<table>
<thead>
<tr>
<th><strong>Project Name:</strong></th>
<th>ID-TRA-632 Hot Cell Building-D&amp;D</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Project Name (Expanded):</strong></td>
<td>Idaho TRA-632 Hot Cell Building D&amp;D [Deactivation and entombment of an 12,000 SF hot cell facility (3 hot cells), including deactivation, component removal, both hot cell monolith removal preparation (HC#1) and hot cell demolition (HC#2 and HC#3), demolition of above-ground steel-frame and masonry, and removal and disposal of hot cells]</td>
</tr>
<tr>
<td><strong>Project Type:</strong></td>
<td>Building / Facility D&amp;D Project Type</td>
</tr>
<tr>
<td><strong>FIMS Hazardous Category:</strong></td>
<td>02 Nuclear Facility Category 2 (previous Building Type 2)</td>
</tr>
<tr>
<td><strong>Project Type Detail:</strong></td>
<td>High-Rad Laboratory/Hot Cell Facility</td>
</tr>
</tbody>
</table>
| **Supplementary Reference Documents** | Removal Action Report for Decommissioning of the TRA-632 Hot Cells, October 2012  
Action Memorandum for Decommissioning of the TRA-632 Hot Cells, December 2009 |

**Site Context:**
The Idaho National Energy and Environmental Laboratory (INEEL) site is in a 890-square mile reservation in southeast Idaho, with significant extremes of weather. The initial INEEL mission as the development and testing of nuclear reactors, first for the US Navy and then for a variety of other programs. Facilities also supported the reactor training for Navy personnel and the processing of military reactors cores to recover the uranium (the naval training is not part of the DOE mission). It also includes numerous laboratories and legacy waste in burial grounds and various other storage configurations. The current mission is science research, mostly in advanced reactor development, environmental cleanup, support operations, and waste management. Contaminants include fission products in dispersed and concentrated forms, and transuranic constituents. In particular, significant quantities of buried TRU waste required repacking prior to disposal at WIPP.

**ECAS Level 4/Parent Project Context:**
The Parent Project grouping developed for this ECAS Project is based on actual cost data for the Idaho Cleanup Project over the period of 2005 to 2016. This period included numerous projects and operations, including D&D projects, environmental restoration projects, waste management projects and operations, and numerous other site operations, activities, and overhead functions. It also included shifts in WBS structure. The five projects chosen as part of this effort were completed D&D projects that would best address deficiencies in the ECAS database.

The selected ECAS Projects are all are part of independent D&D efforts (i.e., not comingled with extensive operations or waste activities), but some falling within different Level 2 site WBS elements. The projects are given below, with the Level 2 WBS elements given in parentheses:
- ID-TRA-642 Engineering Test Reactor-D&D (P.3.D2, TRA/PBF D&D)
- ID-PBF-620 Power Burst Reactor-D&D (P.3.D2, TRA/PBF D&D)
- ID-TAN-607 Hot Shop/Manufacturing & Assembly-D&D (P.3.D1, TRN D&D)
- ID-TRA-603 Material Test Reactor-D&D (P.3.D2, TRA/PBF D&D)
- ID-TRA-632 Hot Cell Building-D&D (T.7.03, TRA/PBF D&D)

