

ORNL Soils Remediation and Slabs Removal – The Bridge from D&D to Redevelopment -
12342

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ABSTRACT

The landscape of the Oak Ridge National Laboratory (ORNL) has dramatically changed over the past 2 years with demolition of aging facilities in the Central Campus. Removal of these infrastructure legacies was possible due to an influx of DOE-Environmental Management funding through the American Recovery and Reinvestment Act of 2009 (ARRA). Facility D&D traditionally removes everything down to the building slab, and the Soils and Sediments Program is responsible for slabs, below-grade footers and sub-grade structures, abandoned waste utilities, and soils contaminated above certain risk levels that must be removed before the site can be considered for redevelopment. DOE-EM has used a combination of base and ARRA funding to facilitate the clean-up process in ORNL's 2000 Area. Demolition of 13 buildings in the area was funded by the ARRA. Characterization of the remaining slabs, underground pipelines and soils was funded by DOE-EM base funding. Additional ARRA funding was provided for the removal of the slabs, pipelines and contaminated soils. Removal work is in progress and consists of removing and disposing of approximately 7,650 cubic meters (m³) of concrete, 2,000 m³ of debris, and 400 m³ of contaminated soil. Immediately adjacent to the 2000 Area is the Oak Ridge Science and Technology Park and the modernized ORNL western campus. The Science and Technology Park is the only private sector business and technology park located within the footprint of a national laboratory. The completion of this work will not only greatly reduce the risk to the ORNL campus occupants but also allow this much sought after space to be available for redevelopment and site reuse efforts at ORNL.

INTRODUCTION

ORNL, managed by UT-Battelle LLC (UT-B), is the Department of Energy's largest Science and Energy Laboratory. ORNL has undergone a remarkable transformation over the last 10 years with significant modernization efforts in both the east and west portions of the main Bethel Valley campus. The Central Campus area continues to blight the ORNL landscape, containing original 1940's era Manhattan Project and cold war reactors and labs and includes many excess, aging and contaminated structures, buried waste, underground liquid low-level waste tanks and pipelines, contaminated surface and subsurface water, contaminated soil and groundwater, and groundwater monitoring wells no longer needed for the groundwater monitoring program.

There is a strong push to make the ORNL Central Campus area (Figure 1) the bridge between the modernized east and west campus and the cornerstone of future ORNL redevelopment.

This will help to address ORNL's continuing need to add new laboratory and office space, upgrade existing infrastructure systems including utilities systems, and provide adequate parking for staff. The American Recovery and Reinvestment Action of 2009 (ARRA) provided a "jump start" for this Central Campus clean-up effort, allowing for the demolition of 44 facilities while reducing overall ORNL risk due to legacy environmental issues.



Figure 1 - ORNL Main Campus Viewed East to West

BACKGROUND

The 2000 Area (Figure 2), located in the Northwest quadrant of the Central Campus, is one of the first priorities for the Central Campus redevelopment due to its prime location next to the recently-constructed Science and Technology Park, the limited number of contaminated underground tanks and pipelines in the area, and minimal evidence of surface soil contamination.

The following are the descriptions and process histories of those former facilities that were the starting points for development of characterization, removal, and disposal plans.

Building 2000

Building 2000 contained bench-scale operations to produce fuel elements containing highly-enriched uranium including metal casting and fabrication equipment; laboratories for testing the mechanical, chemical, and physical properties of uranium and fuel elements; and office space. The High Bay contained metal working, melting, casting, and heat-treating equipment for uranium and thorium metal processing. This facility was used in the development of the

aluminum-clad, aluminum-uranium fuel element used in both the Materials Test Reactor and the Low Intensity Test Reactor. There were two separate below grade, concrete pits in the High Bay that contained equipment associated with these operations: an extrusion press pit and an air hammer forge pit. The extrusion press pit contained concrete pedestals for equipment base plates, and had overall dimensions of approximately 27 ft by 20 ft and a total depth up to 8 ft. The air hammer forge pit also contained concrete equipment bases, and had overall dimensions of approximately 9 ft by 16 ft and a total depth of up to 6 ft. Available information indicates equipment was removed and both pits filled in with concrete. Beryllium machining work was also done in the facility.

