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Innovative ALARA Tools and Work Practices Used at the DOE Hanford Site

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract DE-AC06-09RL14728

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INTRODUCTION

The Hanford Nuclear Reservation occupies an area of 586 square miles in southeastern Washington state. The site was created as part of the World War II Manhattan Project to produce weapons grade plutonium. A multitude of old reactor plants, processing facilities, underground tank farms, contaminated soil and ground water remain and are part of an on-going environmental cleanup mission of the site.

The Columbia River bisects Hanford, and the concern is that the river will become contaminated if the sources of contamination are not removed. Currently facilities are being removed, the ground water is being treated, and contaminated soil is being transferred to an approved burial ground about 15 miles away from the River located in the center of the Hanford Site

The remaining facilities and adjacent structures are undergoing D&D (decontaminate and demolish) and to date, significant progress has been made. During this presentation, I will discuss how we are using innovative tools and work practices to D&D these Hanford Site facilities.

WHAT IS CONTAMINATED?

Facilities have radiological, chemical, and controlled material contamination in or on floors, walls, ceilings, vent ducts, piping systems, and tanks. Structures also contain vaults, processing cells, glove boxes, and fume hoods with similar materials. Many of these components have radiological contamination levels that are too high to measure.

WHAT IS CHANGING WITH THE SHIFT TO D&D?

A work force "cultural" change occurred as Hanford workers learned how D&D work is different from anything they did before. There is now more emphasis on the use of engineered controls and remote tools. Workers were provided skills training in realistic mockups to upgrade their knowledge. As work has moved forward, managers, engineers and workers have become more familiar with the work and the decisions needed to decontaminate and demolish radiological facilities. The concepts of "Graded Approach" and "Risk-based decisions" have been applied as each D&D job was completed. As we gained experience, improvements in facility characterization, planning and execution were implemented.

OPEN AIR DEMOLITION TECHNIQUES

Hanford adopted an "Open Air" demolition technique that safely completed removal rather than taking the time to decontaminate facilities prior to demolition. Buildings are stripped of all necessary equipment and components and the building is sprayed with fixatives to trap any contamination or other hazardous products. Fixatives are then sprayed while excavators demolish the building. This has saved time, money, and worker exposure.

PLUTONIUM CONCENTRATION FACILITY

Most of the building was one-story high but the most contaminated part was a four-story section that contained the processing equipment. Contamination levels in the building were over 10 million dpm/100 cm^2 alpha. Eleven thousand five hundred (11,500) entries by workers wearing multiple sets of protective clothing were needed to decontaminate and remove the process vessels, ventilation and support equipment. Prior to open air demolition, a boundary was established at a 40-meter radius from the building and fixatives were applied inside the building.

Standard industry excavators equipped with misters and fog cannons spraying a water mist were used to minimize contamination spread during demolition of single story structures. Debris piles were sprayed with dust suppressants to ensure no contamination spread as the water moisture evaporated. Radiological surveys

performed during work and after verified the effectiveness of the contamination controls.

The four-story section of the building was removed using large concrete cutting saws and applying mist and fixatives as each section of the building was removed by crane. Surveys taken during demolition revealed no contamination spread outside the 40-meter boundary.

D&D OF A PLUTONIUM INCINERATOR FACILITY

This building was wedged between three other buildings that contained 600 workers and one was used for storing special nuclear material. Fog cannons could not be used so workers installed metal walls and draped other structures with plastic sheeting. Misters were installed every two feet in the adjacent building's rain gutters to completely saturate the building in mist while demolition was in progress. Sump pumps, sand berms, and absorbent pillows were used to control water runoff. Again, no contamination or hazardous materials were released outside the established perimeters.

REMOVING LIQUID FROM TANKS IN A VAULT FACILITY

Four tanks containing about 19,000 gallons of high-level liquid waste were located beneath the floor of a building. In order to turn the building over to a D&D contractor, the liquid had to be removed. The building offered additional challenges. The building was highly contaminated, the crane needed to remove concrete cover blocks to gain access to the tanks was inoperable and the HEPA filtered vent system for the building had failed.

