

**Removal, Packaging and Disposal of Hanford 327 Building Hot Cells  
at the Hanford Site, Washington, USA - 10484**

Gary M. MacFarlan, Worley Parsons Polestar  
601 Williams Boulevard, Suite 4A, Richland WA 99352

**ABSTRACT**

The Department of Energy (DOE) Hanford Site 327 Building, built in 1953, played a key role in reactor material and fuel research programs. The 327 Building, previously a Category 3 nuclear facility, is in the final stages of pre-demolition activities. Under the River Corridor Closure Contract (RCCC), Washington Closure Hanford (WCH) is performing deactivation, decommissioning, decontamination and demolition (D4) for the 327 building, including the pre-demolition removal of eleven primary hot cells within the building. These include hot cells “A through I” located on the main floor of the 327 Building “canyon” and the two Special Environmental Radio Metallurgy (SERF) cells located in an annex room (Upper SERF) and the basement (Lower SERF).

**INTRODUCTION**

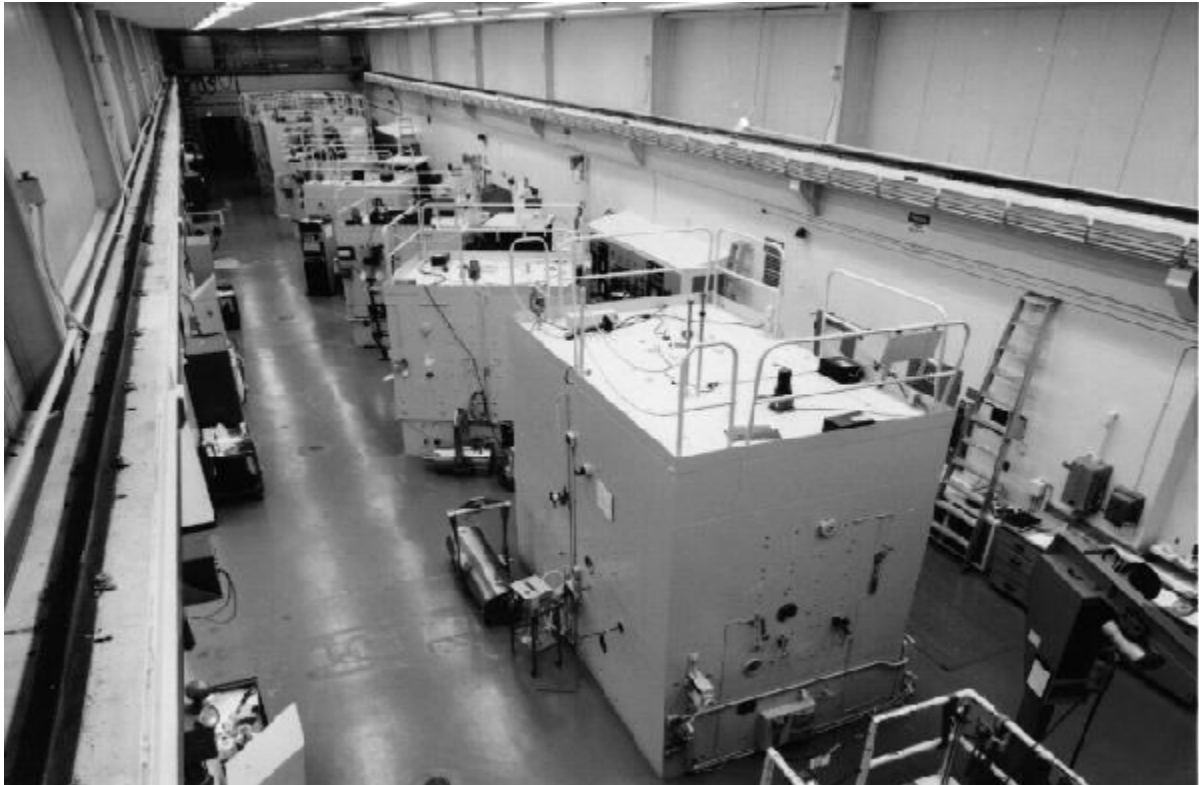
The 327 Building is located in the 300 Area of the Hanford Site and performed its designed mission from 1953 to 1996. The building was designed to provide shielded, ventilated, and specially equipped laboratories (hot cells) for physical and metallurgical examination and testing of irradiated fuels, concentrated fission products, and structural materials in support of operational efforts carried out at Hanford. The primary operating area on the main floor includes a canyon area and connecting bays where auxiliary operations were performed. The 327 Building is a single-story structure with a partial basement. Maximum dimensions are 65.6 m (215 ft) by 43 m (140 ft) and 9.8 m (32 ft) in height. The total work area of the building is approximately 2,340 m<sup>2</sup> (25,200 ft<sup>2</sup>) with 930 m<sup>2</sup> (10,000 ft<sup>2</sup>) of laboratory and work areas, 195 m<sup>2</sup> (2,100 ft<sup>2</sup>) of offices, 223 m<sup>2</sup> (2,400 ft<sup>2</sup>) of storage areas, and 975 m<sup>2</sup> (10,500 ft<sup>2</sup>) of common areas containing ventilation and auxiliary equipment.

