EM-5.22 Lessons Learned Bulletin

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Lessons Learned on Changing Conditions at Plutonium Finishing Plant

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The Plutonium Finishing Plant (PFP), which opened in 1949, was responsible for producing nearly two-thirds of the plutonium used to make America's nuclear weapons. Since its shutdown in 1989, its leftover inventory of special nuclear material has been packaged and shipped. Demolition of numerous buildings, gloveboxes and tanks that make up the PFP complex is currently underway. This phase of demolition, considered to be some of the most hazardous work in the DOE complex, was near completion when a series of airborne contamination events occurred and stopped work. Low risk work has resumed with full demolition activity expected to restart in May 2019.

Numerous lessons learned were generated from the execution of this long, complex project. This Lessons Learned Bulletin covers two separate incidents that occurred during demolition of a glovebox and cleanup of a canyon floor area. These incidents illustrate the need to be wary of changing conditions as demolition activities and processes evolve, and the added need to review initial assumptions for modifications to work procedures, as necessary, to ensure continued safety to employees.

Discussion:

Background

Hanford's Plutonium Finishing Plant (PFP), the facility that produced nearly two thirds of the nation's plutonium stockpile over fifty years, is in the process of being demolished. In this demolition phase, over 230 gloveboxes and ventilation hoods were removed along with almost 50 plutonium processing tanks. Numerous plant support facilities, including the vault complex used for storage of plutonium, were cleaned up and demolished. Beginning in 2016, the final four major facilities were ready for demolition to take the facility down to the concrete slab.

Discussion

In the first event, during deactivation and decommissioning (D&D) activities, workers were reducing the size of a glove box in a room controlled as a High Contamination Area (HCA) due to radiological contamination. With the glove box being three stories high, there was no feasible way to enclose the work area within a containment tent to control contamination. Negative air pressure was used within the HCA to reduce the likelihood for contamination to migrate outside the HCA. Overlooking the glove box was a control room with a shared door designated as an emergency exit from the HCA. This door was not controlled for radiological contamination. Tape had been placed around the door, but it was not further sealed in case it was needed for exiting the HCA. The configuration/control requirements for this door and ingress allowed it not to be monitored, and the organization failed to recognize this area was not under routine surveillance.

When workers entered the adjacent control room to conduct contamination surveys, no contamination was identified leading up to the door between the uncontrolled area and the HCA. However, direct contamination of 280,000 disintegrations per minute (dpm)/100cm2 alpha was detected on the tape near the door handle and 175,000 dpm/100cm2 removable was detected on the floor directly in front of the door. The workers immediately exited the room and reported their findings. Greater than 200,000 dpm alpha requires the room to not only be posted as a HCA, but have additional controls in place for personnel safety such as enhanced protective clothing and respiratory protection.

It was apparent that at some point, negative air pressure was lost, the tape on the door failed, and contamination moved from the HCA into the control room. Several assumptions regarding air flow and room configuration were made

during the planning for the activity being conducted in the HCA, but were not explored to the depth required for this unique situation. Routine surveys of the control room and inspection of the tape on the door were not established. This led to the spread of contamination from the work area when air flow in the work area degraded.

In the second incident, a worker exceeded his/her calendar year radiological dose to the extremities. The worker's extremity exposure was 16,130 millirem (mrem) which exceeded the Hanford Site Administrative Control Level of 15,000 mrem. The worker was part of the team working on cleanup and demolition of the Plutonium Reclamation Facility (PRF) canyon. Workers were cleaning up concrete fragments, metal shavings and accumulations of dried chemicals on the canyon floor left over from past operations. Due to high level of airborne contaminants, fixatives were used to fog the canyon prior to workers entry, and handheld foggers were used in specific work areas.

In one particular area, debris was extremely difficult to remove, and an increased amount of fixative was used as more work was done. The increased quantity of fixative led to a foaming reaction in the trays used to remove debris. This discovery led to the waste being handled a second time, while testing and evaluation of the cause of the foaming was performed. The waste became even more difficult to work with since it was treated, dried and treated again. Reviews of procedures were done during the process, and incremental changes to instructions were made. However, there was no focus on increased dose rates to the workers due to the longer time in proximity to the waste. In this case, when issues that drove the minor changes were considered collectively, the initial assumptions no longer fit the current conditions of the work activity.

Conclusion

Work activities at the Plutonium Finishing Plant were among the most hazardous performed in the DOE EM cleanup portfolio. Two incidents involving demolition of a glove box and cleanup of canyon floor debris illustrate (1) the need to look at the larger picture during work planning and procedure reviews and (2) the need revisit processes and procedures to ensure that initial assumptions remain valid under changed field or working conditions. In both events, the management team became focused on smaller more immediate details of the activity. By not following up and applying a broader, more comprehensive view of the activity, reviews of the work package missed controls that could have prevented the events.

Recommended Actions:

Lessons Learned:

The following lessons learned actions were identified as a result of the two incidents mentioned in this bulletin:

1. Establish second checks or defense-in-depth in the planning process throughout the suite of hazard controls implemented for the work activity.
2. Challenge and validate that the initial assumptions upon which work control are based are correct for the current work conditions during the hazard review process.
3. Look beyond the individual effect of the change and consider the cumulative effect of all the changes on the controls that are in place.

Critical Decision(s):	CD-3
Facility Type(s):	Nuclear D&D Activities
Work Function(s):	Project Management, Engineering, Operations
Technical Discipline(s):	All

References:

1. Southerland, D.T. Todd, "Step Back and See the Forest", Hanford Operating Experience Program, 2016-RL-HNF-0010, June 15, 2016.
2. "Discovery of Contamination Spread at the Plutonium Finishing Plant during Demolition Activities", EM-RL—CPRC-PFP-2017-0018, CR-2108-0022, CH2MHill, March 5, 2018.