**D&D Facility Data:**
### Facilities (FIMS data where possible):

<table>
<thead>
<tr>
<th>Building (Property ID)</th>
<th>Title (Property Name)</th>
<th>Area (SF)</th>
<th>Year Built</th>
<th>Contamination Category</th>
<th>Hazard Category</th>
<th># of Floors</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRA-632</td>
<td>Hot Cell Building</td>
<td>11,862</td>
<td>1952</td>
<td>Not Given</td>
<td>02 Nuclear Facility Category 2</td>
<td>2</td>
</tr>
<tr>
<td>TRA-612</td>
<td>Retention Basin Sump Pump House</td>
<td>64</td>
<td>1952</td>
<td>Not Given</td>
<td>04 Radiological Facility 1</td>
<td>1</td>
</tr>
<tr>
<td>TRA-613</td>
<td>Hot Waste Storage Pump House</td>
<td>1,076</td>
<td>1996</td>
<td>Not Given</td>
<td>04 Radiological Facility 2</td>
<td>2</td>
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<tr>
<td>TRA-712</td>
<td>Retention Basin (Underground)</td>
<td></td>
<td>1952</td>
<td>Not Given</td>
<td>04 Radiological Facility</td>
<td></td>
</tr>
<tr>
<td>TRA-713B</td>
<td>Hot Waste Storage Tank</td>
<td>9000 (Gal)</td>
<td>1961</td>
<td>Not Given</td>
<td>12 Not Applicable</td>
<td></td>
</tr>
<tr>
<td>TRA-713C</td>
<td>Hot Waste Storage Tank</td>
<td>10000 (Gal)</td>
<td>1961</td>
<td>Not Given</td>
<td>12 Not Applicable</td>
<td></td>
</tr>
<tr>
<td>TRA-713D</td>
<td>Hot Waste Storage Tank</td>
<td>10000 (Gal)</td>
<td>1961</td>
<td>Not Given</td>
<td>12 Not Applicable</td>
<td></td>
</tr>
<tr>
<td>TRA-760</td>
<td>Inactiviated Monitoring Station</td>
<td></td>
<td>1959</td>
<td>Not Given</td>
<td>04 Radiological Facility</td>
<td></td>
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<table>
<thead>
<tr>
<th>Building (Property ID)</th>
<th>Title (Property Name)</th>
<th>Asset Type</th>
<th>RPV Description</th>
<th>Usage Code</th>
<th>Disposition Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>TRA-632</td>
<td>Hot Cell Building</td>
<td>501 Buildings</td>
<td>Labs - High Rad Exam</td>
<td>782 Hot Cells</td>
<td>09/30/2011</td>
</tr>
<tr>
<td>TRA-613</td>
<td>Hot Waste Storage Pump House</td>
<td>550 Other Structures</td>
<td>Warehouse/Storage (pre-eng)</td>
<td>694 Other Service Building</td>
<td>07/06/2010</td>
</tr>
<tr>
<td>TRA-712</td>
<td>Retention Basin (Underground)</td>
<td>550 Other Structures</td>
<td></td>
<td>4009 Other, Storage</td>
<td>08/18/2011</td>
</tr>
<tr>
<td>TRA-713B</td>
<td>Hot Waste Storage Tank</td>
<td>550 Other Structures</td>
<td></td>
<td>4441 Tanks (Hazardous Contaminated)</td>
<td>11/17/2010</td>
</tr>
<tr>
<td>TRA-713C</td>
<td>Hot Waste Storage Tank</td>
<td>550 Other Structures</td>
<td></td>
<td>4441 Tanks (Hazardous Contaminated)</td>
<td>11/17/2010</td>
</tr>
<tr>
<td>TRA-713D</td>
<td>Hot Waste Storage Tank</td>
<td>550 Other Structures</td>
<td></td>
<td>4441 Tanks (Hazardous Contaminated)</td>
<td>11/17/2010</td>
</tr>
<tr>
<td>TRA-760</td>
<td>Inactiviated Monitoring Station</td>
<td>550 Other Structures</td>
<td></td>
<td>5009 Structures, Industrial, Other</td>
<td>08/18/2011</td>
</tr>
</tbody>
</table>

**Construction Details:**
TRA-632 was a slab-on-grade structure with exterior walls that were generally constructed of 12-in. pumice blocks tied in with structural steel framing. The roof was built-up with tar and gravel over insulation and precast concrete slabs supported on bar joists and steel beams. The facility consisted of a main floor and an upper mezzanine level as illustrated in Figure 2-4. The height of the building in the hot cell region was nominally 15 ft 10 in. Enclosures for the external charging ports into Hot Cell 1 and Hot Cell 3 were added after the original construction. The exterior walls of the enclosures...
were constructed of 8-in pumice block. A steel-sided truck bay was attached to the east side of TRA-632, with truck access to the building via a vertical sliding door. TRA-632 Hot Cell Building contained three separate shielded hot cells with an associated truck bay, operating gallery, service area, office space, dark room, and change room. Each hot cell was equipped with separate exhaust systems designed to maintain the hot cell at negative pressure to minimize the spread of airborne radioactivity from inside the cell. The exhaust systems were located above the ceiling of the respective cells on the mezzanine level.

The TRA-632 Hot Cells were located at the ATR Complex in the west-central portion of the INL Site.

![Location of TRA-632 Hot Cell Building at the Advanced Test Reactor Complex. Additional photographs are shown below.](image-url)
TRA-632 Building.

