Project Name: RL-Semi-Works Zone Facilities D&D-D&D-R

Project Name (Expanded): Richland Operations ARRA Semi-Works Zone Facilities D&D [Deactivation, dismantlement, and demolition of a 9,000 square foot small nuclear facility (criticality laboratory) and small ancillary buildings]

Project Type: Building / Facility D&D Project Type

Building Type: B Typ 2

Project Type Detail: Generic Radiological Facility(ies)-Extensive Loose Contamination

Supplementary Reference Documents: PRC WBS Dictionary; Documented Safety Analysis for 209-E Facility Critical Mass Laboratory, Rev 0, 2003 (CP-15584)

Site Context:
All ARRA Projects are specific EM projects developed and executed between 2008 and 2011 in response to the American Reinvestment and Recovery Act. These projects were based on a total of 8+6+47 ARRA “Subprojects”, 8 managed by the Hanford Plateau Remediation Contractor (CH2M-Hill Plateau Remediation Company [PRC]), 6 managed by the River Corridor Contractor (Washington Closure Hanford [WCH]), and 47 managed by the Tank Operations Contractor (Washington River Protection Solutions [WRPS]), for a total cost of over $1.8B. The projects exist within larger ongoing site operations, depend on those larger elements for site services and support, and typically include costs for those services as indirect costs.

The historical Hanford Site mission was to reprocess reactor core material to produce plutonium for nuclear weapons and fabricate nuclear weapons components. It originally covered 670 square miles, and it has no future major non-environmental mission (there will be minor laboratory operations, management of waste disposal facilities and legacy controlled areas, and a gravity-wave observatory.

The two major activities associated with the DOE-EM mission are the facility decommissioning, environmental cleanup, and transuranic and solid waste management performed by PRC and WCH, and the vitrification/stabilization of high-level waste held in large below-ground tanks by WRPS. The Hanford EM ARRA scope has been divided into nine ECAS Level 4 Parent Projects based on the SRS organizational and PBS groupings:

**PRC ARRA Scope:**
- RL-PFP-R (WBS 011)
- RL-100K-R (WBS 041)
- RL-D&D-R (WBS 040)
- RL-Env Rest-R (WBS 030)
- RL-Waste Mgmt-R (WBS 013)

**WCH ARRA Scope:**
- RL-Acc Rem-R
- RL-RCC Waste Management Construction and Operations-R
- RL-618 Rem-R

**WRPS ARRA Scope**
- ORP ARRA Projects

**ECAS Level 4/Parent Project Context:**
The RL-D&D-R ARRA Parent Project grouping includes the ARRA ECAS Projects given below.
These projects were administered under the PRC contract and were both decommissioning and environmental restoration projects that completely or partially remove facilities and clean up environmental media in the Central Plateau, Arid Lands and North Slope areas (i.e., 200 and 600 Areas). All ARRA costs under this PBS (i.e., BPS 040) are contained in these ECAS Projects.

- RL-200-E Admin Zone Facilities D&D-D&D-R
- RL-ALE Facilities-D&D-R
- RL-North OU CW-3 Waste Sites-ER-R
- RL-North Slope Facilities-D&D-R
- RL-Outer Zone Barriers-ER-R
- RL-Outer Zone CSNA Waste Sites-ER-R
- RL-Outer Zone Railroad Car-D&D-R
- RL-Outer Zone RTD Waste Sites-ER-R
- RL-Semi-Works Zone Facilities D&D-D&D-R
- RL-T-Plant Zone Facilities D&D-D&D-R
- RL-U Plant Deactivation and Grouting-D&D-R
- RL-U-Plant Ancillary Facilities-D&D-R
- RL-212-N,-P,-R Facilities-D&D-R
- RL-Outer Zone Pipeline ER-R

### D&D Facility Data:

#### Facilities:

<table>
<thead>
<tr>
<th>Building</th>
<th>Title</th>
<th>Area (SF)</th>
<th>In-Service Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>209E</td>
<td>Critical Mass Laboratory</td>
<td>9,073</td>
<td>1960</td>
</tr>
<tr>
<td>2701EC</td>
<td>Guard Station for 209E</td>
<td>182</td>
<td>1980</td>
</tr>
<tr>
<td>209EA</td>
<td>90 Day Storage Pad with Metal Roof</td>
<td>5,114</td>
<td>Unknown</td>
</tr>
<tr>
<td>2718E</td>
<td>Critical Mass Laboratory Fissile Storage Building</td>
<td>1,760</td>
<td>1969</td>
</tr>
</tbody>
</table>

#### Construction Details:

Building 209E, the Critical Mass Laboratory is an "L"-shaped, flat-roofed, one-story concrete block building with a two-story reinforced concrete reactor hall. Building 2701EC and 2718E were both small steel-frame buildings; 209EA was a concrete pad and metal roof.