The building was demolished in FY-2011 with ARRA funding. The remaining slab has a network of below-grade process waste drain piping that connected to the laboratory sinks and floor drains throughout the facility. The drains were cut and capped at grade during building demolition, but remain embedded in the concrete and beneath the slab.

Building 2001

Building 2001 was originally constructed for use as Health Physics laboratories for research in electroscopes, electrometers, proportional counters, and Geiger Mueller counters; and was later used by the ORNL Environmental Sciences Division for basic research until the late 1970s. At that time, the laboratories were removed and the facility remodeled for office space that housed the Information Division Complex from the early 1980s to 1992. The building was demolished in FY-2010 with ARRA funding.

This slab also has a network of abandoned process waste drains embedded in and beneath the slab that were removed during remodeling of the facility. The remaining below-grade drains were grouted at the top of the slab. In addition, grouted source storage wells are located in the northeast portion of the slab. All sources were removed prior to grouting the storage wells. A loading dock is also located on the north side of the slab. Radionuclides and metals are the primary contaminants of concern for both the slab and sub-slab process waste drains.

Building 2010

Building 2010 was constructed in 1951 as the main cafeteria for ORNL. The building was demolished, except for a low concrete and brick retaining wall remaining along the north side of the slab. A steam pit and associated sump which served the building are located north of the slab, and were grouted in-place during building demolition. Portions of the slab and the adjacent steam pit are radiologically-contaminated, and there is the potential for radiological contamination beneath the slab although none was detected during characterization. Unique features associated with this slab include the grouted steam pit and grouted sump, the retaining wall, and a grease trap located under the building slab in the former cafeteria kitchen area. Potential contaminants of concern associated with this slab include radionuclides and metals.

Building 2011

Constructed in 1943, this facility served as the original steam plant for ORNL. Coal was stored in a below-grade pit and yard located at the northwest corner of Third Street and Central Avenue. Coal conveyors were located at the south side of the building, with a pump house on

the north side. Following the completion of a new steam plant, Building 2011 was converted to a research laboratory facility. It supported a number of activities over the years, including:

- installation of a Van de Graaf accelerator and a Cockcroft-Walton accelerator,
- support for liquid metals research and research on reactor materials of construction,
- a Shock Tube laboratory,
- neutron irradiation of small quantities of explosives
- Molten Salt Reactor Program experiments involving the use of depleted U, Th, Be, and Te

The building was demolished to grade in FY-2011 with ARRA funding. Beryllium and radiological contamination were known to be fixed under paint bonding in the building, and evidence of mercury was reported during excavation activities adjacent to the slab. This slab includes a partial basement and a grouted floor trench. The basement is posted as a radiological area, and radon build-up occurs quickly when the basement is closed. Contaminants that may be present in the slab due to past activities include radionuclides and metals.

Building 2016

Building 2016, which was constructed in 1950 as the "West Portal", once housed time clocks and clock alleys but was most recently associated with the Laboratory Protection Division. Building 2016 provided office and training facilities for laboratory protective forces, and was also used for reloading small arms ammunition. The building was demolished during an earlier ORNL maintenance activity. This slab has no unique features, and no radiological or chemical contamination is known to be associated with historical activities at the facility. However, surface soils and sediments immediately adjacent to the slab are radiologically-contaminated due to upwelling from the Corehole 8 plume. As a result, radiological contamination may be present on the underside of the slab, and radionuclides are a potential contaminant of concern for this slab.

Building 2017

Built in 1949, Building 2017 was an ancillary facility to Building 2011. It was originally constructed to house an emergency backup power generator for Building 2011. In 1975 the generator was removed and the facility was put into use as the East Research Services Satellite Shop. Beryllium contamination was known to be present, and fixed radiological contamination was present on the walls, door, ceiling and floor of the building prior to being demolished in FY-2011 as part of an ARRA-funded project. This slab has no unique features. Radionuclides and beryllium are potential contaminants of concern for slab demolition.