TRA-632 Hot Cell Building floor plan.
**Hot Cell 1**

Hot Cell 1 was located on the east side of the TRA-632 Building. The east wall of Hot Cell 1 formed part of the exterior wall of the original building. The inside dimensions of Hot Cell 1 were 14 ft × 6 ft 6 in., with a ceiling height of 13 ft 4 in. The floor was constructed of high-density concrete measuring 3 ft 2 in. thick. The hot cell ceiling was constructed of high-density concrete measuring 2 ft 6 in. thick. The walls were constructed of high-density concrete measuring 4 ft thick. The entire cell interior (i.e., floor, walls, and ceiling) was lined with a 1/4-in. carbon-steel plate. Hot Cell 1 was equipped with one floor drain. Incandescent and mercury-vapor light bulbs provided in-cell lighting. Hot Cell 1 had three large shielded windows on the north wall and one small shielded window on the west wall. All shielded windows, except for the one at the western-most north wall position, consisted of a zinc bromide and water solution layered between leaded shield glass. The western-most north wall window had been replaced with a mineral oil-filled leaded shield glass unit. Personnel access to the hot cell was through two sliding shield doors in the south wall. Multiple penetrations on the north and west walls supported installation and use of master-slave manipulators, periscopes, and other cell access needs. A hand-operated transfer drawer was on the west end of the cell. Also, a charging port was on the east side of the cell. An enclosure covered the area around the charging port. Below is a historic photograph of Hot Cell 1.

![Hot Cell 1](image1.jpg)

**Hot Cell 2**

Hot Cell 2 was located in the center of the TRA-632 Building between Hot Cell 1 and Hot Cell 3. The inside dimensions of Hot Cell 2 were 18 ft 6 in. long × 8 ft wide, with a ceiling height of 13 ft. The walls were constructed of ordinary concrete and were nominally 2 ft 9 in. thick. The roof and floor were constructed of ordinary concrete measuring 2 ft 4 in. thick. The hot cell floor and interior walls were lined with 1/4-in. carbon-steel plate from the floor to a minimum height of 6 ft.
above the floor. This cell could be divided into two equal-sized subcells by means of a 6-in.-thick, motor-driven, steel door, which moved horizontally on a floor track. Hot Cell 2 was equipped with two floor drains (one in each subcell). A metallographic cave was located on the east wall of the hot cell that allowed visual examination of specimens under magnification to approximately 2,000 power. A scanning electron microscope cave was located on the west wall of the hot cell that provided for examining specimens at a resolution of approximately 1 micron. Both caves were lead lined to provide radiological shielding from the specimens moved inside for examination. Incandescent and sodium-vapor light bulbs provided in-cell lighting for Hot Cell 2. Hot Cell 2 had four shielded windows on the north wall and one on the west wall. All shielded windows were leaded glass and filled with mineral oil. Personnel access to the hot cell was through two pairs of 9-in., carbon-steel, single-swing doors on the south wall. Various penetrations were located in the north, east, and west walls of the hot cell that supported installation and use of master-slave manipulators and other cell access needs. Below is a historic photograph of Hot Cell 2.

Hot Cell 3 was located in the west end of the building. The west wall of the hot cell formed part of the exterior wall of the original building. The inside dimensions of Hot Cell 3 were 20 ft 6 in. long × 10 ft wide, and had a ceiling height of 12 ft 10 in. The south and west walls of the hot cell were constructed of ordinary concrete, measuring 5 ft 6 in. thick. The north and east walls were constructed of high-density concrete measuring 4 ft thick. The hot cell roof and floor were constructed of ordinary concrete, with the ceiling measuring 3 ft 6 in. thick and the cell floor measuring 2 ft thick. The hot cell interior, including the floor and the walls, was lined with 1/4-in.,
carbon-steel plate from the floor to a minimum height of 6 ft above the floor. This cell could be divided into two equal subcells using a 6-in.-thick, motor-driven, steel door. Hot Cell 3 was equipped with two floor drains (one in each subcell). Hot Cell 3 had four shielded windows on the north wall and one on the east wall. All shielded windows were leaded glass filled with mineral oil. Personnel access to the hot cell was through two pairs of 18-in., carbon-steel, single-swing doors located on the south wall. Various penetrations were located in the north and east walls of the hot cell and supported installation and use of master-slave manipulators and other cell access needs. A hand-operated transfer draw was located on the east end and provided access into the “cold” side of the cell. Incandescent and sodium-vapor light bulbs provided in-cell lighting. Below is a historic photograph of Hot Cell 3.

