

OAK RIDGE RESERVATION BALANCE OF PROGRAM COMPLETION PROJECT – READY, SET & GO!

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ABSTRACT

The Department of Energy (DOE) Oak Ridge Operations Office and Bechtel Jacobs Company LLC (BJC) have signed a “closure” type contract as an extension to the prior “management and integration” type contract in which DOE Environmental Management (EM) scope was performed between 1998 and 2003. The change in contract type fundamentally alters the manner in which the Oak Ridge Reservation (ORR) EM scope will be completed. DOE has committed to ensure funding is available to perform the scope, monitor progress (but not “how” it is performed), and deliver government-furnished services and/or items in a timely manner. For their part, BJC has agreed to perform the entire scope at a target cost substantially below baseline estimates, meet four (4) major schedule milestones, and most importantly work in a safe and compliant manner.

This paper examines the unique challenges faced by the BJC Balance of Program Completion Project (BOP) over the next five years and some of the *innovations* in-place, or planned, to successfully accomplish the work safely, ahead of schedule, and under target budget. BOP scope involves disposition of legacy and newly-generated waste; operations of waste storage, treatment, and disposal facilities across the ORR; and high-priority risk-reduction cleanup work at the Y-12 National Security Complex, the Oak Ridge National Laboratory, and at properties located off the ORR, all of which present unique technical, cost, and/or schedule challenges requiring the best engineering-management solutions to ensure success.

The new closure contract between DOE and BJC was signed October 1, 2003; in merely a few months, BOP has already realized substantial progress toward completion milestones. All parties, including the regulators, are invigorated, thinking innovatively, and collectively facing issues and collaborating on planning and executing prudent paths to closure.

In short, the “system” is ready for cleanup, the scope is set, and BOP is already going!

INTRODUCTION

The Oak Ridge Reservation (ORR) is a 17-square mile Department of Energy (DOE) facility that has three primary sites: the East Tennessee Technology Park (ETTP) formerly the K-25 Site, the Y-12 National Security Complex (Y-12 Plant), and the Oak Ridge National Laboratory (ORNL). To facilitate, streamline, and holistically address Environmental Management (EM) response actions on the ORR, the ORR is divided into Watershed units. The Bechtel Jacobs Company LLC (BJC) Balance of Program Completion Project (BOP) addresses high-priority risk-reduction activities in three of the Watersheds – Bethel Valley (Main Plant ORNL area), Bear Creek Valley, and Upper East Fork Poplar Creek (Main Plant Y-12). The Balance of Program Completion Project also manages legacy and newly-generated waste storage, treatment and disposal systems at all three ORR sites, and is responsible for the cleanup of three contaminated properties located off the ORR.

The recently signed Closure Contract between DOE and BJC has four major milestones for success. Two of the milestones are specific to BOP:

- Complete disposition of legacy low-level (LLW) and mixed LLW by fiscal year (FY) 2005 and
- Complete high-priority risk-reduction response actions by FY 2008.

The ORR has historically had the largest inventory of LLW and mixed LLW waste in the DOE complex stemming from Cold War operations at the three sites. Approximately 35,000 m³ of legacy low-level waste, enough to fill a football field three stories high, will be disposed by FY05, which is an acceleration of over six years from earlier baseline projection. Acceleration of legacy low-level waste was made, in part, through implementation of a unique and prudent regulatory approach to manage waste stored outdoors under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). The mixed LLW inventory, nearly diminished from a peak of 60,000 m³ in 1995, will also be completed in FY05 nearly 10 years ahead of the original Site Treatment Plan schedule. Although a small mixed waste inventory remains, numerous treatment challenges remain which require a combination of innovative DOE and commercial treatment processes.

High-priority risk-reduction response action scope is focused on remediation of ORR and off-ORR sites contaminated by past ORR operations. Because of the visibility and risk of public exposure of the off-ORR contaminated properties, cleanup of the David Witherspoon, Inc., and Atomic City Auto Parts properties will be the highest priority and completed no later than FY 2008. Remaining BOP priority cleanup focuses on release sites within the plant areas of the Y-12 Plant and ORNL.

The BOP will also operate key disposal and treatment facilities necessary to support cleanup of the entire ORR, as well as the disposition of newly generated waste from Y-12 and ORNL active mission programs. Complete integration of disposal outlets with generating projects is an absolute necessity in order to meet schedules in a cost-efficient manner. The BOP team has the appropriate resources, systems, and tools in place to ensure seamless transition of all waste from cradle-to-grave.

