

EA Operational Awareness Record	Report Number: OAR-EA-WIPP-IVS-2016-05-25
Site: Waste Isolation Pilot Plant (WIPP)	Subject: Operational Awareness of the Design and Modification Progress of the WIPP Underground Interim Ventilation System
Dates of Activity: 5/25-5/26/2016, 8/8-8/12/2016	Report Preparer: Jeff Snook, Joe Panchison, Pete Turcic
<p>Activity Description / Purpose</p> <p>The U.S. Department of Energy (DOE) Office of Environment, Safety and Health Assessments, within the Office of Enterprise Assessments (EA), is reviewing the design, installation, and startup of upgrades to the WIPP Underground Ventilation System (UVS). These upgrades include an Interim Ventilation System (IVS), a Supplemental Ventilation System (SVS), and a Permanent Ventilation System (PVS). The IVS is a modification intended to increase ventilation through high-efficiency particulate air (HEPA) filters, from 60,000 cubic feet per minute (cfm) to 114,000 cfm by the addition of 2 skid-mounted 27,000 cfm HEPA filter units and fans. The SVS is a further modification of the UVS, with the addition of an underground fan to provide an unfiltered ventilation circuit that will increase capacity to support additional WIPP recovery tasks, including mining, maintenance, and waste emplacement activities. The PVS is intended to increase the capacity of the UVS to a nominal 540,000 cfm.</p> <p>The IVS and SVS were originally designed to work in tandem. It was subsequently determined that the necessary ventilation for waste emplacement could be achieved without the SVS. The additional capacity provided by the SVS would enhance underground airflows and support increased support activities underground, but was not necessary for the resumption of waste emplacement operations. The IVS is proceeding on a separate track from the SVS and will be operational before the SVS is completely installed and placed into operation. Because the IVS and SVS projects are now separate projects, EA is focusing on the progress of each UVS upgrade individually.</p> <p>EA is conducting this assessment in accordance with the <i>Plan for the Office of Enterprise Assessments Activity Oversight of the Underground Ventilation Systems Projects at the Waste Isolation Pilot Plant</i>. EA evaluated Departmental and contractor development of safety significant documentation for the WIPP Underground. Acceptance and startup testing of the IVS was in the initial stages, with only the contractor readiness assessment (CRA) and Carlsbad Field Office (CBFO) line management assessment (LMA) completed. Therefore, this Operational Awareness Record (OAR) is limited to those activities. EA will continue to assess IVS operations, its interaction with SVS, and its effect on mine habitability issues.</p>	
ATTACHMENT: None	
<p>Result</p> <p>EA reviewed the design and supporting documents for the IVS, including the safety basis documents, calculations and analyses for the system, functional requirements of the IVS and components, and conditions and assumptions for system performance. Performance criteria for the system for normal and abnormal operation were also reviewed, including the appropriateness and integration of the criteria into the Documented Safety Analysis (DSA) and Technical Safety Requirements (TSR) documents. In general, the Nuclear Waste Partnership, LLC (NWP) design and installation of the IVS met the applicable requirements. In addition, EA collected and analyzed information on the CBFO oversight activities related to the review and approval processes for the implementation of the IVS, including the CRA and the CBFO LMA of the CRA. Overall, the CBFO review and approval processes for the implementation of the IVS are effective.</p> <p>IVS Design and Installation Evaluation</p> <p>EA previously issued OAR, Report Number EA-WIPP-IVS/SVS-2015-11-15, reporting on observations of the design and modification progress of the WIPP Underground IVS and the SVS. EA identified several concerns at that time, issuing two findings in the OAR. The first was that contrary to DOE Order 420.1C,</p>	

Facility Safety, Chapter V § 3.c (2), NWP had no formal design analysis serving as the basis for establishing and evaluating the IVS/UVS system performance to provide confinement ventilation when operated without being integrated with the SVS. The most significant concern focused on the performance capabilities of the IVS under various conditions of natural ventilation pressures (NVP), intended to ensure that the waste disposal circuit airflow and the airflow in the north circuits and the construction circuits were separate.

After EA raised this concern, NWP's subcontractor Mine Ventilation Services, Inc. (MVS) conducted a series of ventilation airflow model evaluations, including the IVS under various NVP conditions, and sent the results via memorandum to NWP on March 2, 2016.

