

**FIXED-PRICE SUBCONTRACTING FOR
DECONTAMINATION AND DECOMMISSIONING
OF SMALL FACILITIES
AT OAK RIDGE NATIONAL LABORATORY***

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ABSTRACT

Abandoned facilities were decontaminated and decommissioned in preparation for final remediation of Solid Waste Storage Area (SWSA) 4 at Oak Ridge National Laboratory. The facilities varied in age from approximately 5 years to more than 40 years, with radiological conditions ranging from clean to highly contaminated with fission products.

A fixed-price subcontract (FPSC) was awarded by the U.S. Department of Energy's (DOE's) Environmental Management (EM) Management and Integration (M&I) contractor for decontamination and decommissioning (D&D) of these facilities. Included in the FPSC scope were the following:

- preparation of pre-D&D regulatory documentation,
- demolition of surface structures to slab,
- stabilization of below-grade structures,
- waste management and disposal, and
- preparation of post-D&D regulatory documentation.

Using stand-off techniques to the extent possible, building structures and ancillary equipment were prepared for demolition and demolished. A fixative coating system was used in conjunction with continuous water misting to control airborne contamination.

Demolition waste consisted of two major streams: clean construction and demolition waste and low-level (radioactive) waste. The debris was size-reduced and packaged, again via remote means.

At all times during the D&D, personnel safety, environmental compliance, and as low as reasonably achievable exposure considerations were paramount.

Upon completion of D&D activities, each site was inspected and accepted by the M&I contractor. This project is a success story for fixed-price subcontracting of D&D work under DOE's M&I arrangement.

INTRODUCTION

Oak Ridge National Laboratory (ORNL) has been a leader in nuclear technologies development for more than 50 years. As national needs and missions have changed, a diverse legacy of radiologically contaminated facilities has evolved across the laboratory. These facilities are now being remediated under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) by Bechtel Jacobs Company LLC (BJC) as part of the Oak Ridge Environmental Management (EM) Management and Integration (M&I) program (1). ORNL consists of two watersheds: Melton Valley and Bethel Valley. Separate Records Of Decision (RODs) define the selected remedial actions for each watershed. As proposed in the Melton Valley Watershed ROD, the selected cleanup alternative for ORNL's Solid Waste Storage Area (SWSA) 4 includes installation of a multilayer engineered cap. Prior to cap construction, a number of small inactive facilities were demolished. Demolition of these facilities was the first action performed under the Melton Valley Watershed ROD at ORNL (2).

METHOD OF ACCOMPLISHMENT

BJC is responsible for M&I of the U.S. Department of Energy (DOE) EM program at the five sites that comprise DOE's Oak Ridge Operations. To achieve this mission, BJC has committed to perform more than 90% of EM work using fixed-price subcontracts (FPSCs) awarded to qualified specialty-service contractors.

Work scope for conducting fixed-price decontamination and decommissioning (D&D) at ORNL typically requires the subcontractor to:

- **Prepare pre-D&D documentation.** For D&D work under CERCLA, planning documents are prepared and submitted for regulator approval prior to initiating field work.
- **Conduct D&D field activities.** Most often, this includes demolition-to-slab of surface structures and stabilization of below-grade structures.
- **Manage waste.** D&D subcontractors are responsible for characterizing, packaging, shipping, and disposing all waste generated during a D&D project.
- **Prepare post-D&D documents.** Reports documenting the work and final site configurations are prepared for regulator review and approval upon completion of field activities.

The above process is essentially the D&D equivalent of a "design/build" construction arrangement.

SUBCONTRACTOR SELECTION

To procure fixed-price subcontractor services for D&D work at ORNL, BJC uses an existing Master Task Agreement (MTA) for remedial actions/decontamination and decommissioning (RA/DD). Under the RA/DD MTA, four pre-qualified specialty subcontractors are available for RA/DD work. Requests-for-proposals for specific work packages are prepared by BJC and provided to these subcontractors for competitive bid. Because each bidder already has been determined capable of safely performing the work, proposal evaluation is focused on the cost/technical approach that provides the best overall value to DOE for the identified work scope.