WASTE MANAGEMENT & ENVIRONMENTAL RESTORATION

Managing the storage, treatment and disposition of waste efficiently will help BJC meet its closure contract milestones – and related fee. Waste managed cost effectively will ensure BJC meets its milestones within target cost. Cost-effective waste management functions can generate revenue to accelerate cleanup, accomplish more cleanup, and enable more fee to be awarded. Simply, managing waste as a *resource* – ensures everyone wins - BJC, DOE, regulators, local stakeholders, taxpayers - everybody.

Waste Disposition Planning

BOP is responsible for the generation, treatment and/or disposal of over 95% of the waste to be generated by the EM Program from 2004 – 2015. BOP will itself generate much of that waste, but the largest contribution of waste that will be shipped to BOP treatment and/or disposal facilities will come from the cleanup of the East Tennessee Technology Park (ETTP). **Figure 1** provides the disposition breakdown of waste generated by the ORO-EM program. Included in Figure 1, newly-generated LLW, MW, and sanitary waste generated by the National Nuclear Security Administration (NNSA) and the Office of Science (SC) is transferred to BJC storage and treatment and/or disposal facilities for disposition.

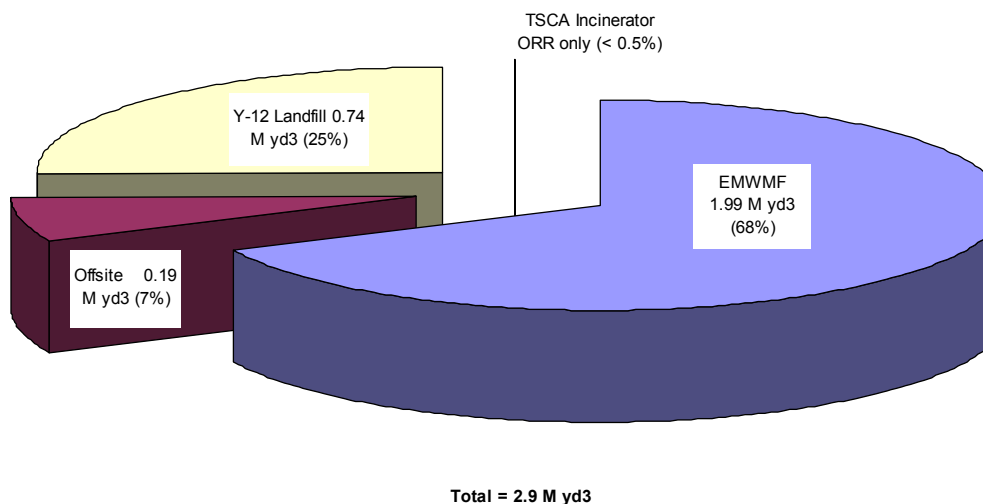


Fig. 1

Innovation – Development and maintenance of a web-based waste generation forecast (WGF) system. Management of our key resource – waste, requires a robust forecasting and reporting tool.

The Waste Generation Forecast was initially developed in the early 1990s to maintain waste type and volume information for early ORR CERCLA documentation. Through many iterations, tireless architecture upkeep and upgrading, the WGF now stands as the model for waste forecasting and reporting. Accounting of *Gold Chart* metrics, environmental restoration volumes, newly generated waste forecast volumes and the origins of waste are but a few of the assets managed by the WGF. The keys to the success of the WGF are four factors:

- Accessibility of the WGF and ease of use (i.e., web-based).
- Data is only as good as the source of data – hence, make sure the WGF finds the right source (i.e., the owner of waste and/or owner of the treatment, storage, and disposal facility) and ensures the owners of the information are trained.
- Use the WGF data fully and advertise the results.
- Quality of data, often suffering in many data systems, is driven toward constant improvement when WGF data is used for all purposes. No one has the time to “check” for quality; rather, BJC must follow basic W. Edwards Deming philosophy and have quality built-in starting with defensible waste estimate take-offs, thorough data entry, maintenance updates, and output in the form of graphics informative to all audiences.

CERCLA Waste Disposal Facility

The Environmental Management Waste Management Facility (EMWMF) is a CERCLA waste disposal facility located in Bear Creek Valley, approximately one mile west of the Y-12 Plant. The EMWMF waste acceptance criteria (WAC) were developed to ensure current, and hypothetical future, receptors are protected by attainment of stringent risk-based performance objectives. EMWMF WAC describes how LLW, mixed LLW, and hazardous waste generated from ORR CERCLA cleanup and D&D activities may be accepted and disposed. EMWMF does not accept sanitary waste, 11e(2) byproduct waste, transuranic waste, or high-level waste.