Hot cells “A through I” are constructed of up to a dozen or more interlocking cast iron components (Figure 1). Of the 10 cells located on the first floor, 5 are elevated above the floor slab on steel corner posts, 4 are located directly on the steel-reinforced concrete floor slab and 1 (Upper Special Environmental Radio Metallurgy (SERF)) is mounted on a concrete pedestal that rises 2 feet above first floor slab elevation and is constructed of steel plate. Cell weights range from approximately 36 metric tons (40 tons) to 159 metric tons (175 tons) and the final packaged cells ready for shipment will range from 68 metric tons (75 tons) to 209 metric tons (230 tons).

The SERF Cell is a sealed enclosure that provides radiological containment/confinement. Nitrogen was supplied to the SERF Cell and was recirculated and exhausted through the HEPA-filtered exhaust system. The pressure inside the SERF Cell is maintained negative

relative to that of the canyon. The nitrogen system has been removed from the facility and the SERF Cell now has an air atmosphere.

The SERF Cell's lower storage area (lower SERF) is located in the basement, is constructed of steel-reinforced concrete with a steel liner and is connected by a transfer tube to the operating area (upper SERF). A manipulator was provided to permit positioning and retrieval of materials in the storage area. Three storage racks are located in the cell, on the wall opposite of and on the two walls adjacent to the operating face of the cell.



**Figure 1. First Floor Layout**

## **WORK ACTIVITIES**

After over two years of engineering studies, planning, and procurement, formal field work activities have begun with an overall project completion expected in the spring/summer of 2010. The field activities associated with the removal of the hot cells has been broken down into 4 main activities:

- 1) Hot cell cutting and coring
- 2) Hot cell removal and packaging
- 3) Loading hot cells on transport vehicle
- 4) Transportation and unloading of hot cells at disposal facility

**Hot cell cutting and coring activities:**

Before the hot cells can be removed from the building they must first be unattached from the primary facility structure. The first step in this process was to remove all exposed piping and miscellaneous equipment from the cells. For cells B, C, D, E and I this operation was much simpler due to the fact that these cells rest on four pedestal legs which allowed all of the support piping and ductwork to be removed from between the cell and the floor using traditional methods and tools. These cells will then simply be unbolted from the floor rather than physically separated from the building.

The remainder of the cells rest directly on the floor so an alternative method was chosen to separate these cells from the building structure. The decision was made to use a diamond embedded wire (Figure 2) to cut the cells free. This method would pull the 3/8" wire through the cell at floor level separating the cell from the rest of the building. Shims would be installed as the cut progressed in order to prevent the cell from crushing the cutting wire as the cut progressed to completion. This method proved to be quite effective and was completed in a timely manner. As cutting progressed it was discovered that many of the cells rested on shim packs that are believed to have been used to help level the cell during installation. These shim packs would often cause the cutting wire to jam and on a few occasions actually break the wire. Other items such as process piping, ventilation ductwork and grout were easily cut through using the diamond wire.

In support of wire cutting and future rigging points, several concrete cores were drilled through the Upper and Lower SERF Cells. These cores ranged from 15 cm (6 inch) to 1.8 m (6 ft) in total length and from 5.1 cm (2 inch) to 10.2 cm (4 inch) in diameter. Prior to several of these cores being drilled the project injected grout into hollow 20.3 cm (8 inch) stainless steel pipes that would be drilled through in order to prevent these pipes being filled with cooling water and presenting a contamination control problem later on when the cells would be moved for packaging and disposal. A total of 15 cores were drilled using diamond embedded drill bits.