Building 2018

This facility served in several different maintenance functions including housing carpenters, machinists, and electricians prior to the building being demolished to the slab in FY-2011 as part of an ARRA-funded project. A storage pad, located adjacent to the North side, is associated with this slab. Three used oil tanks were present on the storage pad. Radiological contamination has been detected in isolated spots on the floor of the facility, and PCBs are present in the concrete, likely due to leaks or spills from electrical equipment in the facility and from used oil storage on the storage pad.

Building 2024

Building 2024 was originally constructed as an annex to Building 2000 and was demolished with Building 2001. The original footprint was expanded in the 1950s, and the building was used by the Solid State Division for laboratories and as office space by multiple ORNL organizations. Associated with this slab are below-grade process waste drain piping and a sub-slab electrical equipment pit. The electrical pit, with dimensions of approximately 4 ft by 4 ft, was previously radiologically posted and is now filled with concrete. Radiological contamination may be present on the underside of the slab and/or in the pit. Metals and PCBs are also contaminants of concern.

Building 2034

The Building 2034 Manhole Monitoring Building was a small (approximately 64 ft²), metal-sided structure installed in 1996, to monitor beta and gamma radiation as well as flow into the main process waste drain line from the 2000 Area. The building contained a lead pig, instrument racks, and associated equipment for monitoring and data transmission. The equipment was removed and the building was demolished in FY-2010 as part of an ARRA-funded project. The slab contains an embedded and below-grade sampling line from the process waste manhole, and radiological contamination is suspected on the underside of the slab.

Building 2087, 2088, and 2092

Buildings 2087, 2088, and 2092 were each small facilities located adjacent to the south wall of Building 2000 and were used for utility service and storage. Building 2087 and 2088 were constructed in 1957 and

Building 2092 was constructed in 1959. All three buildings were shutdown in 2002 and demolished in FY-2010 with Building 2001. There are no unique features associated with any of these slabs. Although no detected radiological contamination is present on upper surface of these slabs, radiological contamination may be present on the underside due their proximity to Building 2000 and the associated drain lines. Metals are the only chemical contaminant associated with these slabs.

Of the remaining buildings, two (2007, 2008) have long term ORNL mission support needs, two (2026, 2099) are in long term surveillance and maintenance awaiting funding for D&D and one is currently in use supporting surveillance and maintenance activities (2101).

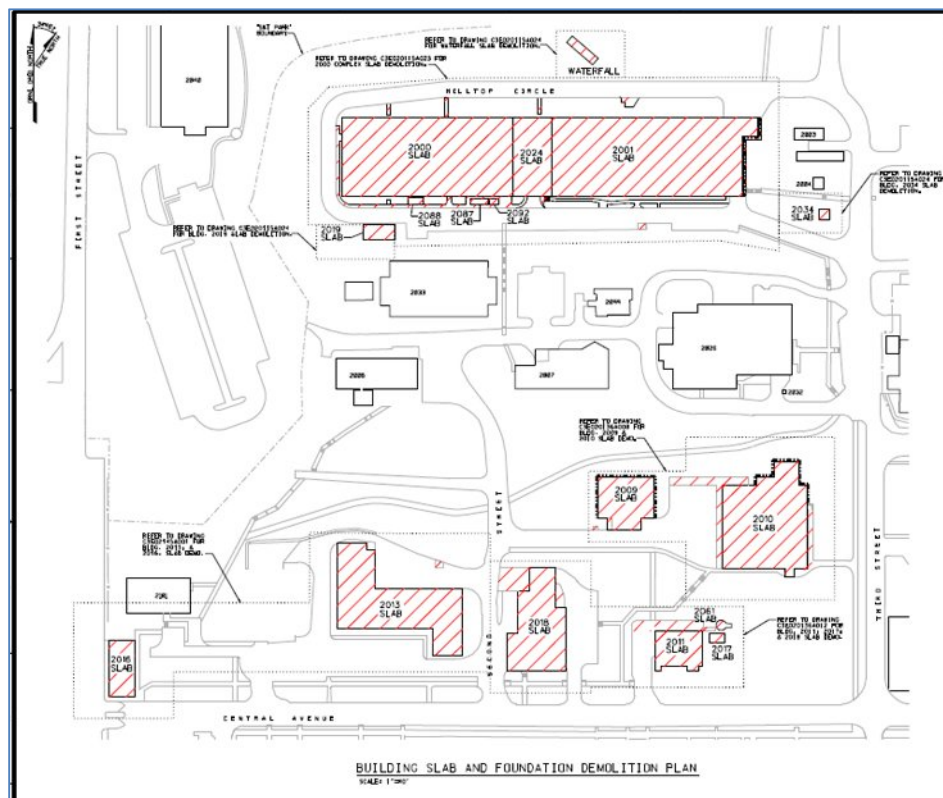


Figure 2 - Location of 2000 area slabs at ORNL and Slabs Planned for Removal (in red)