The BJC BOP organization is responsible for the design, construction, WAC development and maintenance, and operation of the EMWMF. Operations of EMWMF commenced in May 2002 with an initial capacity of 310,000 m³. Approximately 110,000 m³ of capacity has been used to date. Approximately 1,600,000 m³ of CERCLA waste is projected to be generated over the entire EM life cycle through 2015. Currently, 1,400,000 m³ of waste is projected through 2008 – the duration of the BJC closure contract. In order to meet this waste disposal demand, EMWMF capacity expansions must be sequenced to keep pace to ensure fieldwork does not slow or stop. **Figure 2** shows how EMWMF capacity expansion size and timing align to the generation rate of waste.

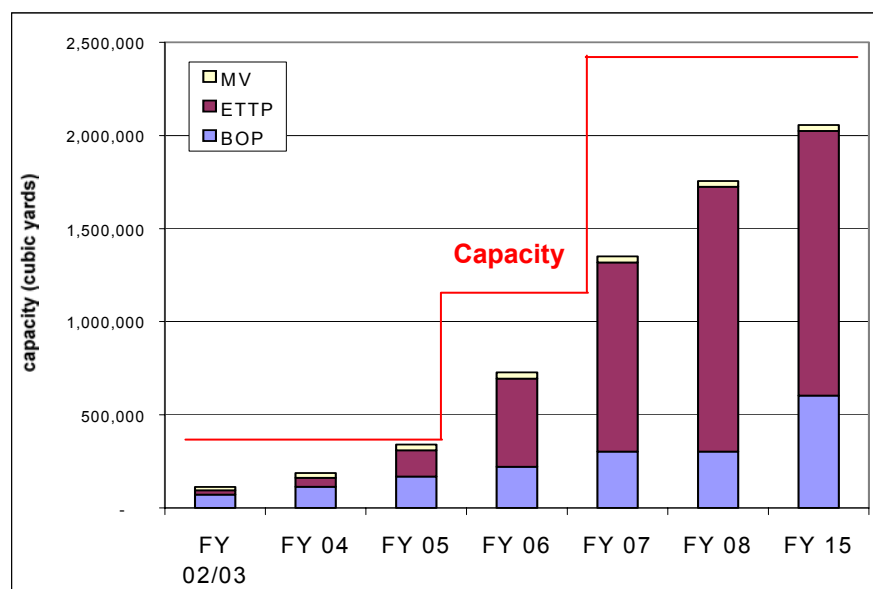


Fig. 2

Innovation – Development of Waste Acceptance Criteria Forecasting and Analysis Capability System (WACFACS), a statistical-based decision and planning tool that enables bounding analyses of volume and contaminant data fully considering project data variability and uncertainty.

Waste volume estimates are developed by generator projects and entered into the WGF. Estimating building decontamination and demolition (D&D) and cleanup volumes is somewhat difficult in that quantifying volumes depends on perspective. Examine three differing perspectives and the impact on volume:

1. In-situ volume – “bank” soil volumes or as the building stands today in the case of D&D work;
2. As-generated volume – the volume of soil generated and set in trucks/gondolas. The volume of D&D waste when the building is demolished and waste piled in heaps; or
3. As-disposed volume – the volume of air space the waste displaces in the disposal facility after material handling steps, volume reduction, and compaction at the disposal facility.

The WGF for BJC represents the first category – in-situ volumes, thus estimates tend to be biased high relative to the actual volume of capacity disposition facilities must plan for but most often less than the as-generated volume, given that typical soil and debris waste “swell” once generated. Challenges faced by BOP relative to EMWMF include:

- Maintaining a properly balanced soil-to-debris ratio for waste received to ensure compaction requirements are met to mitigate future subsidence;
- Effectively and efficiently dispose of waste from generators to meet their cleanup objectives; and
- Ensure sufficient disposal capacity remains in the EMWMF for waste to be generated by EM out-year projects at Y-12 and ORNL.

Analysis of project variability and uncertainty is performed using the Monte Carlo simulation tools provided by WACFACS. WACFACS output includes annual and life cycle expected volumes and lower/upper confidence volume limits. With this data, decision-makers can (and do) make prudent project risk-based decisions.

Legacy Waste Disposal

By the end of FY 2005, all legacy low-level and mixed low-level waste will be safely and cost-effectively disposed. The inventory of legacy LLW, approximately 35,000 m³ and currently the largest in the DOE Complex, will be completely gone in under two (2) years using both DOE and commercial disposal capacity. The inventory of legacy mixed LLW, once approaching 60,000 m³ and among the largest in DOE, will be completely through treatment and subsequent disposal by the end of FY 2005, over ten (10) years ahead of the original Site Treatment Plan approved in 1995.

How? Through the use of innovative treatment and disposal concepts, regulatory support (and push), and a contractual and physical infrastructure necessary to complete the job.

