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WIPP Events and the Lasting Impact

Sean Dunagan

Sandia National Laboratoires

Abstract

In February 2014, two events occurred that will forever change the way the Waste Isolation Pilot Plant (WIPP) is operated and maintained. Following the events many difficult decisions were made and activities accomplished to allow the site to resume limited waste emplacement operations.

The path to limited operations at WIPP has been successful, giving rise to many learning opportunities along the way. As pointed out in the Accident Investigation Board reports, there were many operational deficiencies precipitating the events, some of which developed over the operational period of the facility. A growing dichotomy of cultures evolved between nuclear facility practice and conventional mining. Prior to the incidents, the focus of operations as well as contractor incentives were on rate of waste emplacement expressed in shipments processed per year. This led to production focus that often-overlooked operational maintenance of critical safety equipment. The training and oversight programs were found to be lacking as well.

The WIPP site enjoyed over a decade of incident free, productive operations. However, as was evident by the AIB reports, complacency in operations, facilities, and oversight increased over time. Following the events, DOE focused on nuclear safety to the extent that ground control activities, which are continuous underground activities necessary to keep mining drifts safe from roof and rock falls, were not given proper priority. Limited operations have now successfully resumed and continue to increase with gained efficiencies. A path to full operations has been identified and progress being made. WIPP operations expect to regain full functional capability, but will always have the reminder of lessons learned and the impact of the events from February 2014.

This presentation will discuss the events, recovery from the events, and the lasting impact of those events and decisions during the recovery process. Lessons learned from the events at the WIPP provide a valuable tool to others in the nuclear industry.

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Introduction

The Waste Isolation Pilot Plant (WIPP) had two events occur in February 2014 that will forever change the way the facility is operated and maintained.

On Wednesday, February 5, 2014, at approximately 10:45 Mountain Standard Time, an underground mine fire involving an EIMCO Haul Truck, 74-U-006B, (salt haul truck) occurred. There were 86 workers in the mine (underground) when the fire happened. All workers were evacuated, and six workers were transported to the Carlsbad Medical Center for treatment for smoke inhalation and an additional seven workers were treated on-site (DOE 2015).

An accident investigation board (AIB) was appointed to investigate the fire incident and was led by Ted Wyka. In his summary of the fire incident, Wyka presented the following as some of the contributing causes of the fire (Wyka 2014):

- Nuclear Facility vs. Mine Culture: Difference in expectations between waste handling and non -waste handling vehicles
- Operability and recognition of impaired critical safety equipment
- Ineffective training and drilling
- Unreasonable expectations and uncertain capabilities of the Facility Shift Manager (FSM) to manage all aspects of an emergency or abnormal event
- Maintenance, Emergency Management/Preparedness Programs and NWP contractor assurance system (CAS) and Carlsbad Field Office (CBFO) oversight were evaluated as ineffective.
- Inadequate Headquarters oversight

On Friday, February 14, 2014, there was an incident in the underground which resulted in release of americium and plutonium from one or more transuranic (TRU) waste containers into the mine and the environment. The release was detected by an underground continuous air monitor (CAM) and automatically all mine ventilation was directed through high-efficiency particulate air (HEPA) filter banks located in the surface exhaust building. However, a measurable portion bypassed the HEPA filters through leaks in two ventilation system dampers and was discharged directly to the environment from an exhaust duct. No personnel were determined to have received external contamination; however, 21 individuals initially tested positive on March 28, 2014 for low-level internal contamination through bioassay. Trace amounts of americium and plutonium were detected off-site (DOE 2015).