WASTE MANAGEMENT STRATEGY

Process knowledge formed the basis of the initial waste management strategy to maximize the use of the on-site waste disposal cells. Non-radiologically contaminated concrete was planned for disposal at the DOE Oak Ridge Reservation (ORR) Y-12 Disposal Cell and the contaminated concrete debris and process waste lines were planned for disposal at the DOE-ORR CERCLA Cell, the Environmental Management Waste Management Facility (EMWMF). Contaminated soils are planned for disposal at the Nevada National Security Site (NNSS) under a new site-wide waste soil profile or at the EMWMF depending on volumes. .

Characterization Approach

The characterization of the soils and slabs in the 2000 Area built upon the ongoing DOE-EM funded Soils and Sediments Program. In 2008 the *Remedial Design Report/Remedial Action Work Plan for Soils, Sediments, and Dynamic Characterization Strategy for Bethel Valley, Oak Ridge Tennessee* (DOE/OR/01-2378&D5) was issued. The Remedial Design Report/Remedial Action Work Plan (RDR/RAWP) addresses the characterization activities to define soils and sediments remedial actions as described in the *Record of Decision for Interim Remedial Actions in Bethel Valley, Oak Ridge, Tennessee* (DOE 2002) (BV ROD). The primary objective of the

RDR/RAWP is to define the scope of remediation work to be performed, identify the controls that will be implemented to protect workers and the environment, and describe the methods to accomplish the work. The RDR/RAWP also addresses the BV ROD requirements to develop a soil characterization strategy for use in obtaining additional data to address the identified data gaps.

The soil characterization strategy was based on EPA's QA-G4, *Guidance on Systematic Planning Using the Data Quality Objective Process* (DQO), dated February 2006. The DQO process evaluates existing characterization data and process knowledge and identifies potential data gaps. The data gathering process for the 2000 Area soils began in early 2009 and the DQO session for the Soils RDR/RAWP characterization work was held in November 2009.

Because low levels of contamination were found during the demolition of the buildings, and the project was conducted as a CERCLA action, the contaminated slab wastes were eligible for disposal at the Environmental Management Waste Management Facility (EMWMF). To meet the CERCLA requirements a Waste Handling Plan which included a Sampling and Analysis Plan (SAP) for waste characterization was needed. Similar to the process used for the characterization of the soils, DQOs were developed to evaluate the existing characterization data and process knowledge and to identify any data gaps. The DQO session for characterization of the slabs as well as additional waste characterization that would be required for disposal of soils from remedial actions was held in August 2010. A combined WHP/SAP was developed that incorporated both the soil and slab waste characterization sampling requirement and was issued January 2011 and approved in April, 2011.

Based on the WHP/SAP a total of 102 concrete sample locations and 63 soil sampling locations were identified with 18 of the soils locations being underneath the slabs. The majority of the soils sampling depths ranged 0 – 6 inches and from 0 – 2 feet with 14 locations down to 10 feet. The concrete slabs to be sampled ranged in thickness from 4 inches up to 18 inches. Figure 3 shows the sampling locations

