

INTEGRATED PLANNING FOR CLEANUP OF BETHEL VALLEY AND REVITALIZATION OF THE ORNL MAIN CAMPUS

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ABSTRACT

This paper describes the efforts currently underway to integrate the planning for, and performance of, the cleanup and modernization of the Oak Ridge National Laboratory (ORNL). UT-Battelle, LLC, is the DOE Office of Science (SC) contractor responsible for ORNL Operations and Bechtel Jacobs Company, LLC, is the DOE Environmental Management (EM) contractor responsible for cleanup of the ORNL site. The two companies are working together to address the 50+ year old ORNL contamination legacy while new facilities for the next 50 years of ORNL operation are being built. These joint efforts have accomplished a number of "early cleanup actions" that have significantly reduced the current risk from legacy contamination, are securing approval for cleanup of the ORNL main plant area, and, at the same time, have launched the ORNL modernization efforts.

INTRODUCTION

Oak Ridge National Laboratory is the nation's largest and most diverse energy research and development (R&D) institution. It is a Department of Energy (DOE) multiprogram laboratory, supported primarily by DOE Office of Science (DOE-SC) research programs, but with other significant sponsors from the Department of Defense, the National Aeronautics and Space Administration, the Environmental Protection Agency, the National Science Foundation, and the Nuclear Regulatory Commission.

The main ORNL site (also commonly referred to as the X-10 site) encompasses facilities located primarily in two valleys (Bethel and Melton) concentrated on approximately 4,250 acres of land. The main ORNL operations and research complex is located in Bethel Valley with the exception of the High Flux Isotope Reactor and the Radiochemical Engineering Development Center. ORNL facilities are also located on other parts of the more than 21,000 acres for which ORNL is responsible, including some at the nearby Y-12 Plant and field research areas (Fig 1). The Bethel Valley administrative area is a 1734-acre area defined by the upper drainage area of White Oak Creek and its tributaries in Bethel Valley. Bethel Valley includes the neighboring Raccoon Creek watershed and a small portion of Bearden Creek (Fig. 2).