An AIB was appointed to investigate the radiological release event, also led by Ted Wyka. The summary of this AIB was captured in two reports which are both summarized in DOE (2015):

> The Radiological Event AIB identified the systemic root cause as the Los Alamos Field Office (NA-LA) and National Transuranic Program (NTP)/CBFO failure to ensure that LANL had adequately developed and implemented repackaging and treatment procedures that incorporated suitable hazard controls and included a rigorous review and approval process. NA-LA and CBFO did not ensure the adequate flow down of the Resource Conservation and Recovery Act and other upper tier requirements, including the WIPP Hazardous Waste Facility Permit, Attachment C, Waste Analysis Plan, WIPP Waste Acceptance Criteria, and the LANL Hazardous Waste Facility Permit requirements into operating procedures at LANL.

Focus of Recovery

Following the events, remedial action focused on recovery of the facility with an added emphasis on safety culture. The United States Department of Energy (US DOE) produced the Waste Isolation Pilot Plant Recovery Plan, Revision 0 (September 30, 2014), which highlighted recovery actions that were to take place, with safety as the number one priority.

As pointed out by the AIB findings (DOE 2015), the nuclear safety documentation and safety management programs (SMPs) needed revisions and revitalization. DOE has numerous nuclear facilities around the country with expertise in nuclear safety documentation and safety management programs, and those facilities were called upon to aid WIPP in the effort to correct AIB findings. DOE and the WIPP Management and Operating (M&O) contractor Nuclear Waste Partnership (NWP) spent considerable resources to improve the SMPs and nuclear safety documentation.

The recovery plan (DOE 2014) pointed to improvements and changes at the facility that would be necessary to return to operations. The facility was in a very different operational capacity than it was prior to the events. During the events, underground ventilation shifted from unfiltered to filtered mode, reducing air flow from approximately 425,000 cubic feet per minute (CFM) to 60,000 CFM. Restricted ventilation was immediately identified as an area that required attention because air flow governs what operations can occur in the underground. Management decided that filtered ventilation needed to be increased, as the repository was to remain in filtration mode following the radiological event. Two projects were identified to produce additional ventilation. One was termed the interim ventilation system (IVS)

which would add fan and filter banks to the ventilation system allowing for an increase in filtered air. The IVS was necessary to return to waste emplacement operations. An additional system, the supplemental ventilation system (SVS), was developed to produce ventilation required to return to mining in the WIPP underground. The IVS is now operating at the site and the SVS is going through readiness reviews to begin operating. These systems were neither designed nor intended to provide a long-term solution to WIPP ventilation needs. Two major construction projects (DOE capital asset projects) were proposed and started to produce a long-term solution. The different ventilation plans are explained in the recovery plan (DOE 2014).

In addition to limited ventilation, WIPP underground access was constrained due to concerns about radioactive contamination. These two limitations controlled the amount of work that could be performed. Mine stability operations, such as bolting of the host rock, were not performed for almost 9 months following the events. Before the events, rock bolting was a daily operation because bedded salt formation continues to deform into excavations.

Overall, the WIPP site had numerous processes, procedures, documents, equipment, and systems that needed significant work to address short comings that led to the events (DOE 2014).

Ground Control Issues

As noted, ground control maintenance are continuous underground activities necessary to keep mining drifts safe from roof and rock falls at the WIPP. The WIPP site is different than production mines with similar host rock, because much of the underground was mined with the intention of being open and maintained for an extended period. Ground control activities and measures are taken to maintain open areas to allow work to be safely performed. Following the events, routine ground control activities were not possible for almost 9 months. Thus, the condition of the underground deteriorated. Prior to the events, ground control at WIPP could be classified as “in maintenance mode” or “caught up.” Following the extended lapse of ground control activities, much of the WIPP underground was beyond routine maintenance and was in “catch up” mode.

The recovery plan (DOE 2014) pointed to the importance of mine stability and identified a plan to recover a stable configuration. Problems with the recovery plan included limited ventilation, ongoing issues in the underground (e.g. hoist outage, VOC concerns, radiological contamination), lessened ground control activities efficiency. Bolting necessary to maintain ground control had to proceed in an environment perceived to be contaminated, requiring new training, new procedures, and additional personnel.