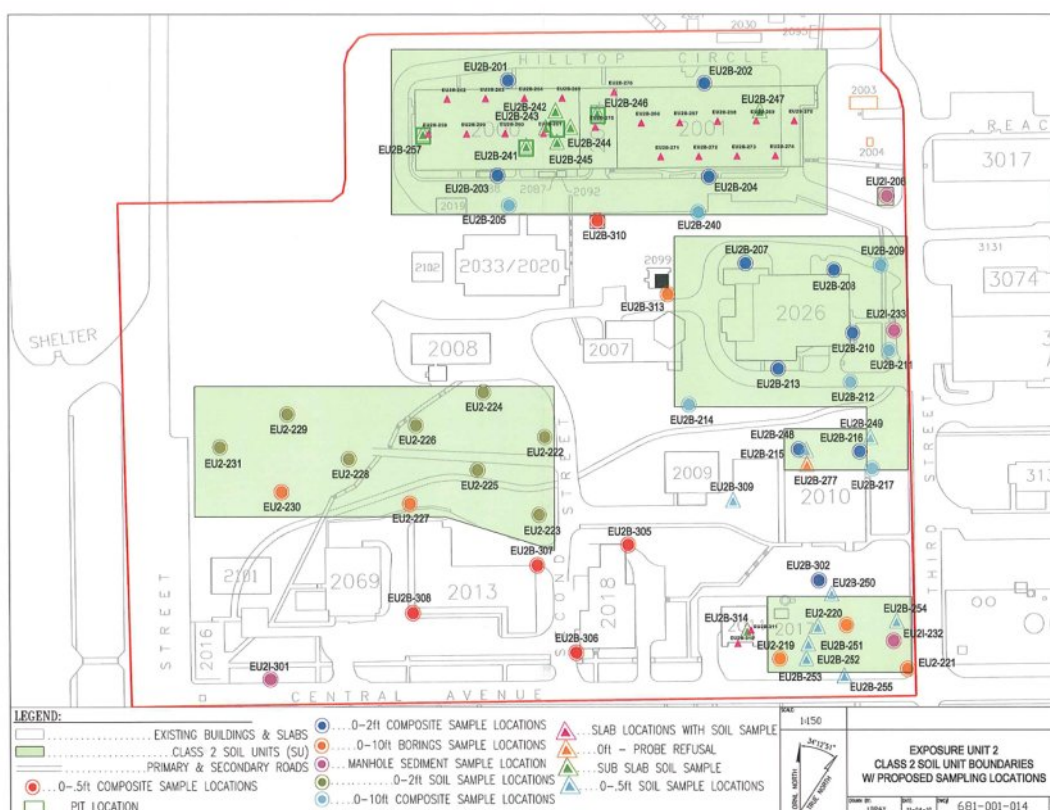


Figure 3 - 2000 Area Sampling Locations

Contracts were put in place for the field sampling and for the analysis of the samples. Sampling began on January 10, 2011 and was completed on February 22, 2011. To obtain the soil samples underneath the slabs, the slabs were cored and the resulting holes used to sample the underlying soil.

Sample Results

Using results from the slab sampling and working closely with the Waste Acceptance Criteria Attainment Team at EMWMF the waste profile for slabs and associated debris was developed and approved. The sample results and an approved radiological survey and release plan were used to identify a final sub-set of the slabs that met the waste acceptance criteria for the ORR Landfills at Y-12. Slabs that are eligible for Y-12 Landfill disposal are being segregated and disposed in that facility to maximize the efficient use of the available on-site disposal options at the ORR. The results from the soil sampling showed 5 locations where the radiological contamination exceeded the average release limit and one location with elevated PCB concentrations.

