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DECOMMISSIONING THE PHYSICS LABORATORY, BUILDING 777-10A, AT THE SAVANNAH RIVER SITE (SRS)

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SRS recently completed a four-year mission to decommission ~250 excess facilities. As part of that effort, SRS decommissioned a 48,000 ft^2 laboratory that housed four low-power test reactors, formerly used by SRS to determine reactor physics. This paper describes and reviews the decommissioning, with a focus on component segmentation and handling (i.e. hazardous material removal, demolition, and waste handling). The paper is intended to be a resource for engineers, planners, and project managers who face similar decommissioning challenges.

I. INTRODUCTION

SRS recently completed a four-year effort to decommission approximately 250 excess facilities. This effort included the Physics Laboratory, Building 777-10A. Completed in March 2006, its decommissioning was the last in a series of decommissioning projects that prepared the lower A/M-Area for SRS's environmental restoration program. The decommissioning also marked the completion of a relatively complex and difficult decommissioning project undertaken at SRS.

II. BACKGROUND

Building 777-10A, located at the south end of SRS's A/M-Area, was built in 1953 and had a gross area of ~48,000 ft^2. Building 777-10A had two main areas: a west wing, which housed four experimental reactors and associated equipment; and an east wing, which housed laboratories, shops and offices. The reactors were located in two separate areas: one area housed the Process Development Pile (PDP) reactor and the Lattice Test Reactor (LTR), while the second area housed the Standard Pile (SP) and the Sub-critical Experiment (SE) reactors. See Figure 1 for a building photo and see Figure 2 for a building cross-section.

The west wing had six levels: three below and three above grade (floor elevations of -37', -28', -15', 0', +13'/+16' and +27' (roof elevation of +62')), while the east wing had two levels: one below and one above grade (floor elevations of -15' and 0' (roof elevation of +16')). Below-grade exterior walls were constructed of reinforced concrete, ~1' thick. In general, above-grade exterior walls were steel frames covered by insulation and corrugated, asbestos-cement board. The two interior walls around the PDP/LTR were reinforced concrete ~5' thick and ~30' high, while the SP/SE reactors resided in a reinforced concrete cell with 3.5'-6' thick walls/roof. All other interior walls were constructed of metal studs covered with either asbestos-cement or gypsum board. In general, the floors were constructed of reinforced concrete on cast-in-place concrete beams below grade and concrete on metal beams above grade. The roofs were flat concrete slabs on metal beams.

FIGURE 1 – Building 777-10A

Building 777-10A was an important SRS research and development location. The reactors helped determine safe operational limits and loading patterns for fuel used in the SRS production reactors, and supported various low-power reactor physics studies. All four reactors were shut down and de-inventoried in the 1970's. The building was subsequently used by various SRS organizations for office space, an audio/visual studio, and a computer network hub.

III. DISCUSSION

III.A. Overall Strategy and Schedule

SRS's demolition strategy was to minimize manual dismantlement and removal (D&R) and maximize heavy equipment use (e.g. excavator with shear attachment). Heavy equipment use was preferred because it distanced personnel from fall hazards and negated hazards associated with hand tools and rigging of components. Some manual D&R could not be avoided. Building 777-10A was radiologically and chemically contaminated due to past operations. Additionally, the building contained various hazardous materials of construction. To prevent their dispersion during heavy equipment demolition, SRS decided early in the decommissioning planning process to first remove (or to stabilize) the contaminants and hazardous materials.

Most of the west wing exceeded 40', the maximum working height for SRS's heavy equipment. Building 777-10A also had relatively weak below-grade walls, which prevented soil loading (i.e. placement of heavy equipment) at the basement rim. (See Figure 3 for a layout of the building along with standoff distances.) Due to lack of reach, available SRS equipment alone could not perform the needed demolition. To reduce the building's height, SRS considered explosives and pullover. For various reasons, SRS decided to lease a long-reach excavator with a shear attachment: a modified John Deere excavator (Model JD 750) outfitted with a special three-piece boom/arm giving a ~50' horizontal and ~100' vertical reach. The thick concrete walls also exceeded the capability of SRS's heavy equipment. For their demolition, SRS leased a Komatsu excavator (Model PC750) with a large (6") diameter hydraulic ram.

