Preparing for Safe and Compliant Open Air Demolition at Hanford's Plutonium Finishing Plant – 15100

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ABSTRACT

The Plutonium Finishing Plant (PFP), located in the 200 West Area of the U.S. Department of Energy (DOE) Hanford Site, began operations in 1949 and produced plutonium metal during the Cold War. Production was stopped in 1989, the facility was formally shut-down in 1996, and material stabilization completed in 2004. DOE contractor CH2M HILL Plateau Remediation Company (CH2M HILL) is tasked with the plant's deactivation, decommissioning, decontamination and demolition, to be completed by September 30, 2016. The project team, partnering with DOE-Richland Operations Office (DOE-RL), is exploring, evaluating and implementing efficiencies to safely and compliantly prepare the facility for demolition.

Since 2008, employees have prepared approximately 75 percent of the complex for demolition. More than 90 percent of the 232 glove boxes have been removed from ventilation and more than 80 percent of pencil tank units have been dispositioned. As decontamination, deactivation and removal nears completion on the remaining glove boxes, pencil tanks and other radiological and chemical processing infrastructure, CH2M HILL and DOE-RL are making preparations to demolish PFP itself, a Hazardous Category II nuclear facility (HazCat II).

Conventional techniques used to demolish buildings heavily contaminated with radiological hazards typically involve extensive hands-on work to remove Material at Risk (MAR) and decontaminate the building to low levels before conventional demolition techniques can be used to remove the building. A safe and more cost effective approach is packaging MAR located in hard to access areas of the plant and removing it during demolition. That process, combined with affixing remaining contamination to walls, floors and equipment, performing detailed air dispersion modeling before demolition and air monitoring and dust suppression during demolition, will reduce employee risk and is more efficient in demolishing a HazCat II facility.

INTRODUCTION

PFP, also known as Z-Plant, operated from 1949 to 1989 and represented the final step in the plutonium production effort at Hanford. At this facility, plutonium was processed into solid, hockey-puck sized "buttons" and plutonium oxide powder that could then be safely shipped to the country's weapons production facilities. PFP produced nearly two-thirds of the nation's plutonium stockpile.

By December of 2009, containerized plutonium-bearing material stored at PFP was successfully stabilized, packaged, and shipped to the Department of Energy's Savannah River Site and to another Hanford on-site location. Iconic security was removed – metal detectors, vehicle inspection stations, armed guards, and razor wire were all gone. This marked the end of the high security profile long associated with PFP and ushered in a new era for PFP workers: cleaning out, decontaminating, and ultimately removing the PFP complex.

The PFP Closure Project encompasses a monumental cleanup challenge to remove the facility and reduce the risks of the hazards within to protect human health and the environment. Demolishing the PFP complex presents several challenges, including working with safety significant ventilation fans and a bridge crane well past their design life, working in highly contaminated areas, removing and size reducing the remaining glove boxes and equipment, and minimizing the risk of residual plutonium and americium that remain in the facility.

BACKGROUND

CH2M HILL, the prime contractor for cleanup of the central part of Hanford, is managing the transition of PFP to full-scale cleanup with decommissioning and demolition of the plant. Removing PFP is a priority project for CH2M HILL and DOE to reduce environmental risks and surveillance and maintenance costs on Hanford's Central Plateau; extending the PFP project past 2016 could require additional safety upgrades approaching $10 million in addition to the annual $25 million surveillance and maintenance costs.

When CH2M HILL started work at PFP in 2008, PFP housed highly complex and contaminated equipment including 232 glove boxes, 196 pencil-shaped tanks, and more than a mile of highly contaminated vacuum system piping.

In 2009, just a few months into the contract, CH2M HILL received $1.3 billion from the American Recovery and Reinvestment Act (Recovery Act) to create and save jobs and accelerate cleanup. The work included a focus on PFP to remove 174 gloveboxes and 32 buildings, which required training and integrating additional workers into the PFP workforce for the limited 2.5-year duration of the funding.

To date, CH2M HILL has removed more than 90 percent of the PFP glove boxes from ventilation and sealed out more than 80 percent of the pencil tank units. The PFP facility is 75 percent deactivated as of November 2014.

As demolition preparations rapidly progress on the inside of the PFP, planning and execution are well underway to begin safely and compliantly demolishing the HazCat II facility itself using open air demolition techniques by:

- Identifying and removing source term and identifying infrastructure and equipment that will be left inside the facility for removal during demolition.
- Thoroughly characterizing the facility using extensive radiological surveys and nondestructive assay measurements to aid in dispersion modeling and waste determination.
- Preparing appropriate documents to maintain compliance with the CERCLA requirements to demolish the PFP to slab-on-grade.

Modifying Controls to Match Declining Risk

The PFP was an operating nuclear facility for 50 years. Safety systems, such as ventilation, fire suppression and the criticality alarm system kept employees and members of the public safe. As the project transitions from an operating facility toward demolition, hazards associated with MAR in gloveboxes, pencil tanks and connected equipment are removed from inside the

building. Our efforts at PFP to revise the Documented Safety Analysis (DSA) will allow us to safely reduce controls as risks inside the building decrease.