Reduced ground control efficiency led to additional prohibited areas due to mine stability concerns. The longer prohibited areas remained inaccessible the more structural instability developed. The accumulation of instabilities led to multiple significant rock falls in September, October, and November of 2016 (Figures 1, 2, and 3).

Following the first two rock falls, a controlled withdrawal from the south end of the WIPP underground was implemented in October 2016 (WIPP Update Oct 14, 2016). Lack of ground control efficiency resulted in loss of disposal area. Following these rock falls, DOE and NWP declared ground control the number one priority moving forward into resumption of operations.

Figure 1. Roof fall in WIPP Panel 4 access drift (WIPP Update Oct 3, 2016).

Figure 2. Roof fall in WIPP Panel 3 access drift (WIPP Update Oct 5, 2016).

Figure 3. Roof fall in WIPP Panel 7 Room 4 (WIPP Update Nov 4, 2016).

Resumption of Operations

While the number one priority remained on ground control operations, there was also a concentrated effort toward resolving all findings from the AIB reports with the goal of resuming operations. In Fall 2016 two independent readiness activities were performed to evaluated if WIPP was prepared to resume operations.

In October 2016, a Contractor Operational Readiness Review (CORR) was performed by an independent group (WIPP Update Dec 23, 2016). The CORR encompassed all aspects of the restart of the Contact-Handled (CH) Waste Emplacement operations at WIPP and provided DOE and CBFO with an independent assessment of NWP's readiness to commence CH waste emplacement operations. The CORR report identified several pre-start and post-start findings but concluded that waste emplacement operations could proceed safely once the pre-start findings were resolved and all prerequisites were completed. The full CORR report is available online at http://www.wipp.energy.gov/Special/WIPP_CORR_Final_Report.pdf.

Additionally, the DOE Operational Readiness Review performed another independent evaluation of the WIPP site to determine if it was capable of safely resuming waste emplacement operations (WIPP Update Dec 23, 2016). The DORR team concluded that upon satisfactory closure of the pre-start findings and approval of corrective action plans for the post-start findings, WIPP can safely restart waste emplacement in accordance with DOE standards. The full DORR report is available online at http://www.wipp.energy.gov/Special/WIPP_DORR_Final_Report.pdf.