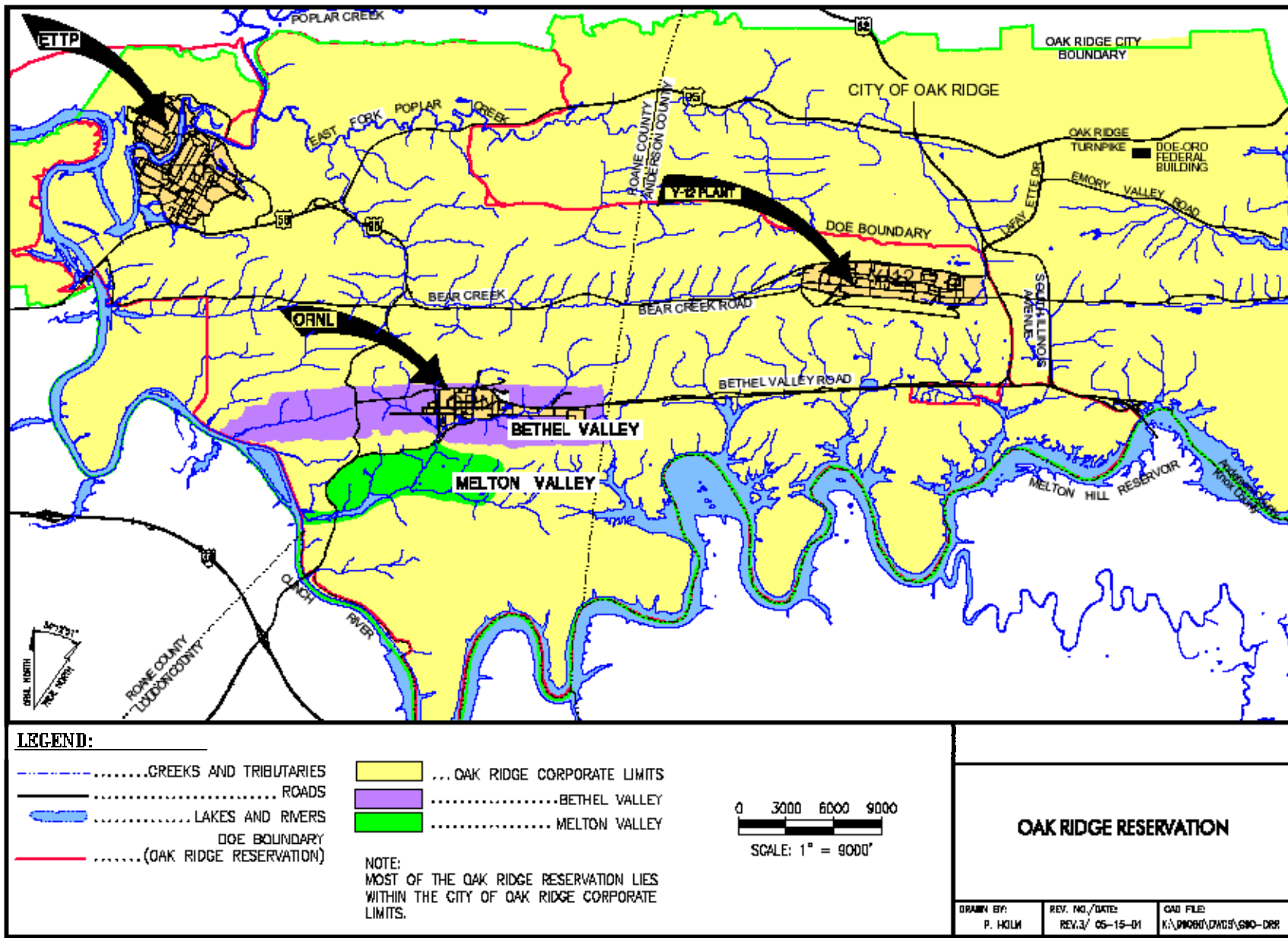


Fig. 1 Bethel Valley area, Oak Ridge Reservation

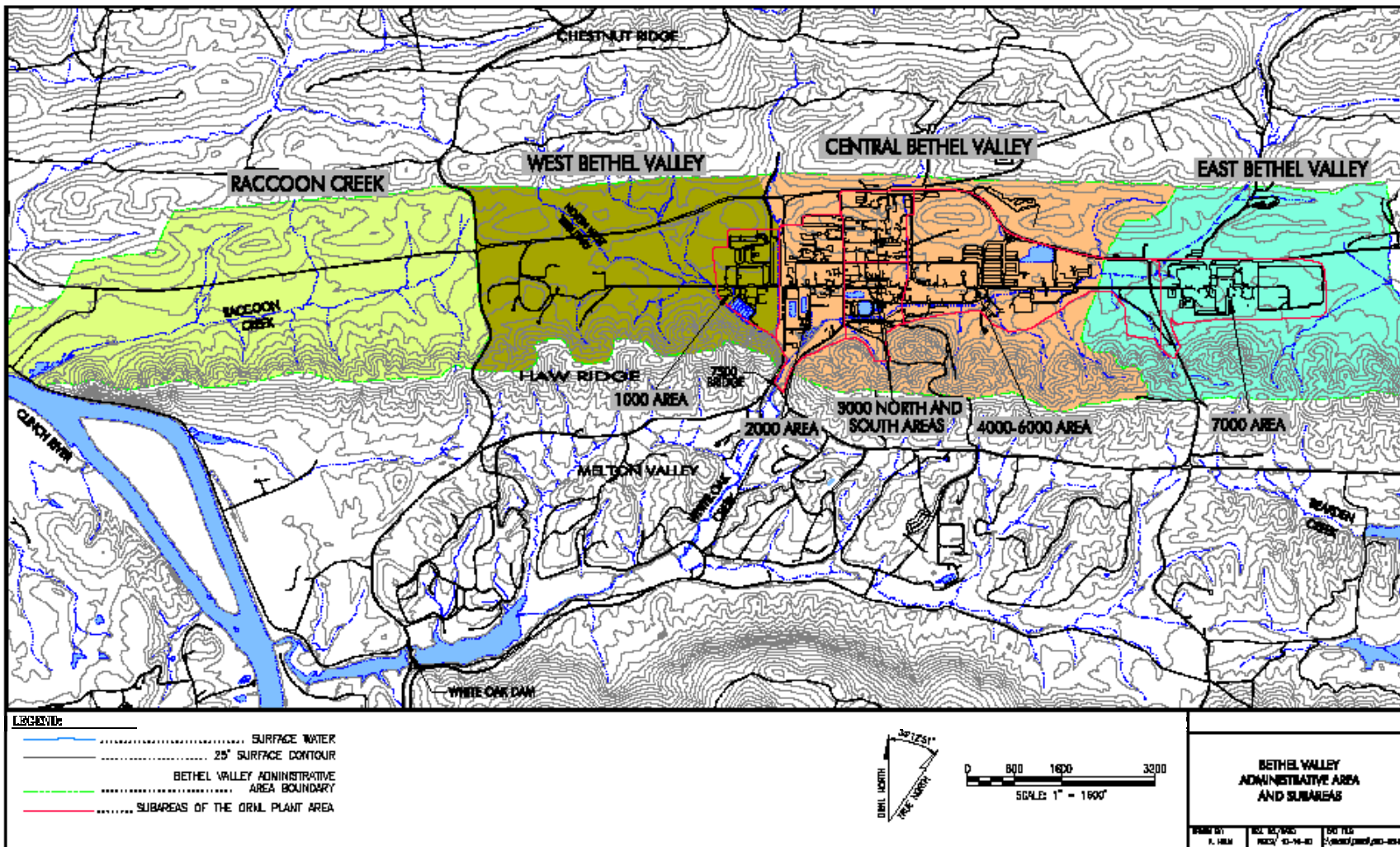


Fig. 2 Bethel Valley administrative area and subareas

ORNL BETHEL VALLEY CLEAN UP

Regulatory Background

Weapons research facilities were established in 1943 on the ORNL site as part of the World War II Manhattan project. ORNL's original mission was to produce and chemically separate the first gram quantities of plutonium as part of the national effort to produce the atomic bomb. As its role in the development of nuclear weapons decreased over time, the scope of work at ORNL expanded to include production of radioactive isotopes, fundamental research in a variety of sciences, research involving hazardous and radioactive materials, environmental research, and radioactive waste disposal. These activities have resulted in the release of contaminants to the environment. Because of these contaminant releases, the Oak Ridge Reservation (ORR), which includes Y-12 and East Tennessee Technology Park, was placed on the Environmental Protection Agency (EPA) National Priorities List (NPL) established under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) [54Federal Register (FR) 48184, November 21, 1989].