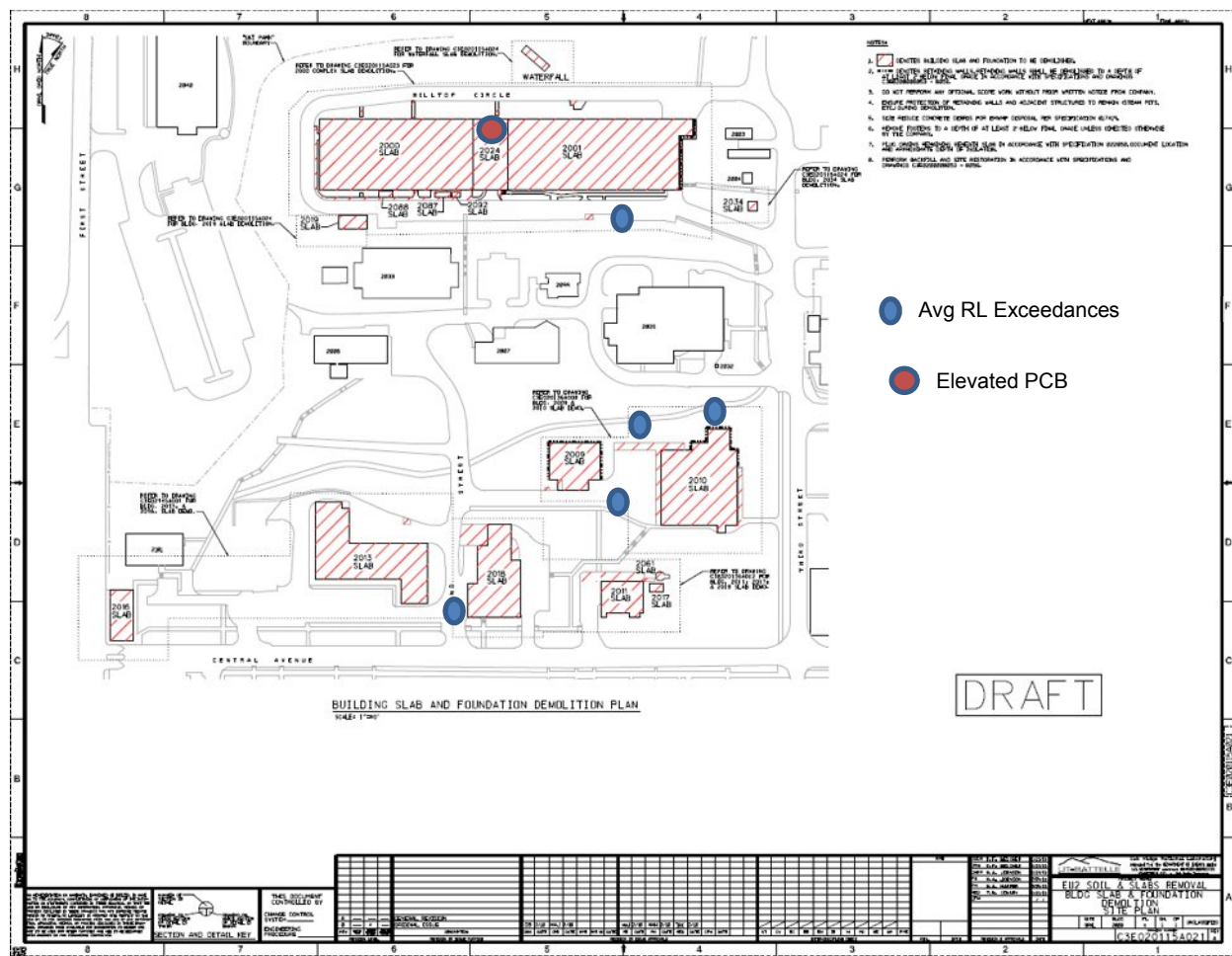


Figure 4 - Location of Soil Release Limit Exceedances in ORNL 2000 Area

SLAB AND SOIL REMOVAL

A decision was made to request optional pricing for the removal of all 8 of the 2000 Complex building slabs and to concurrently obtain a unit rate for the removal of other miscellaneous slabs and contaminated soils during the development of the procurement package for the demolition of the 2000, 2024 and 2034 Buildings in the 2000 Complex. This forward thinking allowed the follow-on slab and soil removal work to be accelerated without having to go through a separate bid and award process. Extensive discussions were held with the ORNL Strategic Planning organization to determine what the desired end state was for each slab location (Figure 4). The end state discussions led to the decision that the 2000 Complex area slabs and the 2018 and 2013 slabs would be restored with gravel as this would provide additional parking, and the remaining slab areas would be restored to grass.

