Hardy Cross Iteration Method (McPherson, pg. 221) to reduce the field data into a balanced ventilation network. Modeling provides the necessary information to update ventilation system operating procedures.

The Test and Balance is an appropriate method for demonstrating system flow because it provides consistent results based on standard engineering practices. The periodicity of the Test and Balance is chosen so that there is little change in system performance between tests. Historic data demonstrates the total system resistance varied by less than 6% from 1994 to 1999. The total system resistance of the WIPP underground is over 8 inches water gage, the resistance from modifying the facility by mining contributes no more than 0.0083 inches of water gage per hundred feet of newly mined entry.

The Test and Balance uses calibrated, traceable instruments, to take measurements. The Test and Balance method is self-checking because the air entering an intersection must equal the air exiting the intersection, and the pressure drop around a closed loop, must add to zero. The Test and Balance demonstrates that actual system performance is accurate to within 10% of system design.

3.3 Monitoring in the Active Disposal Room

The Permittees monitor the underground airflow in the active waste room to ensure compliance with Module IV E.3.b and Attachment M2-2a(3) requirement to maintain a minimum of 35,000 cubic feet per minute of air flow through the active waste room. These requirements are applicable when workers are present in the room and actively emplacing waste.

The Permittees determine the quantity of airflow in each active room using a calibrated anemometer to adjust underground regulators, as necessary, to achieve a minimum of 35,000 cubic feet per minute ventilation flow. Once the operator confirms that the proper airflow has been established, the Waste Handling operator records this value on the Pre-operational Underground TRU Mixed Waste Disposal Area Inspection checklist. Completion and approval of this checklist is required to place the facility in Waste Handling Mode in the underground.

3.4 Monitoring Schedule

Based on changes to the facility, the Permittees will evaluate the need for, and schedule another Test and Balance, within 12 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 12-18 months thereafter. In no case shall the time between Test and Balance assessments be greater than 18 months. In addition, the Permittees conduct a quarterly flow verification check per established procedures. The results of that check are maintained as preventive maintenance records.

Monitoring in the active disposal room to support a shift to Waste Handling Mode is completed prior to transporting wastes to the underground to initiate waste disposal operations.

3.5 Monitoring Equipment

The following types of equipment may be used in conducting the Test and Balance, the Quarterly Flow Verification Check, and to measure the airflow through the active room.

Calibrated Anemometer
Calibrated Differential Pressure Sensor
Pitot Tubes
¼ inch tubing
Calibrated Stop watch
Calibrated Barometer

3.6 Configuration of the Ventilation System and Monitoring Procedures

Within 60 days of the receipt of the final Test and Balance Report, the Permittees will revise the WIPP surface and underground ventilation system procedures to incorporate any required changes to the ventilation system defined in the Test and Balance Report. This data is used, as necessary, to adjust the operating range of fan controls, waste tower pressure, auxiliary air intake tunnel regulator settings, underground regulator louver

settings, and door configurations. This assures that the facility is operated at the design airflow rate for each ventilation mode.

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 Facility Operations personnel throughout the year to compensate for system fluctuations caused by seasonal changes in the air psychrometric properties, and meet specific operations needs.

4.0 DATA EVALUATION

4.1 Evaluation of Monthly and Annual Ventilation Rate Running Averages

Compliance with Module IV E.3.b requires the Permittees to compute the running annual average mine ventilation rate to ensure that it meets the established value of 260,000 Standard Cubic Feet of Air Per Minute (scfm).

The Permittees calculate this running annual average (365 rolling days of data) using data summarized from the Central Monitoring Room (CMR) Log on a daily basis. Run-times for WIPP's various modes of operation are tabulated in minutes. For example, if the CMR Operators 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. The average flow rate is then calculated on a monthly basis as required in Module IV.E.3.b. After one year, the calculations will encompass the previous 12 months worth of data, and become a running annual average.

The Facility Operator uses the tabulated data to calculate the average flow rate for the facility. The flow rate is computed based on the following rates:

Table 1.

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

These modes of operation are verified by the performance of the Test and Balance.

4.2 Calculation of the Monthly and Annual Running Average

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

Average Flow Rate = $\sum$ [(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] + [(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)]/[(Number of Months Since Tabulation Began*) x (730 Hours per month)].

*The average flow rate is calculated on a monthly basis as required in Module IV.E.3.b. After one year, the calculations will encompass the previous 12 months worth of data, and become a running annual average. Hours are calculated to the nearest 0.25 hour for this calculation. All hours are calculated from the times entered in the Central Monitoring Room Log (CMR Log).

5.0 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 room is National Institute of Standards and Technology (NIST) traceable and is calibrated in accordance with WIPP 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.

5.1 Equipment Calibration and Equipment Maintenance

Testing equipment is calibrated in accordance with WIPP Calibration and Control of Measurement and Testing Equipment procedures. Equipment is inspected before each use to ensure that is functioning properly and has a current calibration date. Maintenance is completed at a qualified off-site equipment manufacturer's service facilities. At least one duplicate piece of test equipment will be maintained at the site to ensure that operational and calibrated equipment is available to support on-site testing.

6.0 REQUIRED REPORTS AND NOTIFICATION

The Permittees will report annually to the Secretary on the implementation of this Plan as required by Module IV.E.2b., and IV.F.3.b. In accordance with these requirements, the Permittees will submit to the Secretary an annual report, beginning twelve (12) months after issuance of this permit. The Permittees will notify the Secretary within five (5) working days if the mine ventilation rate requirements established in Module IV.F.3.c. are not met.

7.0 OPERATING RECORDS

The Permittees will retain the following information in the Operating Record relative to implementation of this plan:

The CMRO Log is the operating record that documents system operating mode configuration. The underground facility flow rate calculations are maintained as an operating record by Facility Operations. Active disposal room ventilation flow rate calculations are documented and maintained as an operating record in the Waste Operations, Pre-operational Underground TRU Mixed Waste Disposal Area Inspection checklist. Required reports and notifications are maintained as a part of the RCRA Permitting sections operating record. All required reports and notifications will be submitted to NMED pursuant to the requirements contained in Section 6.0 of this plan.

References.

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