As a result of the NPL listing, the EPA, the Tennessee Department of Environment and Conservation (TDEC), and DOE signed a Federal Facilities Agreement (FFA) for the ORR (DOE 1992a), effective January 1, 1992. The general purposes of the FAA include: ensuring that the environmental impacts associated with past and present activities at the ORR are thoroughly investigated; ensuring that appropriate remedial action is taken, as necessary, to protect the public health and welfare and the environment; and, establishing a procedural framework and schedule for developing, implementing, and monitoring appropriate response actions on the ORR in accordance with Tennessee State Law.

Historical processes, programs, and waste management practices associated with the mission of the laboratory have led to environmental contamination in Bethel Valley. The estimated geographical extent of contamination is approximately 100 acres. These processes included chemical separation techniques, reactor research and development, radioactive waste storage, and waste burial. A large inventory of radioactive waste, combined with other hazardous waste constituents, in numerous locations in the Bethel Valley area, result in the release of contaminants into the environment at concentrations exceeding legal or risk-based criteria. The pervasiveness of contamination in the ORNL complex and the similarity of contaminants found from different sources units complicate the determination of well-defined contaminant plumes and distinct areas of contamination.

A comprehensive field investigation for the main ORNL plant area followed the placement of the ORR on the NPL. This activity was supplemented with data from other investigations conducted to comply with the Resource Conservation and Recovery Act, the National Pollutant Discharge Elimination System, and other environmental statutes, regulations, and permits. A Remedial Investigation/Feasibility Study was prepared based on this information, leading to the issuance of the *Proposed Plan for Interim Actions in Bethel Valley, Oak Ridge, Tennessee*, for public comment in June 2000. A public meeting was held in July 2000 to present the preferred cleanup alternative described in the Proposed Plan and to solicit public input. Based on this input, the *Record of Decision for Interim Actions in Bethel Valley, Oak Ridge, Tennessee*, is expected to be

signed in FY 2002. The goals and the selected remedy presented in this record of decision (ROD) are consistent with recommendations by the public that the DOE remediation decisions achieve, at a minimum, a controlled industrial end use for the entire ORNL Bethel Valley area that allows for surface use of contaminated lands. It is anticipated that actions taken as part of this remedy will be consistent with final actions selected in future decisions for Bethel Valley.

Cleanup Requirements

The scope of the remedial actions identified in this ROD is focused on the 1,734-acre area in Bethel Valley. This area includes: buildings and other facilities designated for decontamination and decommissioning (D&D); buried waste; underground liquid low-level (radioactive) waste (LLLW) tanks; underground process and LLLW transfer pipelines; contaminated surface and subsurface soil; contaminated sediment and surface water; contaminated groundwater; and groundwater monitoring wells and piezometers no longer needed for monitoring. A separate ROD has been issued that addresses the waste disposal areas, contaminated sediments and soil, and contaminated facilities located in Melton Valley.

Previous CERCLA response actions addressed a variety of units located within Bethel Valley. These actions included the removal of liquids and sludges from the Gunite Tanks and other tanks at the site, in-place stabilization of these tanks, the removal of liquids and sludges from the Surface Impoundments Operable Unit, and the removal of contaminated soils associated with Tank W-1A and the Corehole 8 groundwater plume. These previous actions were considered in the development of the Bethel Valley Interim Action ROD. While some of these early actions will be augmented with additional response actions, others will require no additional response actions.

The scope of the selected remedial actions does not include active facilities and infrastructure. Additionally, a final groundwater decision is not part of the selected remedy. However, the ROD does include interim actions associated with contaminated groundwater within Bethel Valley. A final groundwater decision has not been made at this time for several reasons. The regulatory agencies desired to complete the source control actions identified in the Interim Action ROD, monitor their effectiveness, and collect limited additional characterization data. These activities will allow the agencies to make a more informed decision on the final groundwater remediation. Because the proposed remedy does not make a final groundwater decision, and because it does not include active facilities or final land use controls (LUC), it is an interim remedy.

The selected remedy uses contaminant source control and the imposition of LUCs as the overall cleanup strategy for Bethel Valley. Contaminant sources will be removed or physically isolated, depending on waste characteristics, location, and volume. Source control actions, coupled with LUCs, protect human health and the environment by controlling the level of exposure to hazardous substances. Extraction and/or in situ treatment of groundwater minimizes further impacts to groundwater and protects surface water by reducing the mass of contamination present. The selected remedy leaves some hazardous substances in place, which could require land use restrictions for hundreds of years or longer if no additional remedial action is taken. The selected remedy is considered to be an interim decision and will be re-evaluated in the future.