The project took approximately 30 months (June 2004 to March 2006). Early tasks included characterization, planning, and regulatory approval. Actual field work (i.e. deactivation) began in earnest in early 2005 and continued through November 2005. Demolition occurred from November 2005 through February 2006, followed by final filling in March 2006.

III.B. Preparation for Demolition (I.e. Deactivation)

Using primarily hand tools for segmentation/decontamination and man lifts/scaffolds for access, SRS removed contaminants and hazardous materials throughout the building. This removal addressed the following components and/or contaminants:

- Contaminated ductwork, piping, vessels, floors, and sumps
- Fluorescent/incandescent bulbs
- Lead-acid batteries
- Mercury switches/thermometers
- PCB ballasts/paints
- Beryllium
- Brass valves/fittings
- Oil-filled elevator hydraulic cylinder
- Asbestos siding, panels, insulation, tiles and mastic

Due to their inaccessible location, some contaminants were stabilized and/or protected, left in place, and recovered after/during demolition. As an example, this approach was applied to the four stainless steel reactor vessels. Because of their size, location and materials of construction, they could not be easily segmented and removed from the building. Instead, the four vessels were sealed, protected and pre-rigged so as to (during demolition) prevent dispersion of contaminants and allow their recovery.

The building's below-grade spaces housed equipment that was unsuitable fill. To access this equipment during demolition, SRS would need to remove the 0' elevation floor using heavy equipment positioned on the -15' elevation floor. To allow safe travel at this elevation, SRS filled all spaces below the -15 elevation with a low-strength grout (~2,700 yd^3 of fill).

III.C. Facility Demolition

Facility demolition occurred in two primary phases: the east wing first, followed by the more difficult and taller west wing. Throughout both phases, standoff distances (see Figure 3) limited equipment position. The standoffs and limited equipment reach forced SRS to install ramps and to partially fill the basement during the demolition. The ramps and partial fill provided a platform for the heavy equipment to reach all parts of the building.

SRS used the following general steps to demolish the building [1]:

Demolish East Wing

1. Demolish above-grade structure
2. Build ramp to -15' elevation on east side
3. Working east-to-west on partial basement fill (and maintaining internal stand offs), demolish 0' elevation floor, and remove equipment

Demolish West Wing

4. Demolish above-grade structure to extent practice, leaving above-grade concrete walls/cell in place
5. Build ramp to -15' elevation on west side
6. Remove PDP and LTR tanks
7. Working on fill and -15' concrete floor (and maintaining internal stand offs), demolish 0' elevation floor to south/west of shield wall, and remove equipment
8. Working on partial basement fill (and maintaining internal stand offs), demolish 0' elevation floor to east of shield wall, and remove equipment (This step and next, use ramp at east end of east wing to access this area.)
9. Working on partial basement fill (and maintaining internal stand offs), demolish 0' elevation floor to north of shield wall, and remove equipment
10. Build ramp to -15' elevation on north side
11. Partially demolish the SP/SE cell, remove reactors
12. Use hydraulic ram to demolish the above-grade concrete walls

III.D. Final Fill

Post demolition, the building's below-grade spaces were partially filled (to approximate elevation of -9') with a tangle of concrete rubble, rebar, coarse gravel and crusher run. Heavy equipment traffic had compacted this fill to some degree; however, the absence of a flat unobstructed surface prevented adequate compaction of the fill. As a result, SRS overfilled the basement, forming a three foot tall berm over the entire building footprint. The added fill was compacted manually or by machine to the extent practical. Weathering over the past year has made little impact on the berm's height or flatness.

IV. CONCLUSIONS

SRS successfully deactivated and decommissioned Building 777-10A over a thirty-month period at a cost of ~$13M (~$290/ft^2). The effort was complex and difficult due to the building's radiological contamination, height, extensive basement and thick concrete walls. Extensive planning and extensive hazard analysis (e.g. of structural loads/modifications leading to unplanned collapse) ensured the deactivation and decommissioning was completed safely and without incident. The project met contract standards for residual contamination and physical/chemical hazards, and was the last in a series of projects that prepared the lower A/M-Area for SRS's environmental restoration program.