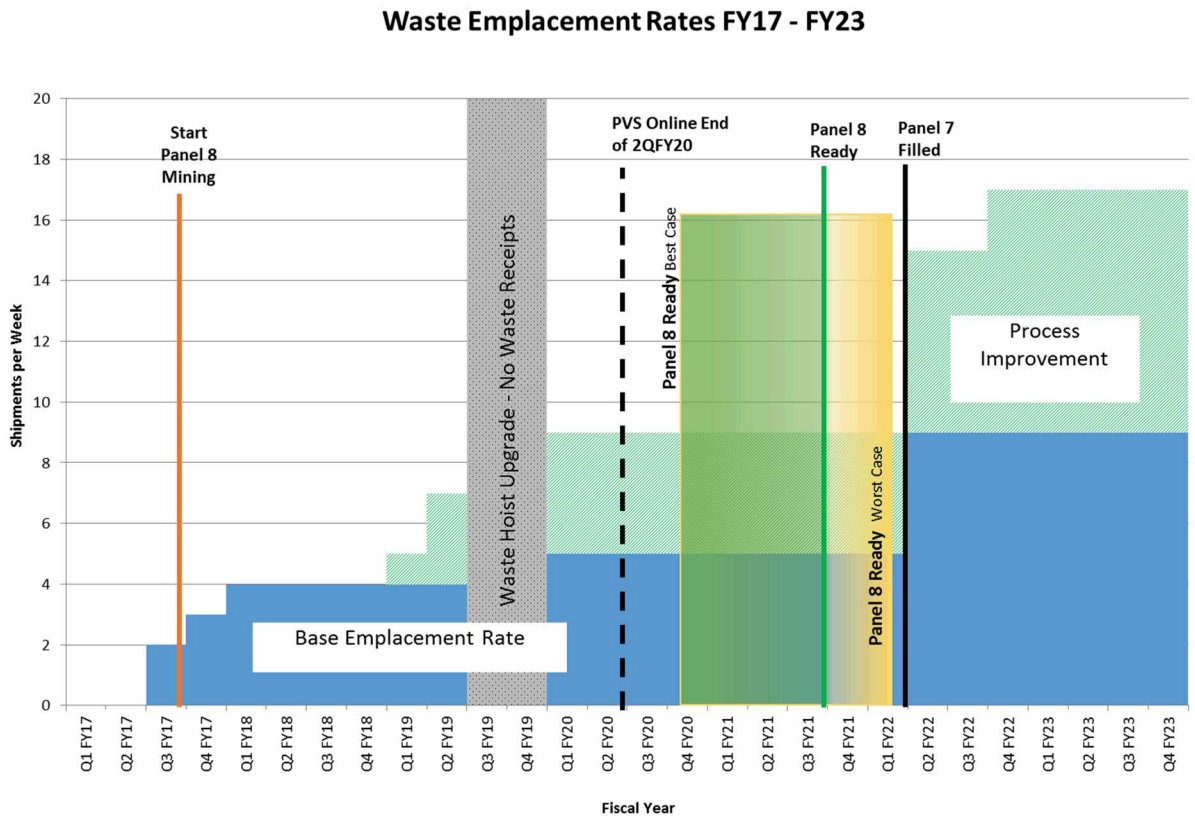
On December 23, 2016, DOE authorized NWP to resume waste emplacement operations. This decision confirmed that all pre-start corrective actions identified in the two operational readiness reviews had been completed and properly validated and other required actions were completed (WIPP Update Dec 23, 2016). Waste emplacement activities resumed in January 2017, shortly after this approval. Waste which was on the surface at the WIPP site, when the incidents occurred, was emplaced upon resumption of operations.

WIPP received its first waste shipment since the February 2014 events on April 10, 2017 (WIPP Update April 10, 2017). This shipment represented WIPP returning to limited operations of both emplacement and waste receipt. Due to the

limited ventilation, ground control issues, and remaining underground contamination, shipment rates are not expected to approach pre-event rates until the two capital asset projects (the permanent ventilation projects) are completed.

The WIPP has a plan and path forward to resuming full operations as well. The path forward for emplacement and mining activities illustrated in Figure 4 was laid out in the Town Hall meeting on March 16, 2017, http://www.wipp.energy.gov/wipprecovery/Presentations/Town_Hall_Slides_03_16_17.pdf. In addition, two major construction project schedules were identified at the Town Hall meeting on September 28, 2017 indicating WIPP is expected to resume full operations in fiscal year (FY) 2022, eight years after the events in 2014.

Figure 4. WIPP Mining and Emplacement Model.



Summary

The path to limited operations at WIPP has been successful, giving rise to many learning opportunities along the way. As pointed out in the AIB reports, there were many operational deficiencies precipitating the events, some of which developed over the operational period of the facility. A growing dichotomy of cultures evolved between nuclear facility practice and conventional mining. Prior to the incidents, the focus of operations as well as contractor incentives were on rate of waste emplacements expressed in shipments processed per year. This led to production focus that often-overlooked operational maintenance of critical safety equipment. The training and oversight programs were found to be lacking as well.

The WIPP site enjoyed over a decade of incident free, productive operations. As was evident by the AIB reports, complacency in operations, facilities, and oversight increased over time. Following the events, DOE focused on nuclear safety and ground control was inadequate. Limited operations have now successfully resumed and continue to increase with gained efficiencies. A path to full operations has been identified with progress being made at the WIPP, but the facility will always have the reminder of lessons learned which have forever changed the way the facility is operated and maintained.

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