Currently PFP is operating under a DSA which reflects the hazards of five years ago. With most of the glove boxes and pencil tanks gone and MAR removed, however, most hazards of five years ago no longer exist. We are in the process of revising the DSA and developing step-out criteria for the ventilation, fire suppression and criticality alarm safety systems while ensuring the safety of employees and the public while work progresses at the PFP.

Through our analysis and characterization, we are determining what needs to be removed from the building prior to demolition and what can stay for removal during demolition. At PFP, some glove boxes were built as the facility was built and are integral to the structure. Some are too large to remove prior to demolition. We are cleaning out those glove boxes and preparing them for removal during demolition. This analysis drives the strategy for demolition.

Making the Complicated, Simple

The PFP strategy to achieve demolition to slab-on-grade depends on defining the specific activities that govern how we are going to take the building apart. This strategy was developed in June 2014 as the basis for the hazard analysis, accident analyses and control selection in the new DSA. The new DSA will specifically reflect what objects will be left in the building for removal during demolition.

In addition to the DSA strategy document, an overall Back-Out Plan was developed early in the project to identify requirements which must be met to complete demolition. Nuclear safety, radiological control, industrial hygiene and environmental subject matter experts documented specific requirements from the DOE, federal and state law and codes and standards to develop a logical sequence of activities that govern how we are going to take the building apart. Both the Back-Out Plan and the DSA strategy document requirements are reflected in the overall project schedule.

Finally, we've adopted an "area" approach to work controls versus a "system" approach. Work packages that allow crews to decontaminate and remove rooms, for example, rather than individual components inside that room. The duct level in PFP (Figure 1) is a good example of a location that contains large quantities of duct and pipe that pose similar hazards and can be safely removed taking an area approach.

Figure 1: Crews removing ventilation ductwork, heavily contaminated after years of plutonium production.

Progression through Demolition Phases

The removal of source term has been underway at PFP for nearly ten years. Glove boxes and other equipment and infrastructure that can't be removed have been or will be prepared to be removed during demolition.

PFP is implementing strategies for source term immobilization for what will be left in place for removal during demolition. For example, in glove boxes and duct work that have low levels of contamination, we are using FireDam fixative to immobilize contamination. In the ducts that we will leave in the building for removal during demolition, we will paint the inside of those ducts and seal both open ends to create a more robust package for removal during demolition.

Right now, we are taking steps to protect and prepare those items that will be surgically removed during demolition. For example, glove boxes will be surrounded by scaffolding to protect them as demolition progression approaches that glove box location. We are installing slings on those glove boxes to make them easier to lift out of the building at the appropriate time during demolition.

Maintaining Regulatory Compliance

After the buildings are stripped of the most hazardous contamination, the structures slated for open air demolition are thoroughly characterized. That determines in what sequence the parts of the building are demolished and how they are demolished. Additionally, before demolition, a fixative will be applied to potentially dispersible contamination inside the building.

Boundaries around the demolition zone will be established and devices used to measure radiation will be stationed throughout the area. Employees nearest the demolition activities will wear the appropriate protective equipment.

Open-air demolition will be conducted in conformance with emissions controls. Controls such as fogs and sprays, encapsulation, and containment will be used as needed to control release of any contaminants. The demolition will be monitored for air emissions throughout the process.

As part of the pre-demolition preparation, items requiring special handling (e.g., stabilized ducting, glove boxes, or HEPA filters) will be identified, clearly marked using a color coding system and prepared for removal before beginning structure demolition (Figure 2).

Figure 2: Brightly colored spray painted identified contaminated items that were left in place during demolition of the 209E Critical Mass Laboratory at Hanford in 2011. That facility contained plutonium-bearing source term and was demolished safely and compliantly.

During open-air demolition, stabilized items identified as requiring special handling would be managed in a manner to minimize disturbance of the contamination. Methods of stabilization will be implemented prior to demolition to address void spaces and eliminate the need for excessive crushing, size reduction, or other actions that could lead to potential airborne releases. Water in mists or fine sprays will be applied, as practicable, for suppression of fugitive emissions and dust during any excavation, backfilling, and demolition activities when contamination is present.

For airborne emissions monitoring, there are two activities that will be performed. Point source monitoring (e.g., stacks, HEPA-filtered vacuums, portable HEPA-filtered exhausters, temporary exhausters) and diffuse and fugitive monitoring (temporary ambient air monitors, near facility monitors, radiological surveys). During the demolition activities at the PFP, both components (point sources and diffuse and fugitive sources) will be monitored at the same time. Monitoring activities may include:

- Real time and periodic radiological monitoring using temporary ambient air monitors as prescribed by the radiological control organization (primary method for evaluating compliance with the action levels and void limits), with concurrence from the environmental organization.
- Radiological smear surveys (Indicator – effluent air emission estimated rates are based on gross residual contamination levels).
- Near facility ambient air monitoring (currently being performed at several locations around the PFP complex).

CONCLUSION

Careful preparation and execution has allowed safe and compliant progress toward demolition of PFP. As the next phase of the project – building demolition – approaches, appropriate controls to match risk, a careful demolition sequence and instituting controls to ensure regulatory compliance will allow the safe completion of goal of building removal by September 30, 2016.