SWSA 4 SMALL FACILITIES D&D

In May 2000, a FPSC was awarded to DEMCO, Inc., under the RA/DD MTA for demolition of the following three small facilities located in the Melton Valley area of ORNL:

1. Alpha Greenhouse (Building 7833)
2. Pilot Pit Facility (Building 7811)
3. Decontamination Facility (Building 7819)

Demolition of another structure, the In-situ Vitrification (ISV) system, was added to DEMCO's FPSC after field work was under way. Each of these facilities was located in SWSA 4, an area destined to be covered with an engineered multilayer cap.

DEMCO's work scope consisted of preparing pre-D&D regulatory documentation, D&D of the facilities, managing all generated wastes to the point of disposal, and preparing post-D&D regulatory documentation.

Safety and Ecology Corporation, BJC's radiation protection subcontractor at ORNL, provided radiation protection services to DEMCO for the project.

PRE-D&D REGULATORY DOCUMENTATION

Demolition of the SWSA 4 Small Facilities was addressed as a discrete action in the Melton Valley ROD; therefore, planning documents for U.S. Environmental Protection Agency (EPA) and Tennessee Department of Environment and Conservation (TDEC) review and approval were required prior to initiating D&D field work. To meet this requirement, DEMCO prepared a combined Remedial Design Report/Remedial Action Work Plan (RDR/RAWP) describing the D&D actions to be taken and how those actions would be accomplished (3). This document was submitted to the EPA and TDEC in accordance with established protocol contained in Appendix E of the Federal Facility Agreement for the Oak Ridge Reservation (4).

D&D OF SWSA 4 SMALL FACILITIES

Alpha Greenhouse

The Alpha Greenhouse, Building 7833, was an abandoned facility located in an open field adjacent to SWSA 4 waste burial grounds. While no written information had been located documenting the historical uses of this facility, discussions with retired ORNL personnel indicated that studies may have been performed in the greenhouse to determine plant uptake of alpha-emitting radionuclides such as plutonium and americium.

Constructed in the mid-1970s, the facility was a 14 by 37-ft aluminum frame and glass greenhouse structure erected on a 4-ft concrete block wall on slab. No utilities beyond electrical service existed at the building.

Pre-demolition radiological surveys revealed no removable contamination or fixed radioactivity above DOE release limits (5). Asbestos-containing materials in the form of piping insulation and stored transite panels were present within the building, as was a small heating, ventilating, and air-conditioning unit. These items were removed from the building, leaving a virtually clean structure for conventional demolition.

A Caterpillar 325 excavator outfitted with a concrete pulverizing tool was used to demolish and size-reduce the structure. Frame sections were placed in a roll-off waste container as they were sectioned and removed. Under a continuous water mist, the masonry sidewalls were demolished, size-reduced, and left adjacent to the building slab to ultimately be covered by an engineered cap (6).



Fig. 1. Alpha Greenhouse.

All non-masonry demolition debris was determined to meet the waste acceptance criteria for disposal at the clean construction and demolition landfill located at the Y-12 National Security Complex in Oak Ridge. One 20-ft roll-off waste container was generated as a result of Building 7833 demolition.

Pilot Pit Facility

The Pilot Pit Facility, Building 7811 and surrounds, was designed and constructed in the late 1950s for use as an experimental facility for self-sintering of radioactive waste. However, the planned experiment using radwaste at the facility was abandoned when hot cell testing results indicated potential problems with the process (7). Following cancellation of the sintering experiment, there is no documented evidence that the building structure or pit were used for anything other than storage of tools and equipment, some of which were radiologically contaminated.



Fig. 2. Pilot Pit Facility.