Facility Use:
The TRA-632 Hot Cell Facility was constructed in 1952–1953 and was the first hot cell facility built at the INL Site. Hot Cell 1 was used primarily for the remote examination of fuel, reactor hardware, and irradiation experiments from the Materials Test Reactor. Hot Cell 1 was equipped with a hoist, manipulators, periscopes, metallographic machines, tools for cutting and etching, a mounting press, ultra-sonic cleaners, and polishing wheels.
In 1958–1960, the construction of the Engineering Test Reactor and the increase in irradiation experiments necessitated the expansion of the TRA-632 Hot Cell Facility to include two additional hot cells. These additional hot cells (Hot Cell 2 and Hot Cell 3) were designed to provide different radiological shielding. Hot Cell 2, known as the “light cell,” was designed primarily for metallographic examination of irradiated materials, which included gamma scanning, photography, and optical metallographic. Hot Cell 3, known as the “heavy cell,” was designed to function much like Hot Cell 1 and could support examination of fuel and reactor hardware.
As the mission at the ATR Complex changed with the shutdown of both the Materials Test Reactor and Engineering Test Reactor, the hot cells’ usage was expanded to also include processing radioisotopes from fuel elements and target materials generated within the Advanced Test Reactor, including cobalt-60 and iridium-192, for use in radiography and other medical procedures, such as cancer treatment.

Processes causing contamination: See above

Contaminants of concern (including extent of contamination by major contaminant):
Nonradiological constituents were determined, by qualitative means, to pose no unacceptable risk to a future residential receptor, groundwater, or an ecological receptor. The radiological source term prior to this D&D effort was as follows:

TRA-632 Hot Cells 2009 and 2095 total radiological source terms.

<table>
<thead>
<tr>
<th>Nuclide</th>
<th>Cell 1 (Ci)</th>
<th>Cell 2 (Ci)</th>
<th>Cell 3 (Ci)</th>
<th>Cell Source Term (Ci)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Totals</td>
<td>2.27E+02</td>
<td>5.05E-01</td>
<td>1.57E+03</td>
<td>1.96E+00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nuclide</th>
<th>Cell 1 (Ci)</th>
<th>Cell 2 (Ci)</th>
<th>Cell 3 (Ci)</th>
<th>Cell Source Term (Ci)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Totals</td>
<td>227 Ci</td>
<td>0.5 Ci</td>
<td>1,570 Ci</td>
<td>2 Ci</td>
</tr>
</tbody>
</table>

Cell #1 had extensive decontamination performed prior to this project. These decontamination activities involved CO₂ pellet-blasting followed by vacuuming of cell surfaces. Based on the nature of work activities performed in the cell (acidic processes that etched the contamination into the cell surfaces), the relatively low reduction in cell dose rate following decontamination, and the decontamination activities performed (vacuuming of surfaces), the cell source term was due to fixed contamination with an insignificant contribution by loose contamination.

Cell #2 was protected as a radiological contamination area. The majority of floor, equipment, and table surfaces had loose contamination at levels that are <2.25E⁻³ μCi/cm². Based on the measured dose rates in the cell, the cell contained fixed contamination at levels that exceed 5 μCi/cm². Thus, the source term in Cell #2 was due to fixed contamination with loose contamination making an insignificant contribution.

The radiological source term for Cell #3 in Table 3-1 was due to waste items (activated materials, Cell #1 decon waste, etc.) remaining in the cell. Three waste items remaining in the cell (a stove pipe, inline filters, and a 1-gal paint can) were then being managed as RCRA mixed waste.

The cell ventilation system source term is fixed contamination levels were as high as 19 μCi/cm². was due to fixed contamination with an insignificant contribution by loose contamination.

The estimated radionuclide inventory for Hot Cell #1 was 227 Ci, Hot Cell #2 is 0.505 Ci, Hot Cell #3 is 1,570 Ci; and cell ventilation system was 2 Ci. Therefore, the total current source term for the hot cells was estimated to be 1,800 Ci.

<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, Beryllium, and incidental RCRA constituents; lead, cadmium, mercury; acids and corrosives;</td>
<td>ACM Category I, and Category II materials present in operating and mechanical areas.</td>
<td>Various radionuclides, including transuranics and fission products up to High Rad and High Contamination areas</td>
<td>Radiological survey results ranged from background in administrative areas to contamination areas, high contamination areas, radiation areas, and high radiation areas. Locations with elevated contamination were associated with mechanical areas and hot-cells.</td>
</tr>
</tbody>
</table>

D&D Project Execution
Site WBS Organization within the ECAS Project Scope:
This project addresses the TRA-632 Hot Cell Building and the three hot cells contained within it. The TRA-632 Building was removed down to the slab, and the three hot cells contained in the building were removed and disposed of at the Idaho Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Disposal Facility (ICDF). No hazardous substances remain above the slab at the former location of the TRA-632 Hot Cell Building. Radiological soil contamination discovered underneath the TRA-632 Building slab and the three hot cells was addressed using the CERCLA new site identification process. Chronology of major events during deactivation and decommissioning of the TRA-632 Hot Cells was as follows:

<table>
<thead>
<tr>
<th>Date</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>September 2009</td>
<td>Finalized TRA-632 Hot Cells EE/CA (DOE-ID 2009b)</td>
</tr>
<tr>
<td>December 2009</td>
<td>Approval of TRA-632 Action Memorandum (DOE-ID 2009a)</td>
</tr>
<tr>
<td>January 2010</td>
<td>Began asbestos abatement of the TRA-632 Hot Cell Building</td>
</tr>
<tr>
<td>March 2010</td>
<td>Removed accessible hazardous materials from inside Hot Cell 1 and Hot Cell 2</td>
</tr>
<tr>
<td>January 2011</td>
<td>Hot Cell 1 was grouted to below the large observation windows</td>
</tr>
<tr>
<td>February 2011</td>
<td>Removed 22,700 R/hr canister from Hot Cell 3</td>
</tr>
<tr>
<td>August 2011</td>
<td>Begun TRA-632 building demolition</td>
</tr>
<tr>
<td>September 2011</td>
<td>Hot Cell 1 monolith removed and transported to ICDF</td>
</tr>
<tr>
<td>December 2011</td>
<td>Completed removal of underlying soils from hot cell footprints</td>
</tr>
<tr>
<td>January 2012</td>
<td>Area graded and covered with clean soil</td>
</tr>
</tbody>
</table>

EE/CA engineering evaluation/cost analysis
ICDF Idaho CERCLA Disposal Facility

Prior to demolition of the TRA-632 Hot Cell Building, hazardous materials were removed from the building. The hazardous materials removed and disposed of at an offsite disposal facility consisted of electronics, light fixtures (i.e., light bulbs, balusters), zinc bromide solution removed from three of the 14 shielded windows, mineral oil removed from the remaining 11 shielded windows, silver zeolite filter media, lead shielding, asbestos, etc. Upon completion of the building strip out, a polymeric coating was applied to the interior surfaces of the TRA-632 Building to minimize the spread of any radiological contamination.

A portion of the south wall of the TRA-632 Building was supported with steel posts so that this wall would remain standing after the roof was removed. This portion of the south wall provided a radiological and construction barrier for the TRA-632 demolition activities from the Battelle Energy Alliance, LLC-occupied TRA-653 Building that houses a fabrication shop and offices and is located just south of the TRA-632 Hot Cell Building. The Hot Cell Building was removed, with the exception of a portion of the south wall, around each of the three hot cells to allow heavy equipment greater access to the hot cells. Upon removal of Hot Cell 1, Hot Cell 2, and Hot Cell 3, as discussed in the subsequent sections, the south building wall was removed. Demolition debris from the TRA-632 Building was disposed of on the INL Site at ICDF or the Idaho CERCLA Demolition Waste Landfill (ICDWL).
TRA-632 Building being demolished around the three hot cells.

*Hot Cell 1 Demolition*

In accordance with the Action Memorandum, Hot Cell 1 was disposed of on the INL Site at ICDF. In order to place the hot cell into ICDF, it was necessary for the radiological and chemical constituents to be within acceptable levels, as defined by the ICDF Waste Acceptance Criteria (WAC). Due to the physical configuration of Hot Cell 1 with only one set of doors into the cell and the radiological
levels inside greater than 1,000 R/hr, manned entries inside the cell to remove hazardous materials were not feasible. Therefore, remote reach tools and the manipulators were utilized to remove hazardous materials to the extent accessible and practicable from Hot Cell 1; this waste was disposed of as Resource Conservation and Recovery Act (RCRA)-hazardous waste at a permitted disposal facility off the INL Site. The removed hazardous waste included mercury-vapor light bulbs and lead in the form of manipulators, shield glass, shot, putty, plugs, and bricks.

To reduce the radiological levels inside the cell, Hot Cell 1 was grouted to the bottom of the large observation windows. The radiological dose inside Hot Cell 1 was reduced from greater than 1,000 R/hr to less than 2 R/hr, with a radiological hot spot of 34 R/hr. Because of this radiological dose, open-air demolition of the upper portion of Hot Cell 1 was deemed unfeasible. Due to the radiological hazards that caused the demolition strategy for Hot Cell 1 to change, the remaining hazardous materials located inside the cell were deemed impracticable to remove. These hazardous items included a poured lead plug associated with the inside portion of the transfer drawer, seven 1,000-watt, mercury-vapor light bulbs, two lead bricks, and a lead sheet, resulting in approximately 482 lb of lead and 3.86E-03 lb of mercury remaining inside Hot Cell 1.

