EA Operational Awareness Record	**Report Number:** EA-WIPP-IVS/SVS-2015-11-15
Site: Waste Isolation Pilot Plant (WIPP)	**Subject:** Observations of the design and modification progress of the WIPP Underground Interim Ventilation System and Supplemental Ventilation System
Dates of Activity: 11/15/2015 – 11/19/2015	**Report Preparer:** Jeff Snook

Activity Description / Purpose:
The Office of Environment, Safety and Health Assessments within the Office of Enterprise Assessments (EA) is reviewing the design, installation, and startup of the WIPP Interim Ventilation System (IVS) and Supplemental Ventilation System (SVS). The IVS and SVS, as well as the supporting computer ventilation flow model, were evaluated with regards to the design process and not to any state or local operating permits. The IVS is a modification of the Underground Ventilation System (UVS) to allow for greater ventilation flow through high-efficiency particulate air (HEPA) filters, increasing capacity from 60,000 cubic feet per minute[1] (cfm) to 114,000 cfm by the addition of two skid mounted 27,000 cfm HEPA filter units. The SVS is a further modification of the UVS with the objective of increasing the UVS capacity to support additional WIPP recovery tasks including, mining, maintenance, and waste emplacement activities.

The purpose of EA's observation at WIPP was to monitor the progress of IVS and SVS activities and to meet with Carlsbad Field Office (CBFO), Nuclear Waste Partnership (NWP), and Mine Ventilation Services (MVS, sub-contractor to NWP) staff to discuss the design, technical basis documentation, and installation and operation plans for the IVS and SVS projects. The EA review team also toured the WIPP underground facilities. This EA observation is one in a series of periodic WIPP site visits related to monitoring of the IVS/SVS project progress.

ATTACHMENTS:
None

Result:
EA toured the WIPP underground facilities and interviewed CBFO, NWP, and MVS staff.

IVS Construction Status:
The IVS construction is progressing. The IVS acceptance testing is scheduled for March 2016.

SVS Construction Status:
The SVS project is potentially delayed approximately 9 to 12 months.

IVS/SVS Design and Operational Expectations:
NWP engineering indicated that the IVS/UVS, when operational, will be able to support waste emplacement operations (42,000 cfm at the waste face), but cannot adequately ventilate the underground north circuit (the experiments area and maintenance shop). The north circuit and W-170 entry is not ventilated through controlled airflow and is limited to air quantities and directions that result from air leakage through the bulkheads and overcasts[2] these air quantities and the direction of flow are subject to frequent change because of fluctuating aboveground air temperatures. According to NWP engineering, no activity will be permitted in the north circuit during waste emplacement. Additionally, other activities in the south circuit, such as bolting operations, will be limited to areas of the mine that can be adequately ventilated while directing sufficient airflow to the waste emplacement face. NWP engineering indicated that it is possible to conduct concurrent bolting operations and waste emplacement with the planned introduction of two hybrid roof bolters that are powered by diesel engine for tramming[3] and electricity for installing bolts. The electrical power for bolt installation eliminates the need for supplemental ventilation while installing roof bolts.

[1] NWP IVS and SVS documents conflict between scfm and acfm. EA could not determine which term was to be used, therefore cfm is used in this report.
[2] Overcast: Air bridges to permit one airway to pass over another without mixing.
[3] Tramming: Movement of equipment from one location to another.