The 209-E facility was an L-shaped reinforced concrete structure with unknown seismic qualifications. The northern most portion of the building housed six offices, restrooms, control room, change room, and a computer room. The southern portion of the building, or reactor wing, consisted of an equipment room, change room, mixing room and a two-story reactor hall referred to as the Critical Assembly Room (CAR); the rooms that contained contaminated equipment and material include the CAR, the mix room, and the “hot side” of the change room.

The CAR and mix room were ventilated with an active ventilation system. The exhaust ventilation system consisted primarily of two stages of fire-resistant HEPA filters, an exhaust fan, and a (9.75 m [32 ft]) stack. The ventilation system flow historically varied from 600 cfm to 1100 cfm. The north, east and west walls of the CAR were 1.5 m (5 ft) thick, while the south wall was 0.9 m (3 ft) thick. The room dimensions were approximately 15.7 m (51.5 ft) by 13.9 m (45.5 ft). The 209-E facility and CAR room structures were designed to provide radiation shielding and to withstand pressures generated from potential uncontrolled criticalities.
The CAR contained two reactor hoods where critical assemblies were held to conduct criticality experiments. Each hood had its own HEPA filter and instrumentation that was monitored from the control room. Contaminated equipment located in the CAR included four hood assemblies and 13 tanks ranging from 38 L (10 gal) to 401 L (106 gal). The CAR had an assigned inventory of 229 g of plutonium all contained within the tanks and assumed to be residual material from heels within the tanks. External contamination, although present, was not considered to represent a significant quantity of plutonium (estimates are below 0.01 grams of plutonium).

The mix room received, handled, and prepared the various types and forms of radionuclides and chemicals used in the experiments. The mix room contained contaminated equipment including three hood assemblies, and nine tanks ranging from 11 L (3 gal) to 322 L (85 gal). The mix room was approximately 6.63 m (21.75 ft) by 7.52 m (24.66 ft) in dimension. The mix room had an assigned inventory of 184 g of plutonium all contained within the tanks (159 g of plutonium), pumps (20 g of plutonium) and the valve area (5 g of plutonium) of the room. Due to the location of the remaining material and the flushing records, this material was assumed to be residual material from heels within the tanks and process lines.

The quantities of equipment present in the CAR and mix room are shown in the table below, as estimated from figures given in the DSA.

<table>
<thead>
<tr>
<th>ECES Codes</th>
<th>Value</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>.31 .09 .01</td>
<td>Cutting, Sizing, and Removal of Equipment</td>
<td>4,000</td>
</tr>
<tr>
<td>.31 .09 .03</td>
<td>Cutting, Sizing, and Removal of Piping</td>
<td>300</td>
</tr>
<tr>
<td>.31 .09 .04</td>
<td>Cutting, Sizing, and Removal of Tanks</td>
<td>880</td>
</tr>
<tr>
<td>.31 .09 .91</td>
<td>Cutting, Sizing, and Removal of Gloveboxes</td>
<td>2,632</td>
</tr>
<tr>
<td>.31 .09 .92</td>
<td>Cutting, Sizing, and Removal of Duct</td>
<td>600</td>
</tr>
<tr>
<td>.31 .09 .93</td>
<td>Cutting, Sizing, and Removal of Plenums</td>
<td>250</td>
</tr>
</tbody>
</table>

Actual quantities of plutonium and process equipment quantities may have been higher than these figures; no actual post-project data on quantities was received, although the waste values in the database (which include a significant quantity of TRU, perhaps more than represented by 550gm of plutonium) are thought to be accurate.

Facility Use:
The 209-E facility was located in the 200 East Area of the Hanford. The facility, constructed in 1960, was designed to provide a heavily shielded reactor room where quantities of plutonium or uranium in solution could be brought into critical configurations under carefully controlled and monitored conditions. The facility featured a mixing room with glove boxes and a mixing hood, and a control room from which experiments could be remotely monitored and controlled. Criticality experiments, where a nuclear chain reaction becomes self-sustaining, were also conducted. In addition, 209-E was a research facility where methods of protecting workers in the event of a nuclear accident were tested.

No research or experiments had been conducted in the building since 1983. However, the radioactive nature of the work that was done in 209-E resulted in some parts of the building becoming contaminated. The administrative offices in the building had been used to support tank
In 1988, the Department of Energy directed that the laboratory be prepared for unoccupied status. This resulted in hazardous materials being removed from the building and tanks that were used in experiments were flushed, emptied, and ventilated. Since 1989, some of the administrative areas of 209-E had been used intermittently, but the only entries into the laboratory of the complex were limited to decommissioning, characterization of materials or equipment, surveillance, and maintenance.

Processes causing contamination:
See above

<table>
<thead>
<tr>
<th>Building</th>
<th>Chemical Hazard</th>
<th>Location/Extent</th>
<th>Radiological Hazard</th>
<th>Location/Extent</th>
</tr>
</thead>
<tbody>
<tr>
<td>General buildings</td>
<td>Asbestos and incidental RCRA constituents; acids and corrosives</td>
<td>Asbestos for interior materials consistent with the age of buildings; various materials in process areas</td>
<td>Plutonium (in gram quantities) and enriched uranium</td>
<td>Nuclear facility quantities of plutonium (although probably crit-incredible) in process equipment</td>
</tr>
</tbody>
</table>

The quantities of plutonium in the equipment require manual size reduction of equipment and the generation of TRU waste.