The water used to cool the diamond wire and bits was collected through a vacuum system and recycled in order to reduce the overall waste water that would need to be disposed. The water vacuumed into 208 liter (55 gallon) drums and then transferred into two 1136 liter (300 gallon) settling tanks. Once the sediment in the water had settled to the bottom of the tanks, this water was transferred into an 1893 liter (500 gallon) feed tank. The water from the feed tank was pumped to the drill and wire saw equipment as cooling water and once again collected and recycled.



**Figure 2. Wiresaw Cutting of Lower SERF**

**Hot cell removal and packaging activities:**

In order to install the first floor canyon temporary gantry system that will be used to lift the hot cells from the floor, several facility modifications had to be completed. These modifications included removal of several hundred feet of highly contaminated piping and ventilation ductwork from the basement to allow for the installation of twenty 108,862 kg (240,000 pound) capacity shoring stands. These stands will be strategically located in the basement under the gantry joint locations to add additional support to the canyon concrete floor. The shoring stands will be placed on 3 m (10 ft) x 2.4 m (8 ft) x 0.3 m (1 ft) shoring mats and used to lift 226.8 kg (500 pound) header beams snug to the underside of the canyon floor.

Prior to the installation of the gantry system, the entire east wall of the canyon will be removed to allow for the placement of up to 13,608 km (30,000 pound) gantry rail sections into the building. A temporary 9.1 m (30 ft) x 12.2 m (40ft) plastic curtain will be installed to help prevent any contamination spread from inside the building to the environment. The roughly 91.4 m (300 ft) of gantry rails that will be installed into the building will be placed by use of both an external mobile crane and the facility overhead cranes. The rail sections will be placed as far into the facility as possible using the mobile crane and then in order to get the rail sections completely into the facility a dual pick will be accomplished by using both the mobile and facility crane.

In addition to the 91.4 m (300 ft) of rail installed inside the facility, another 121.9 m (400 ft) of gantry rail will be installed outside of the building. Once the rail installation is complete four 363 metric tons (400 ton) capacity hydraulic gantry legs with two 7.6 m (25 ft) header beams will be installed onto the rail system.

Once the gantry system is installed and tested, each cell will have four lifting haunches installed. The lifting haunches will be bolted to each cell using existing bolt holes from the original cell construction process. The jacking haunches will be attached to the header beams on the gantry system and used to lift the cells for placement onto a stainless steel plate built into the bottom skid section of the disposal package. The gantry system will then be removed from the jacking haunches and attached to lifting eyes that have been built into the bottom skid section. The skid and cell will be in-turn moved outside of the building after a thorough contamination survey is completed and placed onto a pad outside of the building (Figure 3). Once the gantry is disconnected, the four disposal package steel walls will be erected and bolted to the skid with gasket material placed between all connecting surfaces. A temporary lid will be installed to prevent rain and dirt from entering the disposal package until all of the cells are removed and packaged outside of the building.

Once all of the cell disposal packages are outside of the building a grouting campaign will be initiated. The grout will be used to not only fill the interior cell void spaces, but will also be used to fill any space between the exterior cell surfaces and the interior disposal package walls. The grout will be poured in alternating cell interior and external lifts to prevent cell windows and access ports from being pushed out of the cell due to internal grout pressure. In addition, whalers will be installed on the outside of the package to prevent the package from bulging due to grout pressures. The disposal packages will be filled to within 2.5 cm (1 in) from the top and then the package lid will be installed and bolted in place with gasket material between the sealing surfaces.