The key feature of the Pilot Pit Facility was a shielded below-grade containment vessel containing a sintering furnace and mixing assembly. The vessel was covered by a 5-ft-thick concrete shield plug with access hatch, and surrounded by a mound of asphalt-covered soil. The asphalt/soil mound was maintained on three sides with concrete walls. Adjacent to one wall was Building 7811, a concrete block building on slab with a maximum footprint of 16 by 21 ft, designed as the control house for the pit experiment. A below-grade off-gas cleaning system was housed in concrete culverts placed vertically in the ground

about 50 ft away from the sintering pit. Co-located at the Pilot Pit Facility site were four 12-ft tall vertical concrete lysimeters on concrete bases. These structures were used in 1984 for municipal waste leaching studies.

Radiological surveys were conducted on miscellaneous items stored inside Building 7811, as well as the building structure itself. Visual indications of a legacy spill on the building floor were confirmed when contact dose rates up to 210 mrad/h beta and 3 mR/h gamma on contact with floor slab were discovered. This area of the floor also contained low levels of removable contamination. Surveys of the lysimeters, off-gas system, and sintering pit revealed no additional radiological conditions. Non-friable asbestos-containing material was detected in the built-up roofing system of Building 7811.

The four concrete lysimeters were the first structures to be demolished at the Pilot Pit Facility using a Caterpillar 325 track hoe with concrete pulverizer. The lysimeters were pushed over and the waste from the 1984 experiment was separated out and placed in an open-top roll-off waste container pending disposal at the nearby Y-12 Sanitary Landfill. The remaining concrete lysimeter structures were crushed and left on-site.

Building 7811 was demolished to slab using the trackhoe in conjunction with a Bobcat-mounted hoe-ram attachment. All non-masonry debris was managed as clean construction and demolition (C&D) waste. Masonry debris was size-reduced and spread on-site with the exception of a number of concrete blocks found to contain radiologically contaminated mud dauber nests. These blocks were handled as low-level (radioactive) waste (LLW). The portion of the building slab having elevated levels of radiological activity was cleaned of transferable contamination and covered with several inches of new concrete.

Below-grade structures at the facility (off-gas cleaning system and sintering pit) were exposed by removing the concrete covers. Equipment from these structures was removed and the pits were filled with the size-reduced clean masonry rubble generated from demolition of the above-grade structures.

Three waste streams were generated during demolition of the Pilot Pit Facility: sanitary waste (one roll-off container), clean C&D debris (one roll-off container), and LLW (less than one intermodal container).

Decontamination Facility

The Decontamination Facility (Building 7819) was constructed in the early 1960s to provide a facility for decontaminating equipment and materials from ORNL's laboratories and hot cells. Decontamination processes in the building included acid baths and abrasive blasting. Activities were halted in 1971 due to concerns about the environmental impact of the large volumes of liquid wastes generated and potential contaminant migration from the facility. All utilities had been isolated from the facility shortly after process termination



Fig. 3. Decontamination Facility.

The building consisted of a steel frame with insulated, corrugated metal roof and side panels on a 48 by 33-ft concrete floor slab. A 6-ft-deep decontamination pit was constructed below the slab. The building contained a small change room/office area constructed of concrete block walls. Floor gravity drains conveyed liquid rad waste to an adjacent waste disposal pit (Pit 1). Equipment remaining in the building included an overhead monorail hoist, decontamination vessel, welding hood, and milling machine. The facility had no process ventilation system. Exterior to the building were a number miscellaneous concrete pads and tank support structures.

Due to the nature of processes conducted in the building, a variety of radiological contaminants were present in different configurations. Pre-demolition characterization data indicated that the building was grossly contaminated with beta and gamma emitters (primarily Sr-90, Cs-137, and Co-60), with localized spots of high contamination. Some alpha contamination was also present. The entire building was posted as an airborne contamination zone, radiation zone, and contamination area. General area dose rates within the building ranged up to 10 mR/h. Contact dose rates, particularly on equipment in the building, were

substantially higher. In addition to radiological constituents, asbestos pipe insulation was present in the building (8).