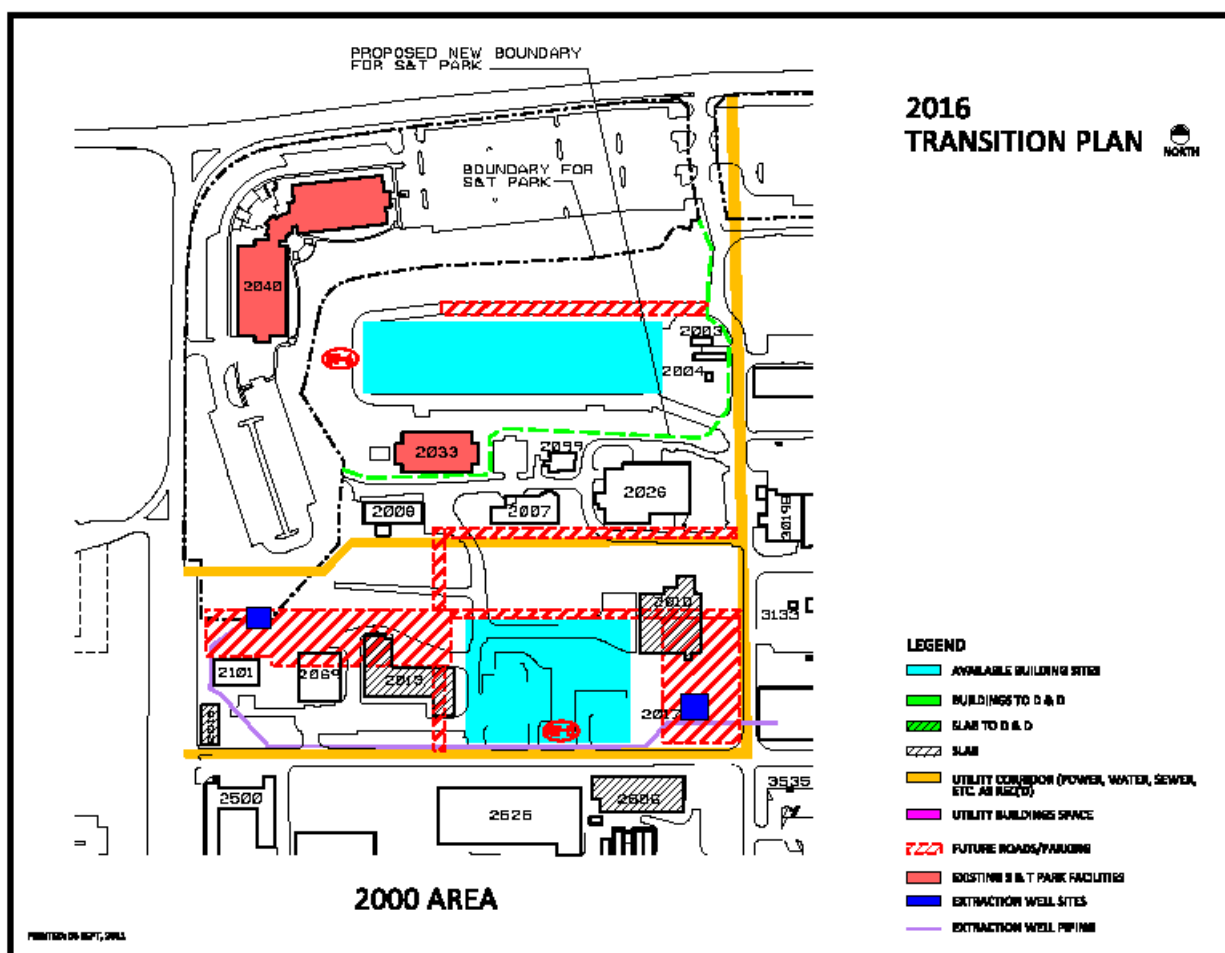


Figure 5 - Five Year Transition Plan for the ORNL 2000 Area

The optional scope was placed with the 2000 Complex demolition contractor, Safety and Ecology Corporation (SEC) once the sample data were received. The contractor's submittals and work plans were reviewed and approved and SEC was given notice to proceed on September 26, 4 days ahead of the September 30 milestone schedule.

Initial removal operations began on the 3095 slab as that slab was located next to an ongoing ARRA construction project and the early removal of the slab would ensure there were no conflicts as the construction work proceeded. This was a radiologically-clean slab so it allowed the project to start with lower risk work. This sequence also allowed work to be initiated in the field while the EMWMF waste profile for the radiologically contaminated slabs was in final approval. Demolition of the 3095 slab was completed in October and the team moved over to the 2000 Complex area slabs. Removal of these slabs was completed in January 2012 and the work proceeded to the south. The completion of the work for the entire area is targeted for the end of March 2012.