Decisions were made to fix the contamination using an aerosol generator to apply a glycerin-based fixative and then spray the floor and walls with a polyurea coating. Work was done in a containment complex that consisted of a passageway and four small containments located on the concrete floor over each of the four tanks. Workers then core drilled holes through the concrete blocks and lowered a plasma arc torch to cut openings in the top of each tank. A submersible pump was then used to transfer the liquid up and out of the building.

Containment installation was accomplished with a small workforce by inflating each section of the containment and then installing scaffolding inside. This approach provided worker protection as the final containment structure and equipment was staged.

WORKER PREPARATION

D&D involves application of existing tools, technologies, and approaches but often using a different approach. Training of the worker must be evaluated. A worker may be proficient at a particular tool's use but not capable of successfully using the tool in a multi-hazard work site while wearing various types of protective clothing, often with respiratory protection.

At the Hanford Site, over 2,000 new workers have been trained at the HAMMER Training Facility because of hiring actions resulting from the Recovery Act of 2009. Many of these workers had no previous work experience and additional training was required on proper tool use during D&D activities. Just-in-time training and mockups were provided for critical activity to assure that the preparation for actual work was adequate.

LESSONS LEARNED

- Accurate characterization that includes current radiological surveys of each work area is important in the planning process.
- During D&D, conditions change rapidly. As the work progresses, opportunities to make improvements will occur. Workers and managers need to take action when they recognize an opportunity.
- Waste handling needs to be orchestrated to prevent bottlenecks. For example, the Plutonium Concentration Facility cut cement blocks were sized for maximum allowed transport and packaging weights.
- The waste stream may dictate how the work is accomplished. Agreements need to be made when multiple waste stream controls are involved.
- Worker hands-on training and realistic mockups pays off. The HAMMER Training Facility located at Hanford provided extensive safety and health training to contractor personnel and individuals hired under the Recovery Act.
- Include IH, Rad Engineers, Safety, and Fire Department as part of the D&D team and early in the process.

- Conduct pre-job briefings for each evolution
- Debrief completed work often - do not wait until a long job ends.
- Listen to the team member's suggestions each day on making improvements.
- Each project is different. Do not become complacent.
- Keep an open mind and... expect the unexpected! Plan for the unexpected or except the risk of delays when new situations emerge.

INNOVATIVE TOOLS AND TECHNIQUES

Several types of tools and work practices have worked well at Hanford.

- Remotely operated demolition machines have been used to dig out fuel basins and recover spent fuel elements.

- Power hacksaws work well at size reducing long components.

- Several companies sell metal cutting saw blades that easily size reduce materials.

- Split-frame or Clamshell cutting tools work well for cutting piping and size reducing long components.

- Blade plunging cutters and battery-powered shears are valuable tools for D&D. They can be remotely operated and are able to cut material in a few seconds.

- Plasma Arc cutting of metal works well when you have sufficient ventilation to control airborne contamination and fumes. Lessons learned reveal that at least 2,000 cfm flow is required to capture the average airborne particulate.

- Expandable foam or a fixative can be squirted into a pipe before cutting to reduce contamination spread.

- Nibblers are tools that bite their way through metal. They are often used to size reduce stainless steel glove boxes.

- Core drilling is a technology that uses hollow cylindrical cutters with diamond bits to easily cut through concrete and rebar. Water prevents the tool from overheating.

- Cutting large thick components is done by dragging a wire fitted with diamonds through a component. Water is normally used to cool the wire and reduce the amount of airborne debris.

Hot taps can be used to drain piping and provide a location for connecting a HEPA filtered vacuum cleaner to draw a suction on the inside the piping for additional cutting.

Localized or point source ventilation keeps contamination from spreading into the worker's breathing zone as long as it's located properly, positioned within one duct diameter, and a scoop is installed to force incoming air to pass through the region where airborne contamination might be present.

IN CONCLUSION

Hanford personnel continue to have success doing D&D work using innovative tools and work practices. Please contact the Hanford ALARA Center if you have lessons learned to share or need information.

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