The actions required to implement the selected Bethel Valley cleanup are expected to cost in the range of \$200 million and continue through 2014. A Life Cycle Baseline (LCB) has been developed that describes the scope, schedule, and cost estimate for this effort. The LCB is reviewed and updated annually to reflect cleanup progress and funding allocations.

Bethel Valley Cleanup Progress

The following section summarizes the significant progress that has been made to date in the cleanup of Bethel Valley. The Gunite and Associated Tanks (GAAT) consist of six large tanks of 170,000-gallon capacity each and two smaller tanks of 42,500-gallon capacity. A CERCLA interim remedial action was implemented to remove the waste from the tanks and a CERCLA non-time critical removal action was implemented to stabilize (grout) the tank shells in-place. The associated piping, valve pits, contaminated soil, etc., will be addressed in other remedial actions implementing the selected remedy in the BV ROD. Tank waste removal was completed in FY 2000 and tank shell stabilization was completed in FY 2001. Over 400,000 gallons of waste slurry containing about 87,000 gallons of transuranic mixed waste sludge were transferred to the Melton Valley Storage Tanks where it will be treated in the Transuranic Waste Processing Facility for shipment to the Waste Isolation Pilot Plant (WIPP) in New Mexico for disposal. Dismantlement of waste removal equipment and platforms has been completed and the site is now used as a parking lot.

The Corehole 8 contaminated groundwater plume (CH8 Plume) is the result of liquid low-level waste (LLLW) pipeline leaks at the LLLW Collection/Storage Tank W-1A located in the North Tank Farm at ORNL. In 1995, a CERCLA removal action was initiated to collect and treat contaminated groundwater. A shallow interceptor and sump collection system was installed with the water being pumped back to a manhole for treatment at the ORNL Process Waste Treatment Plant (PWTP). In early 1998, a shallow french drain collector was installed and two manholes were waterproofed to prevent contaminated groundwater infiltration into the storm drain system and ultimate release into First Creek. In 2000, extraction of contaminated groundwater was initiated from a well (Well 4411) that intercepts a portion of the plume. The extracted groundwater is being treated at the Process Waste Treatment Plant.

An additional CERCLA removal action was implemented to stop further leaching of contaminants from the plume source into groundwater. The project focused on remediating the contaminated soil, Tank W-1A, and pipelines at the plume source leak site. Tank contents were removed in FY 2001 and 90% of the contaminated soil was excavated. Unexpectedly high concentrations of transuranic contaminants were encountered while excavating soils immediately surrounding the tank. Excavation of this highly contaminated soil was not within the approved scope of the removal action. The tank and approximately 100 cubic yards of highly contaminated soil were left in-place to be addressed in a future CERCLA action, and the excavated area was backfilled.

The Metal Recovery Facility (MRF) was a one-story, metal-sided building used as a pilot and small-scale nuclear fuel reprocessing plant between 1952 and 1960. A CERCLA removal action was initiated in FY 2001 to remove the surface structure of the facility to the finish floor elevation. The walls of the dissolver pit, small storage building, and canal were demolished to

the finish floor elevation of the facility. The dissolver pit and other small pits and sumps were drained, decontaminated, and stabilized with grout. The remaining slab was stabilized in-place in early FY 2002.

The Surface Impoundments Operable Unit (SIOU) consists of four impoundments designated A (3524), B (3513), C (3539), and D (3540). The impoundments received radioactive low-level liquid wastes generated during experiments and materials processing at ORNL. The selected remedy consists of the removal, treatment, and off-site disposal of the sediments and backfilling of the impoundments for beneficial reuse. Impoundments C and D were successfully remediated in 1998. A facility to treat the sediments has been constructed on these backfilled impoundments. Sediment was transferred from Impoundment A to Impoundment B in 2000. Impoundment A was then backfilled with rock and grout and is now being used as a staging area for treated waste awaiting shipment for disposal. Treatment system startup with hot and cold testing was completed and treatment of consolidated sediment from Impoundment B was initiated in FY 2001 and is scheduled for completion in FY 2003.

A CERCLA removal action was implemented to remove the contents from 27 inactive LLLW storage tanks located in Bethel Valley and Melton Valley and stabilize (grout) the shells and residual internal contamination in-place. Seven tanks were remediated in FY 2000 and 17 tanks were remediated in FY 2001. The remediation of three tanks (i.e., T-1, T-2, and HFIR) was deferred to a future CERCLA action due to the nature of their contents (i.e., resins) that will require a more sophisticated approach for retrieval and treatment.