Grout pour to the bottom of the large observation windows inside Hot Cell 1.

After the initial partial grouting of the hot cell and prior to lifting the hot cell, the interior surfaces of the cell were sprayed with a polymeric coating for radiological contamination control. All penetrations into the cell were sealed in preparation of the transport to ICDF. Finally, Hot Cell 1 was separated from the concrete building slab with a 40-in. circular concrete saw. The floor slab and underlying soils immediately adjacent to the hot cell were removed to allow access to the exterior wall of the hot cell for installation of the lifting fixtures. These removed materials were CERCLA low-level waste, along with the other debris generated from the D&D of TRA-632, and disposed of
in the ICDF landfill. As the sliding shield doors and concrete were being removed, a significant radiation field of 7 to 200 R/hr was exposed in the concrete seam located under the door and floor slab. For worker protection, a steel frame was installed so that approximately 127.5 lead bricks and seven lead blankets could be mounted in front of the door seam. This lead shielding reduced the radiation field to manageable levels (less than 500 mR/hr) while not interfering with the lifting fixtures.

In order to lift and transport the 1.2-M-lb hot cell as a single monolith to ICDF, a massive set of lifting fixtures was designed and fabricated. The lifting fixtures and hardware alone weighed approximately 40,000 lb. The lifting fixtures were attached to the hot cell by 2 to 2½-in.-diameter bolts epoxied into 160 holes drilled approximately 17 to 24 in. deep into the top and bottom of the cell. The lifting fixtures were linked by steel connecting rods from the top plate to the bottom to disperse the weight of the massive load. Workers worked around the clock to ensure that the lifting fixtures were installed by the time Southwest Industrial Rigging (subcontractor hired to lift and transport Hot Cell 1 to ICDF) arrived on site.

Hot Cell 1 was lifted utilizing a portable 850-ton-capacity, four-legged mobile gantry crane system set on tracks to horizontally move the suspended load to the transport trailer. The gantry system was selected due to the stability of the suspended load (even in windy conditions, which often occur at the INL Site) and the relatively short time needed to assemble, lift the load, disassemble, move, and reassemble the gantry system at ICDF.

Concrete saw used to separate Hot Cell 1 from the building slab.
Installation of the lifting fixtures on Hot Cell 1.
The hot cell was lifted very carefully with plastic drapes, a remote camera, and high-efficiency particulate air ventilation to ensure the highly contaminated Duriron drain line located underneath the cell separated, as anticipated, when the hot cell was lifted. The drain line was part of the Voluntary Consent Order (VCO). Once the hot cell was lifted and it was confirmed that the drain line was successfully separated from the hot cell monolith, the cell was moved to a catch pan that was filled with sand. The purpose of the sand was to support the uneven surfaces of the cell bottom. The pan was covered in a large plastic tarp that was wrapped around the bottom and sides of the hot cell to
contain any radiological contamination that may have been present on the bottom of the cell. Then the pan was attached to the hot cell utilizing heavy ¾-in. chains, which attached to mounting brackets that had been attached to the hot cell. This allowed the hot cell and pan/sand assembly to be lifted and placed onto a specialized Goldhofer transport trailer assembly that was approximately 22 ft wide and 70 ft long. The trailer consisted of 14 lines of axles, with a total of 224 tires. The Hot Cell 1 and pan assembly were placed on the Goldhofer trailer in a precalculated location to ensure that the trailer load and weight distribution met manufacturing specification and engineering calculations. Once the load was secured, the transport embarked on the 2.5-mile journey to ICDF, reaching a maximum speed of 5 miles per hour (see Figure 3-12). Once at ICDF, the load was staged until the gantry system was reassembled inside ICDF. Using a Caterpillar D9T bulldozer, Hot Cell 1 was moved into ICDF, where the cell and attached pan assembly were lifted off the trailer and placed onto the final resting place within ICDF. Prior to transport, Hot Cell 1 had been grouted to just below the large observation windows. After placement in the ICDF landfill, the remaining internal void was filled with grout, meeting the Land Disposal Restrictions alternative treatment standards for hazardous debris (mercury-vapor light bulbs) in 40 CFR 268.45, the treatment standard for radioactive lead solids in 40 CFR 268.40, and the void space requirements of the ICDF WAC.
Lifting TRA-632 Hot Cell 1.