Building 3095 slab BEFORE demolition



Building 3095 slab DURING demolition



Building 3095 slab area AFTER demolition



Building 3095 slab area AFTER Restoration

NEXT STEPS

Planning is underway for the next phase of Soils and Slabs Removal in the ORNL Central Campus. The 3500 Area is located in the Southeast Quadrant and has been part of the ARRA-funded transformation. Approximately \$2M is currently allocated in FY- 2012 for this project including planning, characterization, and removal of six building slabs.

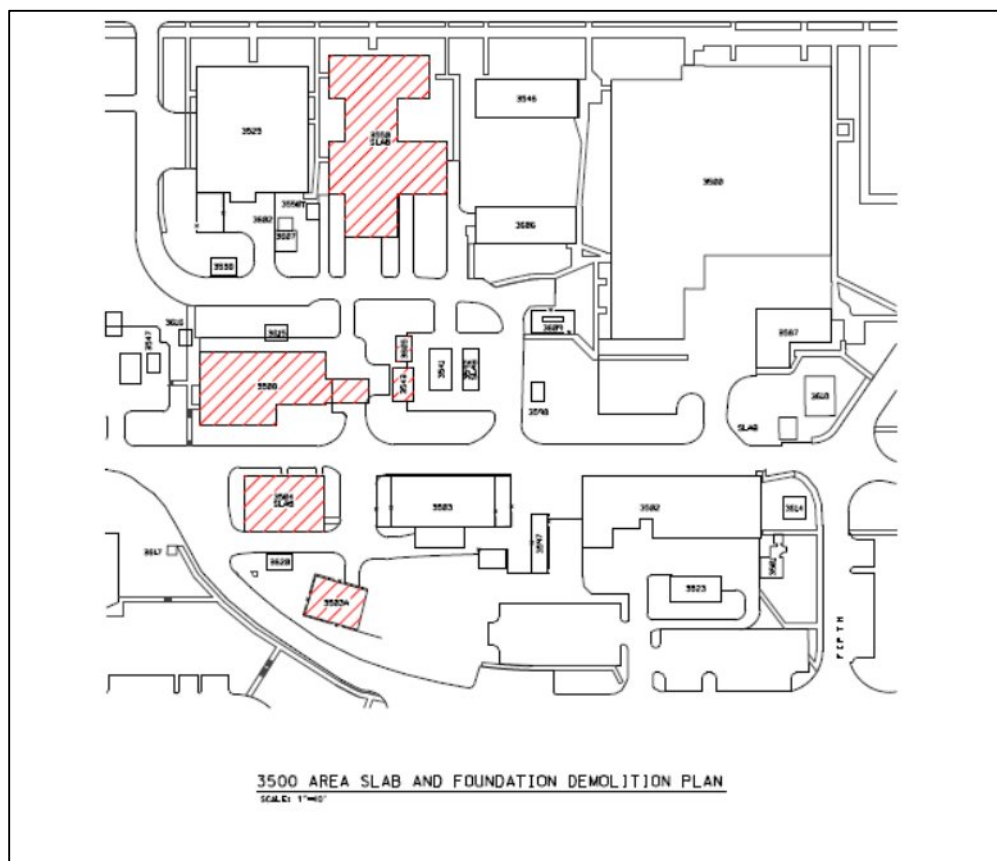


Figure 6 - Location of 3500 area slabs at ORNL and Slabs Planned for Removal (in red)

CONCLUSION

Demolition of aging facilities enabled by injection of ARRA funding has significantly altered the landscape at ORNL while reducing risk to laboratory personnel and operations and providing valuable central campus land parcels for redevelopment to expand and enhance the science mission of the Laboratory. D&D of these infrastructure legacies that were once eyesores that harbored risk in the ORNL Central Campus have been transformed to green spaces and extremely valuable candidate sites for future buildings. The 2000 Area slabs and soils removal marks the first step in creating the bridge between the modernized east and west campus and acts as the cornerstone in the redevelopment of the ORNL Central Campus area (Figure 6) which will be a key contributor to ORNL meeting its vision of the future.



Figure 7- Artist rendering of Modernized ORNL Central Campus