Six ORNL cooling tower structures [HRE Cooling Tower (7554), Oak Ridge Research Reactor Heat Exchanger (3087), ORRR A/C Cooling Tower (3089), ORRR Cooling Tower #3 (Building 3103), Pool-Water Cooling Tower (3086), and BSR Cooling Tower (3117)] were demolished in FY 2000. Waste generated from demolition of the towers will be dispositioned in FY 2002. The remaining basins and any contaminated soil associated with the towers will be addressed in the BV ROD selected remedy.

The objective of the ORNL Spent Nuclear Fuel (SNF) Project is to safely, reliably, and efficiently manage SNF that is stored on the Oak Ridge Reservation until it can be shipped off-site for disposal. SNF is being retrieved, repackaged, and certified for shipment to the Idaho National Engineering and Environmental Laboratory (INEEL). The final SNF package has been retrieved (KEMA fuel from SWSA 6) and is being repackaged for placement back into safe storage pending shipment to INEEL. A cask loading facility was constructed in FY 2001 to allow packaging of SNF in licensed containers that will be used to ship SNF to INEEL beginning in FY 2003.

ORNL REVITALIZATION

Facilities Revitalization Background

To accomplish their scientific research mission, ORNL staff are dependent upon the availability of a wide variety of buildings and equipment, including specialized experimental laboratories, user facilities, hot cells and nuclear reactors, and a large complement of office space and

associated utility systems. ORNL's physical facilities are, however, quite old, and many have reached the end of their safe operating life. The poor condition of facilities is a key environmental, safety, and health concern; adds considerably to overhead costs in terms of energy consumption, increased maintenance costs, and research inefficiencies; and reduces ORNL's ability to attract and retain world-class scientific talent. Revitalization of the ORNL campus is a key initiative of the new ORNL prime contractor, UT-Battelle, LLC. An ORNL Strategic Facilities Plan has been developed that describes the details of UT-Battelle's approach to upgrading the scientific resources and supporting infrastructure of the Laboratory.

The ORNL staff occupies approximately 4.5 million gross square feet of building space. The majority of these buildings were constructed during and immediately after World War II, with some 80% of the space exceeding 30 years of age, and nearly 54% being over 40 years old. Limited DOE budgets have allowed the physical condition and adequacy of that space to decline over the years, such that, at present, only 23% of the occupied space is deemed adequate under DOE criteria. The continued installation of sophisticated and expensive research equipment in such deteriorating physical facilities is compromising ORNL's standing as a world-class research institution. Similarly, the plant infrastructure serving the majority of ORNL's buildings also requires upgrading, as much of the piping, wiring, HVAC, fire safety, and connecting road systems were installed in the 1950s and have not been replaced or significantly upgraded. Much of this infrastructure does not meet current codes, or the evolving environment, safety, health, and quality requirements, and needs replacement as the rest of the ORNL campus revitalization is conducted.

The facilities upgrade needs at ORNL are not unique within the DOE-SC multiprogram laboratory system. Across the five primary SC multiprogram laboratories, similar facilities and infrastructure concerns exist and are the focus of a new initiative to upgrade the existing sites into "Laboratories of the 21st Century." SC's goal is to accomplish full modernization of its multiprogram laboratories by 2012, and each SC site is to develop a strategic facilities plan to outline its approach to meeting that goal, within the site-specific constraints of each laboratory and in concert with the institutional plans for new program growth at each site. The ORNL Strategic Facilities Plan (ORNL/TM-2001/238) has been issued to meet this need, as well as to provide the basis for longer-term, site-wide, and reservation-wide planning efforts.

Facilities Revitalization Project Scope and Planning Process

To accomplish the goal of a fully modernized Laboratory of the 21st Century, ORNL has established a dedicated project team. The FRP has been authorized by the DOE Oak Ridge Operations Office (DOE-ORO) as one of the high-priority initiatives of the new UT-Battelle management and operating contractor team for ORNL. The FRP mission is to provide world-class facilities for ORNL staff, consolidated at the main ORNL site, with the first phase of construction to be completed within 5 years. The project utilizes a combination of DOE, State of Tennessee, and private sector funding to accomplish the revitalization goals in the near term. The project also interfaces with Bechtel Jacobs Company to integrate the ongoing cleanup actions with the revitalization efforts.

A comprehensive planning process has been employed by the FRP team in the development of this Strategic Plan. That process was initiated with a formal review of the ORNL Institutional Plan and hosting of a workshop with Laboratory senior managers to validate program directions and needs in each of the primary research mission areas, as well as to obtain input on the Laboratory priorities on support functions to be provided by the new campus. It was during that workshop that the guiding principles were also established for the architectural feel of the revised campus setting. Using this information and the existing ORNL facilities data as a baseline, a detailed review of all existing facilities and infrastructure conditions was conducted and an initial determination of strategic buildings made to guide consolidation planning. Those strategic facilities then formed the nucleus around which the resulting Master Plan was developed. For facilities considered nonstrategic (due to age, conditions, high maintenance costs), consolidation plans were then drawn up for all staff/equipment housed there, and by-building mapping of relocation needs produced. Those plans were reviewed with the management of each of the affected divisions, and modifications were made to accommodate specific needs. These consolidation plans then drove the siting and sizing of new facilities and infrastructure needs, and those new facilities were captured in the Master Plan layout.