D&D Project Execution

Site WBS Organization within the ECAS Project Scope:
The scope of this ECAS Project contained the requisite activities and resources necessary to perform and manage the safe and compliant decontamination and demolition (D&D) of 209E and the associated facilities. D&D included all activities necessary to take a facility from the point at which it is transferred to Balance of Site (BOS) D&D Projects to the point at which structural demolition removes the facility and resulting waste debris is disposed of. This was expected to include the D&D activities of mobilization, demolition prep, characterization, asbestos removal, structural demolition, waste disposal, and final site restoration.

The project to D&D the 209E facility was originally planned as the D&D of a standard small contaminated facility (not a nuclear facility); it was assumed that the interior equipment could be size reduced as part of the demolition, and was originally estimated as about a $4M project (final costs - $13.6M). As planning progressed it became clear that the interior equipment in the mix room and the CAR would need to be stabilized and/or decontaminated, then manually size reduced by craft in substantial levels of PPE, and the resulting waste segregated into TRU and LL waste components.

The costs for the D&D of the whole group of Semi-Works facilities were collected under a single cost code. Since the original estimate/budget was for a scope that was substantially different than the executed scope, there is no effective way to even estimate how much work (and cost) was dismantlement, and associated with the TRU-contaminated equipment, and how much was associated with the work typical of the D&D of a small contaminated facility.

Methods of execution:
Management: The scope was planned, managed, and executed as a single element. Management
**Project Name:** RL-Semi-Works Zone Facilities D&D-D&D-R

Included technical and project oversight, planning, project controls, and quality assurance.

**Regulatory:** The work was done in compliance with Removal Action decision documents (Engineering Evaluation and Cost Analysis (EE/CA) and Action Memorandum) for structures and regulatory documents necessary to implement approved Records of Decision and or Removal Action Memorandum related to U-Plant Zone. These included the following:
- Removal Action work plans (RAWP)
- Remedial Design (RD)/Remedial Action (RA) Work Plan(s) (RD/RAWP)
- Remedial design reports (RDRs) as applicable - Sampling Analysis plans (SAPs)
- Data Quality objectives
- Closure documents (response Action report (RAR) or equivalent)
- Operation and Maintenance (O&M) plans as applicable
- RD report (RDR), including the designs and schedules for Construction of the Remedy including structures and necessary support facilities

These documents were prepared prior to the start of this project; preparation was not included in project scope.

**Physical Approach:**
- Initial characterization, and planning using detailed work packages)
- Removal of process equipment - manually removed process equipment using various contamination containment approaches and using hand-held power-tools.
- Abatement of asbestos from all friable sources (principally insulation and interior transite)
- Conventional demolition and loadout of remaining structure; less-contaminated equipment was size reduced as part of the building
- Site restoration as appropriate

**Technologies:** The contractor used aggressive decontamination of process gloveboxes and tanks to reduce size reduction (required to fit materials in TRU SWBs). It measured and calculated the glovebox and tank activities to be non-TRU (i.e., LLW using the SCO process). It used larger containers for disposal of LLW instead of size reduction to smaller waste box size, and subcontracted the final decontamination of gloveboxes to Perm-Fix (a separate contractor) when possible after the gloveboxes were removed from the building. Large holes were cut in building walls, and large airlocks were installed to accelerate removal of large equipment. Standard techniques were used for asbestos abatement and contaminated demolition.

**Activities self-performed:**
- All management and key technical positions along with a portion of the technical staff
- All of the Site hourly labor doing the physical removal of process equipment
- Decontamination of structural surfaces
- Waste management and disposal
- Used significant professional services contracted (i.e., seconded) labor inter-mixed with prime contractor staff

**Activities subcontracted:**
<table>
<thead>
<tr>
<th><strong>Project Name:</strong></th>
<th>RL-Semi-Works Zone Facilities D&amp;D-D&amp;D-R</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Removal of non-process equipment</td>
<td></td>
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<tr>
<td>• Characterization of surfaces prior to demolition, and sample analysis</td>
<td></td>
</tr>
<tr>
<td>• Waste treatment of mixed wastes (on-site and off-site)</td>
<td></td>
</tr>
<tr>
<td>• Demolition of structures</td>
<td></td>
</tr>
</tbody>
</table>

**Issues that impacted the project:**
- None

**Scope Growth:**
Substantial scope growth due to failure to recognize the impacts of the plutonium holdup. The final cost was about three times the initial estimate and the schedule extended into the beginning of FY12.

**Notes Regarding Use of Data**
- This project is the removal of a number of collocated industrial facilities and a low-level rad laboratory on a pond with past releases (i.e., contaminated mud).