Closure of the Reactor Maintenance, Assembly, and Disassembly Facility and the Pluto Disassembly Facility at the Nevada National Security Site: American Recovery and Reinvestment Act-Funded Acceleration of Demolition and Lessons Learned – 11157

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ABSTRACT

The U.S. Department of Energy, National Nuclear Security Administration Nevada Site Office received funding from the *American Recovery and Reinvestment Act* to demolish two Nevada National Security Site facilities. These facilities are the Reactor Maintenance, Assembly, and Disassembly Facility and the Pluto Disassembly Facility. They were both constructed in the late 1950s and early 1960s to support design and testing of nuclear reactor-powered components. Both facilities were previously closed under the *Federal Facility Agreement and Consent Order* (1996, as amended March 2010) as agreed to by the State of Nevada; U.S. Department of Energy, Environmental Management; U.S. Department of Defense; and U.S. Department of Energy, Legacy Management.

Receipt of *American Recovery and Reinvestment Act* funds allowed the demolition of these two facilities to be completed significantly ahead of schedule. This schedule acceleration also resulted in more efficient, safe, and compliant demolition activities. The availability of personnel who had previously worked at these facilities contributed to more complete work planning that required less time. The use of a single demolition subcontractor provided additional efficiencies in operation as resources were shared between projects.

Lessons learned were compiled and are being used to plan for future demolition activities. Utilizing this experience allowed more effective and efficient planning for the remaining demolition activities.

INTRODUCTION

The Reactor Maintenance, Assembly, and Disassembly (R-MAD) Facility and the Pluto Disassembly Facility at the Nevada National Security Site (NNSS) were constructed in the late 1950s and early 1960s. These facilities were used to support design and testing of nuclear reactor-powered components. Both facilities were closed under the *Federal Facility Agreement and Consent Order* (FFACO) (1996, as amended March 2010) as agreed to by the State of Nevada; U.S. Department of Energy, Environmental Management; U.S. Department of Defense; and U.S. Department of Energy, Legacy Management [1]. Closure under the FFACO process ensures that these facilities are characterized and potential source materials removed to place the facilities in a stable state so that the environment and public are protected from the hazards contained in the facilities.

In 2009, funds were made available through the *American Recovery and Reinvestment Act* (ARRA) for the demolition of these two facilities. Accelerating the schedule to demolish these facilities resulted in more efficient, safe, and compliant demolition activities. Personnel who previously worked at these facilities and who performed initial characterization, decontamination, and demolition activities were available to provide guidance and information on the potential hazards. The availability of these personnel contributed to more complete work planning that required less time. In addition, the use of a single demolition subcontractor provided the opportunity for additional efficiencies in operation as resources were shared between projects.

BACKGROUND AND CURRENT STATUS

The R-MAD Facility was built to support the nuclear rocket program and was operational from 1959 through 1970. It was used to assemble reactor engines and to disassemble and study reactor parts and fuel elements after reactor tests. The non-radiologically contaminated portions of the facility were demolished in late 2005.

Demolition activities for the radiologically contaminated portions of the R-MAD Facility were initiated in October 2009, with the funding made available through the ARRA. Demolition activities included removal, packaging, and disposal of insulation of pipe elbows and roofing material containing asbestos; conventional demolition of the non-high bay structures; explosive demolition of the water tower and large stack; and use of explosives to lower the high bay followed by conventional demolition. Building debris was used to fill the basements, which were then capped with 30 centimeters (cm) of grout/concrete. The remainder of the debris was packaged and transported to the NNSS Area 5 Radioactive Waste Management Complex (RWMC) for disposal. After disposition of the building debris, the area was posted as a use-restricted area for polychlorinated biphenyls (PCBs) and radionuclides associated with the building pad and basements. Demolition of the R-MAD Facility was completed on July 15, 2010, and demobilization activities were completed on August 31, 2010.

Fig. 1. Before and after photos of the R-MAD Facility.

The Pluto Facility was used to support design and testing of nuclear reactor-powered missiles and was in use from 1960 until 1964. Preliminary site investigation activities were conducted in May and June 2007, including collecting samples of paint, oil, flooring material, and surface smears. Radiological swipes and surveys also were conducted, and swipe samples for beryllium and lead were collected. Closure activities conducted under the FFACO occurred from May 2008 through March 2009. Closure activities included tapping and draining utility systems and equipment reservoirs, investigating vaults, removing leaded glass shield windows and hazardous material (such as lead and PCBs), remediating soil, and placing final postings and markings. The FFACO closure of the Pluto Facility was achieved on July 6, 2009, with approval of the Closure Report by the Nevada Division of Environmental Protection [2].