Once the complete listing of facilities requirements was identified, decisions were made on expected funding type (DOE, State, or private-sector) for each identified project, and a formal prioritization process then implemented for the DOE projects to rank them within the overall ORNL capital assets program. This ranking information, along with reasonable expectations on availability of State, private-sector, and DOE expense funds through each of the project phases, was then used to sequence facilities construction plans and allow roll-up of funding estimates.

The current plan estimates that \$125 million in DOE capital funds will be needed for infrastructure, building upgrades, and major science facilities. Funding for \$26 million will be provided by the State of Tennessee for four joint institutes. Private sector funding of \$70 million will be provided for offices and light labs. Fig. 3 provides an overview of the ORNL Master Plan.

INTEGRATION OF ORNL CLEANUP AND REVITALIZATION

Bechtel Jacobs Company and UT-Battelle staff interact on a regular basis to integrate the ORNL cleanup and revitalization efforts. These interactions take place at strategic and tactical levels.

Strategic Integration

The goal of the strategic integration efforts is to coordinate overall planning, identify common goals and opportunities, and minimize the potential for interferences. As indicated previously, both UT-Battelle and Bechtel Jacobs Company have developed and will maintain planning documents for their respective efforts. Staff from both organizations have met to discuss these plans and have identified two major interface areas.

The first strategic interface area is the need to ensure that new SC developments are complying with CERCLA and NPL requirements for land use. As noted earlier, the goal for the Bethel