Hot Cell 2 Demolition

In accordance with the Action Memorandum (DOE-ID 2009a), Hot Cell 2 was disposed of on the INL Site at ICDF. In order to place the hot cell into ICDF, it was necessary for the radiological and chemical constituents to be within acceptable levels, as defined by the ICDF WAC (DOE-ID 2010). The physical configuration of Hot Cell 2 with a cold side and a hot side, allowed manned entries into the cell to remove all the equipment, tables, and hazardous materials, which included sodium-vapor light bulbs and lead in the form of manipulators, shield glass, plugs, and shield caves (scanning
electron microscope and metallographic). These RCRA-hazardous materials were disposed of at a permitted disposal facility off the INL Site. Once all items had been removed from Hot Cell 2, the interior surfaces of the cell were sprayed with a polymeric coating for radiological contamination control. The resulting radiological dose remaining inside Hot Cell 2 supported open air demolition. Heavy equipment was used to demolish the hot cell, and the debris was loaded into heavy duty dump trucks or containers for disposal at ICDF. The entire cell was removed, including 1–2 ft of soil underneath Hot Cell 2. These removed materials were classified as CERCLA low-level waste, along with the other debris generated from the D&D of TRA-632, and disposed of in the ICDF landfill.

Demolition of Hot Cell 2.
**Hot Cell 3 Demolition**

In accordance with the Action Memorandum, Hot Cell 3 was disposed of at ICDF on the INL Site. In order to place the hot cell into ICDF, it was necessary for the radiological and chemical constituents to be within acceptable levels, as defined by the ICDF WAC.

**Removal of Material from Hot Cell 3**

The physical configuration of Hot Cell 3 with a cold side and a hot side, allowed manned entries into the cold side of the cell. Low-level waste items located on top of the table were remotely moved from the hot side to the cold side of the cell. The 6-in.-thick shield door, which separated the hot and cold sides, provided sufficient shielding from any remaining high radiological dose items located in the hot side of the cell when closed. This shielding allowed workers to open the doors into the cold side of the cell and remove the waste items. Special shielded boxes made of concrete and steel plate were designed and constructed to provide the necessary shielding for the waste items remotely placed inside. These concrete/steel boxes were rigged onto a cart, which could be manually pushed into and pulled out of the cell, minimizing the time that the workers were exposed to the radiological doses present in the cell.

![Waste items located on the table top inside the hot side of Hot Cell 3.](image)

A remote camera was placed in Hot Cell 3 that allowed the workers better views. An AMP-100 was also placed in the cell to obtain radiological readings of all the waste items being removed to ensure the ICDF WAC limits were achieved. A metal grid was placed over the lighter waste items in the concrete/steel box to prevent them from floating during the subsequent grouting. The waste boxes were grouted in-cell (cold side) prior to being removed. Once removed from the cell, the grouted concrete/steel waste boxes could be placed into Department of Transportation-compliant containers and grouted, if necessary, to further reduce the radiological dose to acceptable transportation levels. The waste items then were transported to ICDF for disposal.
Grout being pumped into a loaded concrete/steel box.

Workers rigging the concrete/steel waste box into a Department of Transportation-compliant TX-4 box.

A satellite accumulation area containing RCRA-hazardous and Toxic Substances Control Act (TSCA)-regulated waste also was located inside Hot Cell 3. The RCRA/TSCA-regulated waste items were removed and treated in a similar manner as the low-level waste items described previously.
However, the RCRA/TSCA-regulated waste was disposed of at a permitted disposal facility off the INL Site. The treatment and removal of these RCRA/TSCA-regulated waste items were specifically excluded from the Action Memorandum and are not addressed further in this RAR.

Once all the waste items had been removed from the top of the table located in the hot side of Hot Cell 3, an aluminum plate was moved that covered a U-shaped notch in the table that allowed items to be moved from the charging port into or out of Hot Cell 3. A canister reading 22,700 R/hr was discovered in this U-shaped notch. Documentation was obtained confirming that this canister was holding unprocessable cobalt (Co-60) targets. The canister was removed from Hot Cell 3 and loaded into the white elephant transport cask, overpacked into a Department of Transportation-compliant CO-225 waste box, and transported to ICDF for disposal.

Once all the waste items had been removed from the table top, all the waste that had accumulated underneath the table since the cell became operational in the early 1960s had to be removed. The ANDROS, a remote robot, was utilized to remove the waste from under the tables. A vacuum system was used to remove the loose waste items. All the waste removed from under the table was containerized and transported to ICDF for disposal.
White elephant transport cask containing the 22,700-R/hr canister.