The ARRA-funded demolition of the Pluto Facility started in October 2009 with preparation of the facility for demolition. Demolition preparation activities included radiological surveys; radiological decontamination; equipment strip out; and removal, packaging, and disposal of radiologically impacted items, and asbestos-surfacing material. Explosive demolition of the water tower was completed in February 2010, and demolition of the facility using traditional methods began in September 2010. Radiological decontamination activities and extensive radiological surveys performed during demolition preparation allowed the building rubble to be used as fill material. This resulted in cost savings by reducing the cost for importing fill material required at the disposal location, and avoiding the cost of packaging the waste. Shipping of the building rubble to the NNSS Area 5 RWMC for use as fill began in September 2010.

Additional building rubble was used to fill the basement, which will be capped with 30 cm of concrete. Demolition of the Pluto Facility is anticipated to be complete by January 2011, and all demobilization activities are anticipated to be complete by February 2011. The final configuration will include an underground radiological material area at the former facility.

Fig. 2. Before and current photos of the Pluto Facility.

The competitive procurement process was used to select one demolition subcontractor to perform the demolition of both the R-MAD and Pluto Facilities, as well as other non-ARRA funded facilities. The proposals were evaluated on technical approach, safety record, and cost. The selected subcontractor became familiar with the operating conditions and requirements at the NNSS, and successfully applied the knowledge acquired during the demolition to follow-on demolition projects. The subcontract workers moved from project to project where possible.

Because the training requirements were similar, this minimized the amount of training needed for each project.

The site workers supporting these projects also moved from project to project where possible. As more efficient methods for performing work were identified, this trained, qualified, and cognizant workforce was able to apply these methods successfully and efficiently to the follow-on projects.

LESSONS LEARNED

Several lessons learned were generated during the planning and demolition of these facilities. As discussed below, these were grouped into the following categories: characterization, residual hazardous materials, safety, and waste management.

Characterization

Demolition planning involves review and documentation of existing historical documents, closure plans, drawings, sample results, and other pertinent information. This planning establishes the extent and confidence level of the existing characterization. For regulatory (FFACO) closure of a facility, the facility is characterized in enough detail in its existing physical state to determine whether further action is required to protect the environment, site workers, and the public from the hazards contained in the facility. This type of characterization does not always provide the level of information required to protect demolition workers and to determine the waste disposal options. Therefore, additional characterization is often required.

In particular, facilities constructed in the 1960s and earlier should be evaluated for the presence of asbestos-containing materials (ACM). Asbestos was not only used as insulation and construction materials, but also added to paint and skim coat for walls, floors, and ceilings. The presence of ACM may not be obvious during early characterization activities, yet significant funds may be required for sampling and abatement activities prior to demolition. Asbestos-containing materials were identified relatively late in the planning process at both facilities, with resulting schedule delays and cost impacts.

For facilities with multiple paint types and surfaces, an *Asbestos Hazard Emergency Response Act* (AHERA) survey or a similar assessment should be considered to evaluate and identify potential ACM.

Careful examination of facility surfaces is required to identify ACM. At the Pluto Facility, asbestos tiles were found beneath equipment in one room, and wall and ceiling surfacing materials in some areas contained asbestos while the surrounding materials did not.

Residual Hazardous Materials

Equipment reservoirs, including pumps, overhead cranes, and manipulator arms are generally drained during closure; however, a substantial volume of residual fluids may remain in low

points of these systems. Residual hazardous fluids are most commonly found in systems that have been gravity drained. Prior to demolition, systems should be checked to determine whether residual fluids are present. Doors that are being held open by door actuators would indicate they still contain hydraulic oil.

If painted interior and exterior surfaces have not been sampled, then samples should be collected to determine whether regulated metals (e.g., lead, chrome) are present, and if present, whether their concentrations are below regulatory levels. Paint containing PCBs is common in older facilities. If paint contains PCBs greater than the regulatory threshold for PCB-containing material (50 parts per million), additional regulatory requirements must be met for disposal of bulk PCB product waste. Paint used at the R-MAD Facility contained regulated metals and PCBs.

Safety

For facilities expected to undergo demolition, routine surveillances are reduced or eliminated. Therefore, during the demolition planning phase, the facility needs to be inspected for safety concerns and issues. Suspect areas that should be inspected include the following:

- Ladders, both wall-mounted and portable
- Stairs and handrails
- Floor surfaces for liquids that may have drained or deterioration that makes them unsafe
- Uncovered openings in floors (e.g., vaults) or uneven floors where grates have been removed
- Unventilated spaces
- Protrusions from walls or ceilings where equipment was removed but not the supports
- Wildlife and insect nests

It is not practical to bring facilities up to *Occupational Safety and Health Act* (OSHA) standards before demolition; however, temporary postings and/or barricades must be used to protect the workers. Unsafe ladders and stairways must be barricaded to prevent use, and holes and openings in ceilings and floors must be covered or barricaded to prevent injury.