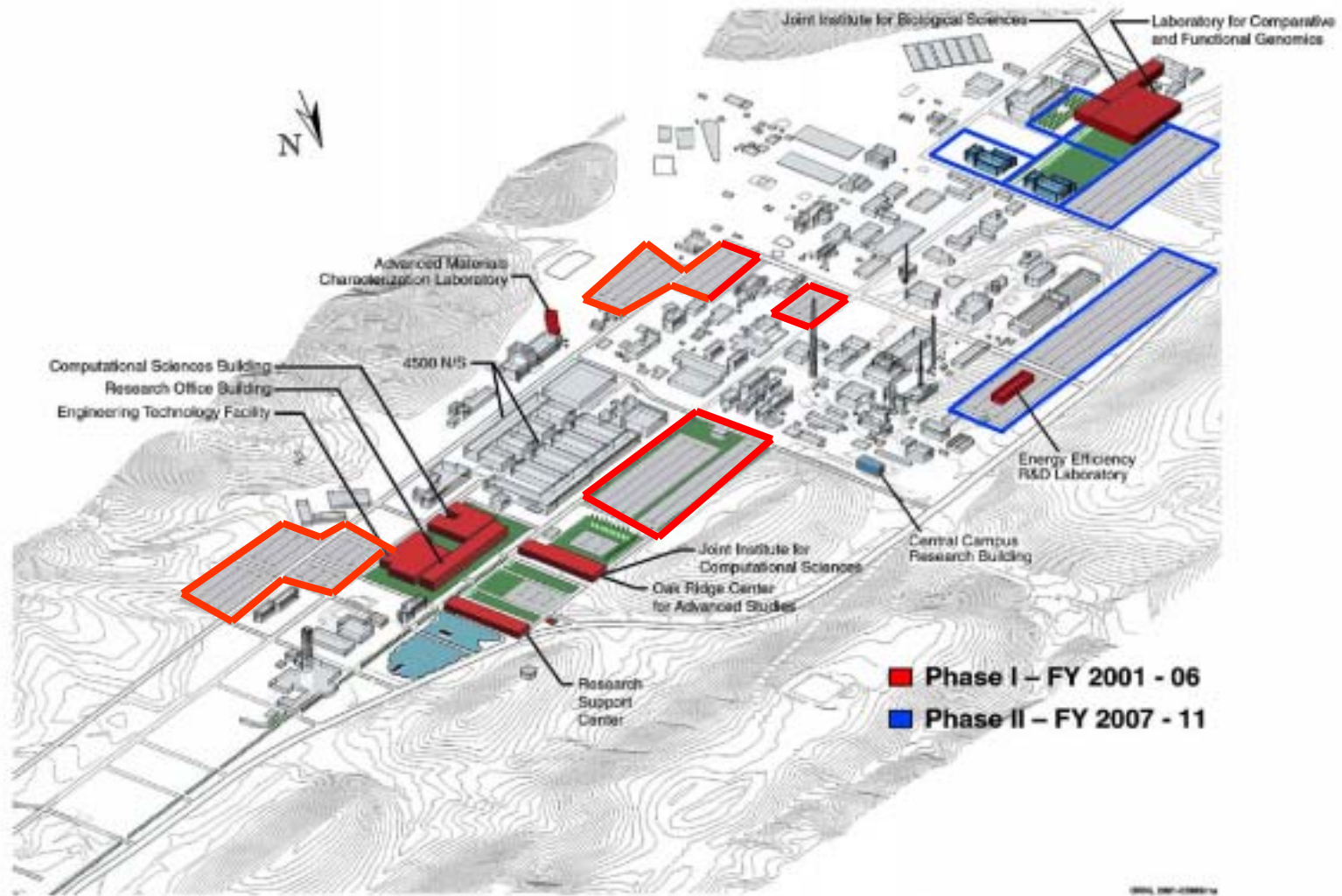


Fig. 3 ORNL Master Plan

Valley cleanup actions is to achieve, at a minimum, a controlled industrial end use for the entire ORNL Bethel Valley area that allows for surface use of contaminated lands. The revitalization plan is focused over the next ten years on developments in areas of the laboratory where the potential for encountering subsurface contamination is low, thus minimizing issues associated with the need to remove or treat contaminated soils before or during new facility construction. A major integration effort was required as part of the private sector financed buildings to ensure that the associated deed and lease arrangements meet regulatory requirements. In addition, Bechtel Jacobs Company assisted UT-Battelle in arranging for the TDEC Radiological Monitoring and Oversight Program to perform radiological surveys of the area to be leased for the private sector facilities to confirm that they meet regulatory requirements.

The second strategic interface area is identifying and implementing opportunities where the cleanup and revitalization efforts can work together to help achieve each program's goals. A number of successes and future opportunities have been identified and are reflected in Fig. 4 and are summarized briefly below.

Parking - A major component of the revitalization efforts is the need to develop significant new vehicle parking areas. This need arises for two reasons. First, six new facilities are planned to be built in current parking lot areas beginning in early 2002. This will eliminate parking spaces that must be replaced before construction begins. Several new parking areas are being developed to address this issue – two of which involve an interface with Bechtel Jacobs Company. Agreement has been reached for the use of an asphalt surface that was placed over the South Tank Farm as part of the Gunitite Tanks remediation for parking. In addition, UT-Battelle is assisting Bechtel Jacobs Company in establishing an area to stage containerized wastes, freeing up an area along South Side Drive for parking area development to replace capabilities that will be eliminated with construction of the Advanced Materials Characterization Laboratory. Second, the relocation of ORNL staff from facilities at the Y-12 Plant and other locations into the new buildings at the ORNL site in 2003 will require several hundred new parking spaces. Bechtel Jacobs Company is working to obtain agreement that a parking area can be developed by UT-Battelle on top of the Surface Impoundments Operable Unit (SIOU) that is currently being remediated. The staging area mentioned previously will also be used for wastes generated during the SIOU action, helping to keep that project on schedule. UT-Battelle and Bechtel Jacobs Company are also working together to gain approval for potential development of a parking lot in the Solid Waste Storage Area 2 area to support the new East Campus facilities.

Facility transition to EM – As part of the facility revitalization effort, UT-Battelle reviewed all the ORNL facilities (at X-10 and at Y-12) and determined that a significant number of them were not needed to support the Laboratory missions. Many of these excess facilities are expected to meet the criteria for transition to the EM program for D&D. UT-Battelle, Bechtel Jacobs Company, and BWXT at the Y-12 site have been working together with DOE to facilitate this transition process. Two facilities, 9735 and 3597, were transferred from SC to EM at the end of FY 2001 and efforts are underway to accelerate the transfer of additional facilities in FY 2002 and beyond.