Underground Ventilation Computer Modeling:
NWP uses a computer based flow model that predicts underground ventilation performance for IVS and SVS operating in construction (i.e., mining) mode and waste handling mode; however, NWP did not perform software validation and verification documentation for this model as required by DOE Order 414.1D, Attachment 4. Extrapolated data from this model indicate that the IVS without the SVS operational could sufficiently ventilate the waste face for limited waste emplacement operations. However, during IVS operation, the installed nonfunctional SVS fan provides a significant flow resistance that NWP has not evaluated, resulting in airflow quantities and pathways that differs from the current configuration model. NWP plans to use the existing UVS #860 exhaust fan pulling through the two existing HEPA filters (856, 857) and the new IVS HEPA filter skids. However, the current flow model does not support the performance of the IVS/UVS in this configuration (i.e. SVS fan causing an air flow restriction) even though the IVS installation is nearing completion. This is contrary to the requirements found in DOE Order 420.1C and NQA-1. Furthermore, the ability to meet the draft Technical Safety Requirement Limiting Condition for Operation 3.2.3 requirement of differential pressure less than or equal to negative 0.05 inch water gauge (wg) across the 308 Bulkhead is indeterminate. No controlled calculation has been reviewed and approved that predicts underground ventilation performance with IVS/SVS operational. In addition, the existing draft flow model does not predict UVS performance with only the IVS operational.

FINDING-WIPP-01: Contrary to the requirements in DOE Order 420.1C §V.3.c.(2), NWP has not performed a formal design analysis to serve as the basis for establishing and evaluating the IVS/UV system performance.

FINDING-WIPP-02: Contrary to DOE Order 414.1D, Attachment 4, NWP has not validated and verified the airflow modeling software used for design analysis.

Underground Walk around Observations:
During the mine tour, EA witnessed a negative 0.065 wg differential across the 308 Bulkhead. This negative differential was achieved with one UVS #860 exhaust fan pulling 60,000 cfm through the two existing HEPA filters. The Central Monitoring Room (CMR) instrumentation indicated that the #860 fan was exhausting 63,500 cfm. The exhaust flowrate from the mine is actually lower than that read in the CMR since there is an exhaust contribution of flow to the detector read in CMR from the Building 413 ventilation system. The flow detector for the CMR instrumentation is downstream of the HEPA filters in Building 413; therefore, the CMR instrumentation for the UVS #860 exhaust fan reads 3500 cfm higher than the mine exhaust flow. The Building 413 flow can be as much as 6000 cfm.

The rubber seal that is part of some underground bulkheads (e.g., 308, 313) had obvious leakage paths since the seal in some locations was lifted and was permitting bypass air leakage. Also for some bulkheads, leakage paths were apparent for some flow regulators as well. This bypass leakage is required to be factored into the draft underground ventilation model.

The SVS fan was essentially installed in drift S-90 with an associated new bulkhead. The location of the inoperable SVS fan while only using the IVS exhaust fan constitutes an additional resistance to airflow from the Air Intake Shaft. This arrangement provides a more torturous flow path to the IVS exhaust, and is required to be factored into the draft underground ventilation model.

Summary:
Construction of IVS is progressing and acceptance testing is scheduled to occur in March 2016. The SVS sub-system however has been delayed approximately 9 to 12 months. As a result of this delay, limitations are planned for work activities due to reduced air flow. NWP has not formally issued underground ventilation computer air flow modeling calculations of the IVS operating in the absence of SVS. Further, NWP has not validated and verified the flow modeling software. NWP has stated they will validate the computer model, but this validation is yet to be scheduled. EA performed a tour of the underground and observed SVS fan installation in drift S-90. Various key bulkheads and flow regulators had seals that permitted bypass leakage. It will be necessary to consider this condition when finalizing the flow model analysis.

EA Participants	References (Key Documents, Interviews, and Observations)
1. Joe Panchison 2. Pete Turcic	1. CBFO staff (Alan Jines, Hung-Cheng Chiou, James Garza) 2. NWP staff (D. K. Ploetz, Jill Farnsworth) 3. MVS staff (Keith Wallace)

Were there any items for EA follow-up? ☒ Yes ☐ No

EA Follow-up Items:

1. Review the approved underground ventilation model calculation and verify that the modeling software has been qualified as per DOE Order 414.1D, Attachment 4, requirements for WIPP software quality assurance.

2. Witness IVS modification acceptance testing.