The R-MAD and Pluto Facilities were disconnected from the utility systems (“Cold and Dark”), and visibility of hazards was an issue. Adequate temporary lighting was provided when work was performed inside the facilities, and care was taken to minimize the tripping hazards associated with the temporary power.

High pressure water spray was used to remove the asbestos containing skim coat. While effective, when several workers were removing the skim coat within containments, the amount of moisture in the air caused visibility problems. Future abatement work should consider additional ventilation or moisture removal systems to prevent or mitigate excessive moisture buildup resulting in visibility problems.

Both the R-MAD and Pluto Facilities were home to wildlife, including rodents and insects. Both facilities required numerous Hantavirus cleanups during the course of planning and demolition activities. Snakes, bats, and birds also were present in these facilities. Biologists were consulted to provide guidance on how to remove them safely.

The daily safety briefings for workers also emphasized the hazardous nature of working within unmaintained facilities and the specific hazards present in the work areas.

Waste Management

A significant effort was made to identify and characterize waste streams before demolition. A waste management plan was developed for each of the facilities to identify the type of waste generated and how to package and manage the waste. As conditions changed, the waste management plan was revised to include additional, unplanned waste streams. This effort eliminated the confusion from the packaging standpoint and avoided rework once the waste was generated.

A radiological characterization survey was performed at both the R-MAD and Pluto Facilities. Based on the results, building debris from the R-MAD Facility was disposed as low-level waste. However, the radiological characterization survey of the Pluto Facility indicated that only small areas were radiologically contaminated. Therefore, the decision was made to decontaminate these small areas and then perform a final release survey. Upon the successful conclusion of this survey, the building debris was determined to meet the waste acceptance criteria for the on-site sanitary landfill. The building debris from the Pluto Facility is being used as clean fill material at another on-site waste disposal cell. This resulted in significant cost savings over the planned disposal as low-level waste (LLW).

At both facilities, the age of the concrete and exposure to harsh conditions, combined with the large size of the rebar, resulted in the rebar readily separating from the concrete during demolition. The remaining concrete was then packaged with a much lower potential for damaging liners and waste containers. The rebar was handled separately. At the R-MAD Facility, the rebar was coated with a fixative and sent to the on-site LLW landfill as its own package. At the Pluto Facility, the rebar was loaded into end dumps and disposed as sanitary waste or fill material.

At the R-MAD Facility, the waste containers utilized were intermodals lined with heavy duty bags that included adsorbent pads in the bottom to eliminate the potential for free liquids. The process for loading and shipping these containers was extensively evaluated to streamline the process and eliminate project delays. A one-way traffic pattern was established to eliminate congestion and reduce the potential for backing incidents. Permission was received to ship overweight vehicles which resulted in packaging more waste per container, reducing the number of shipments, the cost of the shipments and the resulting risk to the site worker. The roadway was routinely inspected to verify that damage was not occurring. A dedicated crew at the Area 5 RWMC was utilized to immediately offload waste containers that were then staged for disposal. Dedicated radiological control technicians surveyed the trucks for a quick release and return to

the site. The shorter turn-around time at the RWMC increased the number of shipments per day, also reducing costs.

CONCLUSIONS

Using ARRA funds to accelerate work scope and maintaining the same subcontractor and site workers across several projects resulted in identification of more efficient methods for performing work that were applied to R-MAD, Pluto, and Test Cell C.

Lessons learned on these projects included identifying efficiencies in waste packaging and shipment, and the importance of a rigorous approach for identification of asbestos-containing materials. These lessons learned are being used to plan for future demolition activities. Utilizing this experience allows for more effective and efficient planning for other demolition activities, including EMAD and Test Cell C.

REFERENCES

1. FEDERAL FACILITY AGREEMENT AND CONSENT ORDER, agreed to by the State of Nevada; U.S. Department of Energy, Environmental Management; U.S. Department of Defense; and U.S. Department of Energy, Legacy Management (1996; as amended March 2010).

2. U.S. DEPARTMENT OF ENERGY, NATIONAL NUCLEAR SECURITY ADMINISTRATION NEVADA SITE OFFICE, *Closure Report for Corrective Action Unit 117: Area 26 Pluto Disassembly Facility, Nevada Test Site, Nevada*, Rev. 0, DOE/NV--1324 (2009).

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