The first D&D task at the Decontamination Facility was abatement of radiologically contaminated asbestos pipe insulation. The entire interior of the building and its contents were coated with a spray-applied fixative to lock-down transferable surface contamination. No attempt was made to decontaminate equipment items in the building. Instead, all equipment was managed as LLW and placed in intermodal containers for shipment to an off-site, licensed disposal facility.

Demolition of the building structure was accomplished using a Caterpillar 325 track hoe with a hydraulic shear. An experienced operator carefully peeled the roof and side panels from the structural steel framework, placed the removed sections into an intermodal waste box, and size-reduced the sections as necessary using the shear. Demolition and size reduction of the framework proceeded in the same manner.

Once accessible, the concrete block room was demolished with the shear. Because the block did not exhibit elevated levels of radioactivity, it was size-reduced and placed in the building decontamination pit as a means of stabilizing the below-grade structure. The remaining slab was cleaned of all loose material and coated with fixative. All other debris generated from Building 7819 demolition was managed as LLW. Eight 20-ft intermodal waste containers from Building 7819 were packaged for transport to and disposal at Envirocare of Utah.

In-situ Vitrification System Structure

In-situ Vitrification (ISV), a technology designed to minimize leaching of soil contaminants into groundwater, was demonstrated at a liquid low-level radioactive waste disposal pit (Pit 1) in SWSA 4. Graphite electrodes were inserted into the Pit 1 contaminated soil and energized, resulting in electrical resistance heating of the soil until it melted into a molten pool. The molten pool would then cool over time and harden into glass, thus stabilizing the contaminated soils. In 1996, a fire caused by an upheaval of steam and molten glass on and around the off-gas collection hood occurred at the demonstration site. Following this event, the ISV system was secured and abandoned in-place (9).



Fig. 4. In-situ Vitrification Hood System Structure.

The ISV system structure consisted of a 50 x 50 x 6-ft-high off-gas collection hood fabricated from over 200 separate stainless steel panels. The hood, which contacted the ground during operations, was suspended from a large framework structure using shackles and chain. The tubular steel framework provided support for all the components that comprised the ISV hood system. Flanged plates having either bolted fasteners or clevis ends with pin fasteners were used to join the members. Tensioning members used to truss the structure consisted

of steel cable and turnbuckles. The structure also contained a travel system that allowed it to be moved and steered by four geared wheel assemblies under its own power (10).

Surveys of the ISV system revealed few areas of slightly elevated radiological activity. Because of the benign condition of the structure, regulators agreed that in-place disassembly of the system, which was to be covered later by the SWSA 4 engineered cap, was an acceptable D&D solution. Initially, all

mechanical components that contained hydraulic fluids were removed. The ISV structure was then demolished in-place using a Caterpillar 325 with a hydraulic sheer attachment. The demolition debris was size-reduced and placed in a single layer so that the height of any single piece was not greater than 18 inches. Individual pieces of debris with enclosed void spaces greater than 8 inches were crushed. The debris was left in-place to be covered by the SWSA 4 cap.

POST-D&D REGULATORY DOCUMENTATION

The Melton Valley ROD requires the preparation of a Remedial Action Report upon final completion of ROD actions. As elements of the ROD are incrementally completed, Phased Construction Completion Reports (PCCRs) are prepared and submitted to the regulatory agencies. A PCCR for D&D of the SWSA 4 small facilities was prepared by DEMCO and submitted for EPA and TDEC review and approval. The PCCR documents the field work and describes the post-D&D configuration of the SWSA 4 small facility sites (6).

SUMMARY

Fixed-price subcontracting was successfully used to safely complete D&D of four small facilities located in ORNL's SWSA 4 in preparation for installing an engineered cap. As the first action under the Melton Valley Watershed ROD, the project was completed within baseline cost and schedule, and all regulatory commitments were met. No Occupational Health and Safety Act recordable or first aid cases occurred in over 8000 man-hours of effort. All personnel exposures were maintained as low as reasonably achievable.

REFERENCES

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FOOTNOTE

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