REFERENCES

1. W. E. AUSTIN, J. L. COPE and A. L. MECKLEY, “Demolition Plan for Building 777-10A,” SRS Document No. V-PMP-A-00042, Revision 2, 12/8/05.

2. J. L. COPE, “Decommissioning Project Final Report, 777-10A, Site Utilities Office Facility (Physics Assembly Laboratory),” SRS Document No. V-PCOR-A-00054, Revision 1, 5/4/06.

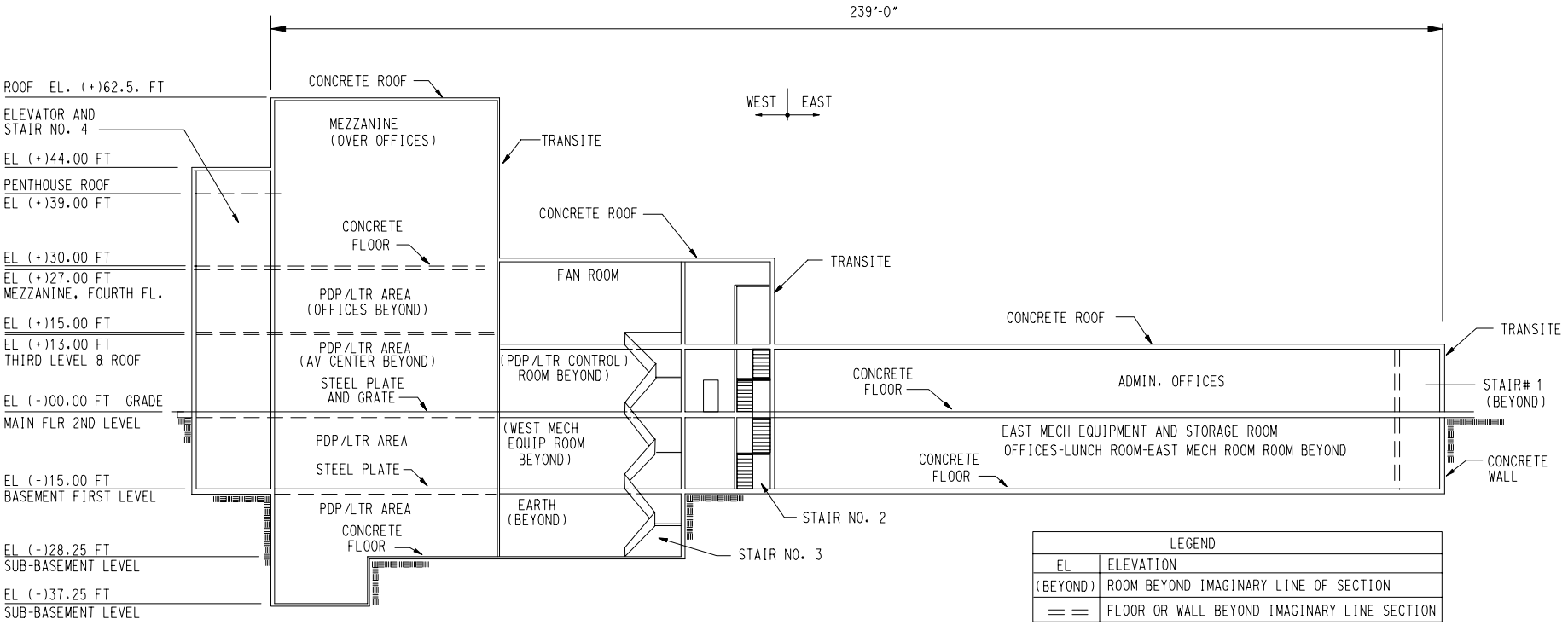

Figure 2 - Longitudinal Cross-Section of Building 777-10A
Looking North
(not to scale)