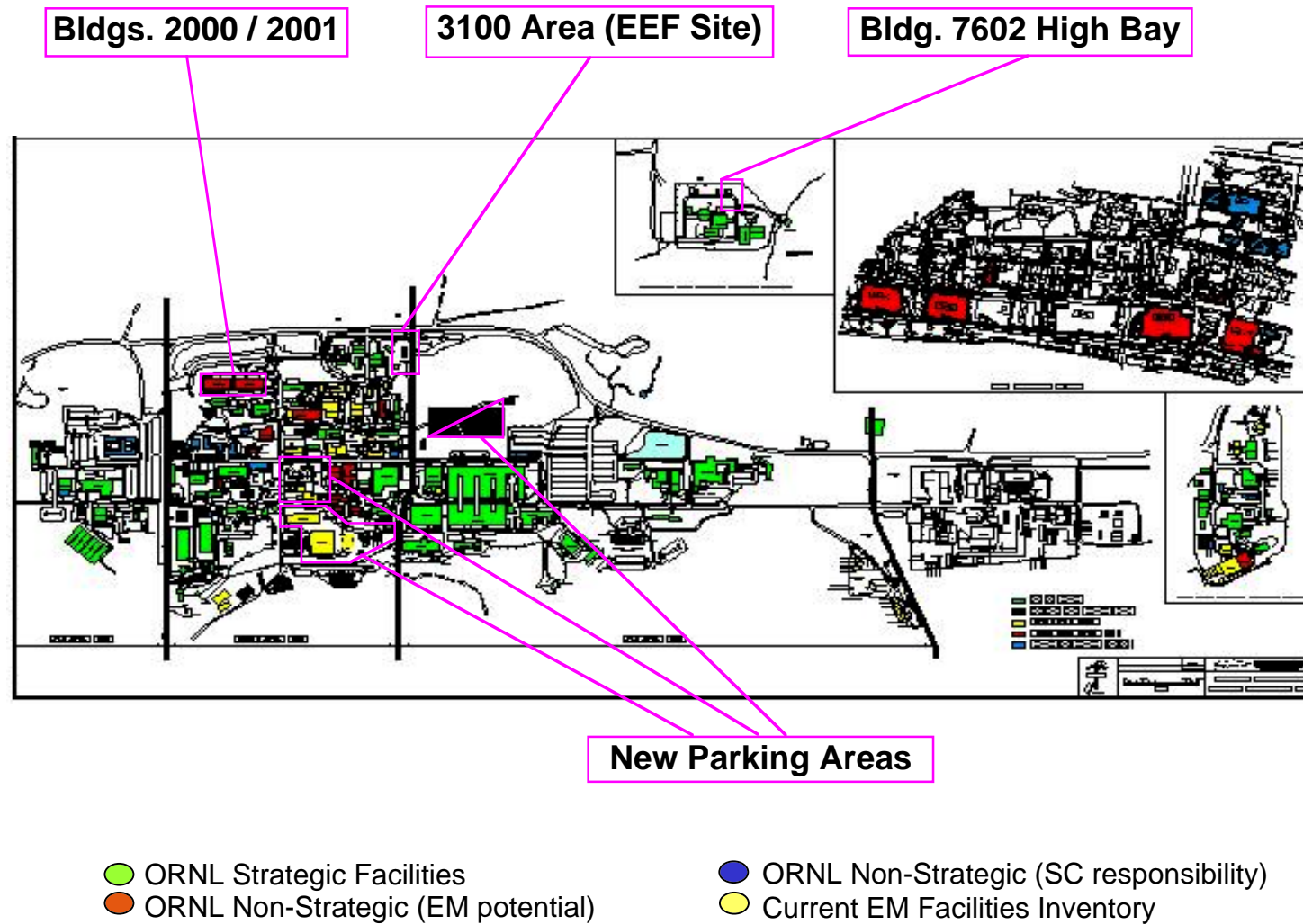


Fig. 4 ORNL Revitalization: Near-Term Priorities for Bechtel Jacobs Company

North entrance and Energy Efficiency Facility (EEF) site – The Master Plan for ORNL includes planned improvements to the North Entrance of the Laboratory and the construction of the EEF. This area is the site of a recently completed Bechtel Jacobs Company early action that demolished the above grade portions of 5 old cooling towers. UT-Battelle and Bechtel Jacobs Company are working together to gain approval to accelerate the completion of remediation of the surface and below grade portions of this area that will allow the UT-Battelle developments to proceed.

7602 / 7603 – The 7600 area has been identified as the location for consolidation of the Fusion Energy Division (FED) staff. To support this consolidation, office and high bay areas are needed. An existing EM high bay facility, Building 7602, would be suitable for FED use if it were decontaminated. UT-Battelle and Bechtel Jacobs Company are working together to gain approval to accelerate decontaminating this facility. In a related effort, UT-Battelle and Bechtel Jacobs Company worked together in FY 2000 to remove equipment and decontaminate the EM portion of Building 7603 so the area could be used for the mock-up and testing of equipment for the Spallation Neutron Source.

Tactical Integration and Support

The goal of the tactical integration and support effort is to enhance the cleanup and revitalization of ORNL through day-to-day support and coordination efforts. The UT-Battelle ORNL Environmental Management Program Office and the Bechtel Jacobs Company ORNL Project are the focal points for this effort. These two organizations facilitate any real time communication and actions that are required to support ongoing work performance or issues resolution. In addition, the organizations have established a number of regular meetings among key ORNL groups to facilitate work integration. A bi-weekly meeting is held with UT-Battelle, Bechtel Jacobs Company, and DOE-SC and -EM representatives to review and coordinate work plans and resolve any issues. A monthly meeting is held with ORNL emergency response and operations groups to review planned work, identify any potential work interference, and to resolve any issues. Monthly meetings of Senior Managers from both companies are also held to review inter-company performance metrics and resolve issues.

UT-Battelle and Bechtel Jacobs Company also perform a significant amount of work for each other. As the EM contractor, Bechtel Jacobs Company is responsible for transport and disposition of newly generated solid waste from ORNL operations, and for operation of the Liquid Waste and Gaseous Waste treatment facilities at ORNL, in addition to being responsible for site cleanup actions. UT-Battelle is responsible for a number of site operations that support Bechtel Jacobs Company activities such as emergency response, security, utilities, grounds maintenance, etc. In addition, UT-Battelle provides craft support for maintenance of Bechtel Jacobs Company facilities and, in limited circumstances, for support of cleanup activities.

CONCLUSION

Bechtel Jacobs Company and UT-Battelle have been successful at joint planning and integration that has allowed both companies to conduct their missions safely and effectively. In addition, the companies have completed a number of mutually beneficial actions and identified many more that they are working to complete in the future. The ultimate benefit of these initiatives is improved performance (lower cost, decreased schedule) for DOE in the cleanup and revitalization of ORNL.