ANDROS remote robot and worker remotely operating ANDROS to remove waste from cell floor.

Vacuums were used to remove the loose waste items.
Demolition of Hot Cell 3

RCRA-hazardous materials, which included sodium-vapor light bulbs and lead in the form of manipulators, shield glass, plugs, counter weights, and shielding, were removed from Hot Cell 3 and disposed of at a permitted disposal facility off the INL Site. The interior surfaces of the cell were sprayed with a polymeric coating for radiological contamination control. The resulting radiological dose remaining inside Hot Cell 3 supported open air demolition. Heavy equipment was used to demolish Hot Cell 3, and the debris was loaded into heavy duty dump trucks or containers for disposal at ICDF. The entire cell was removed, including 1–2 ft of soil underneath Hot Cell 3. These removed materials were classified as CERCLA low-level waste, along with the other debris generated from the D&D of TRA-632, and disposed of in the ICDF landfill.

Photographs of the demolition of Hot Cell 3.

Building Slab End State
Portions of the building slab were cut using a 40-in. circular concrete saw to remove the concrete and underlying soils to access the TRA-632 drain pipes, which were removed as part of the VCO. Removed sections of building slab and soils were disposed of at ICDF on the INL Site. Once the drain lines had been removed and soil samples collected, clean fill was brought in to fill the trenches that were cut into the building slab. In areas where heavy equipment was utilized, the trenches also were filled with grout to ensure a smooth working surface. Then the TRA-632 Building was demolished to the top of the slab.

The three hot cells, which extended below the building slab, were removed in their entirety. In order to ensure that residual radiological contamination associated with the demolition debris had been removed, approximately 1 to 2 ft of soil below the bottom of the three hot cells was also removed. The removed materials were classified as CERCLA low-level waste, along with the other debris generated from the D&D of TRA-632, and disposed of in the ICDF landfill.

Contamination was identified at the bottom of the excavations. Although the NTCRA scope did not include addressing soil contamination, while the excavation was open, the remaining soils were sampled as a matter of convenience to provide initial information to the Idaho Cleanup Project CERCLA Program for the preparation of the New Site Identification Form for the area. The hot cell excavations then were backfilled with clean fill from the Monroe pit (an INL approved borrow source for clean fill material). Approximately 1 to 2 ft of clean fill was brought in to cover the TRA-632 Building slab. The area was graded and rolled to stabilize the surface area over the TRA-632 Building slab.

Portions of the TRA-632 Building slab removed to access TRA-632 drain piping and resulting trench filled with clean gravel.
Removing Voluntary Consent Order drain pipes and soils from under the TRA-632 Hot Cells.

Methods of execution:
*Management:* The scope was planned, managed, and executed as a single element. Management included technical and project oversight, planning, project controls, and quality assurance.

*Regulatory:* An EECA was prepared to determine the appropriate disposition alternatives.

*Physical Approach:*
- Initial characterization, and planning using detailed work packages
- Removal of hot cell internals and accumulated waste
- Removal of equipment - manually removed process equipment using various contamination containment approaches and using hand-held power-tools.
- Stabilization of hot cells prior to either intact post-demolition removal or individual open-air demolition after the building was demolished.
- Abatement of asbestos from all sources
- Conventional demolition and loadout of remaining structure; less-contaminated equipment was size reduced as part of the building
- Follow-on removal of Hot Cell #1 intact to the on-site CERCLA landfill
- Demolition of the Hot Cell #2 and Hot Cell #3 in place.
- Removal of below-slab lines, tanks, and other below-grade materials and some adjacent soil
- Backfill of excavated areas

*Technologies:* Normal D&D approaches for manual removals and demolition, although special care for demolition of highly-contaminated concrete. Bracing of wall prior to demolition to avoid impact on adjacent operating facility. Use of robots, special cameras, manipulators, vacuums, and other equipment to address work in high-rad hot-cell cavities and removal of extremely high-rad waste.
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, and hot cell demolition.
- Waste management and disposal
- Used significant professional services contracted (i.e., seconded) labor inter-mixed with prime contractor staff

Activities subcontracted:
- Characterization of surfaces prior to demolition, and sample analysis
- Waste treatment of mixed wastes (on-site and off-site)
- Demolition of structures

Issues that impacted the project:
- None; no “anomalies” were identified.

Scope Growth:
None identified.

Notes Regarding Use of Data
Although removal of below-grade structures was performed, below-grade soil remediation was not completed to cleanup standards.