Underground Ventilation Computer Modeling

The modeling of the IVS under current mine conditions without the SVS indicated that the IVS is capable of providing sufficient airflow as described. However, the NVP modeling showed that under certain conditions airflow can travel up and out of the Waste Shaft while an acceptable pressure differential is maintained, as measured at Bulkhead 308 (BH308). Airflow up the Waste Shaft would permit the release of unfiltered air from the waste shaft. Modeling also showed that uncovering the Air Intake Shaft (AIS) (a scenario that could happen inadvertently) during cold winter NVP conditions could cause low airflow in the Waste Shaft (WS) and reverse the direction of airflow, creating flow out of the mine depending on environmental temperatures. The modeling report identified 17 scenarios where the air in the WAS reversed. None of these scenarios showed air from the waste panel flow up the WS. Because of the large difference in temperatures between the Air Intake and Salt Shafts and Waste Shafts, winter NVP conditions could cause airflow reversals in the Air and Waste Shafts, creating unfiltered airflow from the mine. This modeling showed that the upcasted air in the WAS and AIS would be air coming from the Salt Shaft.

Modeling conducted and reported via memorandum by MVS, Inc., serves as supporting analyses for the safety basis design for the performance of the IVS. EA reviewed the calculation packages for each of the memoranda submitted on IVS. These calculations provided "unverified assumptions" for flow and pressure drop (to be verified through actual field measurements) for the design associated with the IVS for equipment sizing and selection. Additionally, contrary to DOE Order 414.1D, *Quality Assurance*, the software used to ensure the proper hazard analysis associated with IVS performance has not been validated and verified as required. EA previously cited this problem as a deficiency in OAR EA-WIPP-IVS/SVS-2015-11-15, the status remains unchanged.

While this modeling serves as supporting analyses for the safety basis design for the performance of the IVS, the results of the modeling are summaries contained in two memoranda, not formal calculations, and do not provide sufficient information, such as input and output results, to fully validate the calculations. Additionally, contrary to DOE Order 414.1D, *Quality Assurance*, the software used to ensure the proper hazard analysis associated with IVS performance has not been validated and verified as required. EA previously cited these problems as deficiencies in OAR EA-WIPP-IVS/SVS-2015-11-15, the status of these deficiencies remains unchanged.

IVS Acceptance Startup Testing Evaluation

EA reviewed the NWP IVS CRA activities, as well as the CBFO LMA of the contractor's performance and the CRA team performance of the readiness assessment for the WIPP IVS. The CBFO LMA concluded that the IVS CRA did not provide justification for the startup of operations under DSA Rev. 4, as required by both the Implementation Plan and the Plan of Action, but recommended IVS startup after implementation of DSA Rev. 5. The LMA also concluded that the criteria for eight of the nine Functional Areas were not met and that additional significant issues were identified that were not addressed by the CRA. On June 24, 2016, CBFO issued Contract DE-EM0001971-Nuclear Waste Partnership LLC – Contracting Officer Direction for Contractor Actions to be Conducted in Advance of a DOE Readiness Assessment of the Interim Ventilation System, directing seven actions associated with the IVS. These actions include correcting pre-start findings, conducting an Implementation Verification Review under DSA Rev. 5b for the IVS, and conducting a Management Self-Assessment to declare readiness for a DOE readiness assessment. The CBFO path forward is appropriate, and the CBFO processes for review and approval of the IVS are effective.

<p>EA Participants</p> <ol style="list-style-type: none"> 1. Joe Panchison 2. Pete Turcic 	<p>References (Key Documents, Interviews, and Observations)</p> <ol style="list-style-type: none"> 1. CBFO staff (Alan Jines, Hung-Cheng Chiou, James Garza, Randy Elmore, Wes Mouser, Josef Sobieraj, Brandon Madrid, Clayton Hollowell) 2. NWP staff (D. K. Ploetz, Jill Farnsworth) 3. MVS staff (Keith Wallace) 4. Interim Ventilation System Readiness Assessment Plan of Action, February 11, 2016 5. WIPP Interim Ventilation System Contractor Readiness Assessment (CRA) Implementation Plan, May 13, 2016 6. CRA, WIPP Interim Ventilation System Contractor Readiness Assessment, Revision Draft 7. LMA, CBFO Line Management Assessment of Waste Isolation Pilot Plant Interim Ventilation System Contractor Readiness Assessment, May – June 2016 8. Memorandum from Mine Ventilation Services, Inc. to NWP Re: IVS without SVS Description, January 8, 2016 9. Memorandum from Mine Ventilation Services, Inc. to NWP Re: Modeling UVS/IVS Fan Configuration with Various NVPs and Upset Conditions, March 2, 2016
<p>Were there any items for EA follow-up? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No</p>	
<p>EA Follow-up Items:</p> <ol style="list-style-type: none"> 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 software quality assurance. 2. Witness IVS modification acceptance testing. 3. Follow the progress of the CBFO readiness assessment. 4. Validate IVS system performance. 	