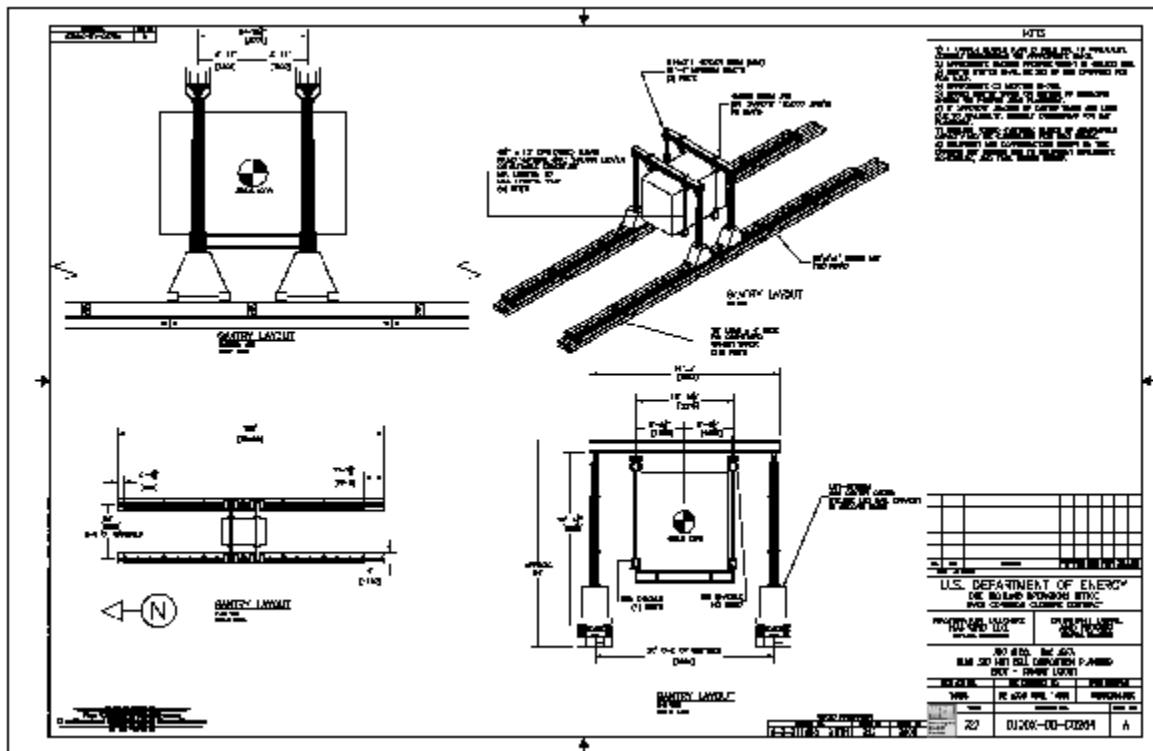


Figure 3. Transport of Hot Cell Package from Building

**Loading hot cells on transport vehicle activities:**

Once the hot cells are out of the building they will be individually loaded onto a 12-axle transporter for disposal using the gantry system installed to the east of the 327 Building. The gantry system will be attached to the disposal package lifting points and the package will be lifted high enough to be moved over the transporter and lowered between a heavy duty longitudinal restraint system (Figure 4). The restraint system will be moved into position and bolted into place to ensure that the disposal package will not move during transportation of the cells to the Environmental Restoration Disposal Facility (ERDF).



**Figure 4. Packaged Hot Cell on Transporter**

**Transportation and unloading of hot cells to disposal facility activities:**

In addition to the 61 m (200 ft) x 15.2 m (50 ft) compacted gravel pad being built outside of the 327 facility to support the installation of the gantry system newly constructed roads will be in place that will allow the transport vehicle to access previously constructed site roads.

Each disposal package will be individually transported the approximate 41.8 km (26 miles) to the ERDF. Due to on-site shipping restrictions the transport vehicle will have a maximum speed limit of 8.0 km (5 miles) per hour and can only be on the road between the hours of 6:00 p.m. and 5:00 a.m.

WM2010 Conference, March 7-11, 2010, Phoenix, AZ

Once the hot cells reach the disposal facility they will be unloaded using a second gantry crane system that will be assembled inside of the ERDF. This will require the construction of an additional 61 m (200 ft) x 15.2 m (50 ft) compacted gravel pad and a large additional area for support equipment. Once all of the hot cells have been off-loaded, both gantry systems will be de-mobilized and the hot cells will be buried in place using standard heavy equipment.

**Path Forward:**

As of the end of 2009, all wiresaw and coring activities associated with the 327 Hot Cells has been completed. With the completion of this activity additional facility preparations need to be accomplished prior to the installation of the gantry crane and removal of the Hot Cells. It is anticipated that gantry shoring installation will begin the first part of February 2010 and the gantry crane will be installed by the end of February 2010. The actual Hot Cell removal and packaging activities will take place in March and April 2010 with the transportation and disposal at the ERDF occurring in May 2010.