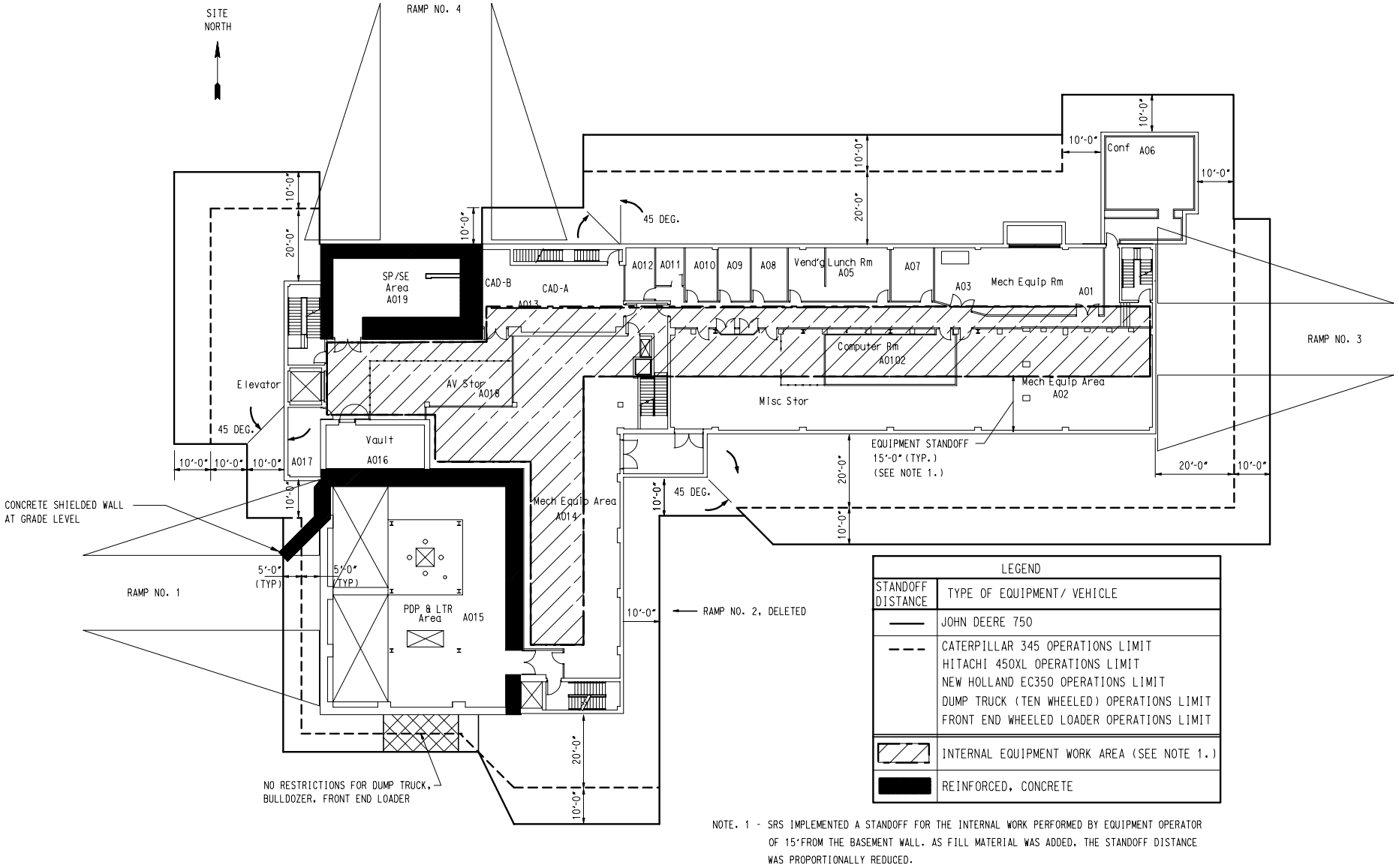

Figure 3 - Layout of Building 777-10A, (-)15'Elevation
(not to scale)