The 35,000 m³ of legacy LLW is located in numerous storage facilities across the three sites on the ORR. Much of the legacy LLW lies on the critical path of D&D work, that is, prior to building D&D and/or remediation around and beneath buildings, legacy LLW and mixed LLW must be disposed.

Innovation – Consolidate legacy LLW from multiple storage areas to a minimum set of strategically located storage facilities off of the critical path resulting in the minimization of storage infrastructure, thus savings costs to enable acceleration of legacy waste disposal.

Intra-site movement of legacy LLW to consolidate into fewer strategic storage locations does require double handling of waste and perhaps utilization of wasted resources from a micro-perspective. To address the downsides to consolidation, BJC negotiated with its subcontractor's cost-effective intra-site shipment rates and motivated financially expedient closure of storage space, related safety-basis documentation, and permits to enable this initiative. Through an aggressive footprint reduction program, the overhead cost related to storage decreased substantially freeing up more resources for ultimate disposition. Also benefiting are D&D and cleanup projects now able to accelerate their respective scope as stored waste is no longer in their way.

Innovation – Management of outdoor legacy LLW at the ETPP site under the auspices of the CERCLA

Approximately 17,000 m³ of the legacy LLW inventory (~50%) is located outside around the K-33 former gaseous diffusion process building or on the K-1066H storage pad. Outdoor legacy LLW has been stored for many years in B-25 boxes and/or sealand containers that are degrading in varying degrees. Due to the threat of release of legacy LLW migrating from deteriorating boxes and entering storm water pathways, DOE, the state of Tennessee Department of Environmental Conservation (TDEC), and the U.S. Environmental Protection Agency Region 4 (EPA) agreed to manage the disposition of the outdoor legacy LLW as a non-time critical removal action. **Figure 3** shows legacy LLW boxes stored outside Building K-33 at the ETPP.



Fig. 3.

As required for CERCLA non-time critical removal action, an engineering evaluation/cost analysis (EE/CA) was developed in the summer of 2003 and issued for public comment. Additionally, briefings on the proposal were provided to a broad base of stakeholders to ensure an informed decision would be manifested. Only one comment was received which supported the concept of “labeling” outdoor legacy LLW as a CERCLA LLW. Heretofore, legacy LLW was managed solely under DOE’s Atomic Energy Act authority and its implementing regulation DOE Order 435.1 “Radioactive Waste Management.”

In October 2003, the Action Memorandum (AM) for outdoor legacy LLW was signed. An ensuing enforceable schedule was established requiring disposal of the outdoor legacy LLW in one year – a full year ahead of the contract mandated end-date of FY 2005. By virtue of the EE/CA AM and CERCLA pedigree placed on the ETTP outdoor legacy LLW inventory, disposition of the LLW at the EMWMF has been enabled at an estimated savings of \$10M compared to disposal off-site. Disposal of the ETTP outdoor LLW at EMWMF commenced in December 2003.

Newly-Generated Waste

Since 1998, the start of the EM management and integration contract, BJC has had the responsibility to collect, manage, store, treat, and disposition waste generated at the Y-12 Plant by National Nuclear Security Administration (NNSA) and ORNL by University of Tennessee-Battelle Laboratories (UT-Battelle). Early independent studies of the EM Program recommended that the EM Program maintain the human and capital resources to manage waste, and having such a capability in multiple Program Secretarial Offices with DOE was inefficient. Counter to that argument would be the waste minimization/pollution prevention axiom that unless a generator has responsibility for the disposition of waste, the generator will not truly work to minimize the volume of waste generated and minimize difficult waste streams with potentially no-path-to disposition.

The current EM position is to divest itself from activities that don’t lead to the eventual extinction of the program (i.e., “closure”). A noble cause, as EM is a series of projects at its lowest levels, and therefore, in its entirety EM should also be viewed as a project, with a discrete start and end-date. As a result, the new EM policy was manifested to transition newly generated waste responsibility out of EM as soon as practical. Plans are now under development to transition the responsibility for newly-generated liquid and solid waste from EM back to NNSA and SC at the start of FY 2005. Should the FY 2005 date or a subsequent transition date be missed for whatever reason, the new BJC Closure Contract requires BOP to manage newly-generated liquid and solid waste through the contract life, or 2008. This scope is out of the target cost of the contract for fee purposes; thus, there is little incentive for EM or BJC to maintain this scope of work.

Innovation – EM established newly generated waste volume “caps” that, when exceeded, would require NNSA and/or SC to fund and manage the overage waste volume.

Since the newly-signed closure contract between DOE and BJC established an annual and baseline target cost for the scope of work, all parties recognized that fluctuating volumes of newly-generated solid waste would substantially impact costs in the year of generation. For this reason, it became imperative to differentiate between “operations waste” versus “construction/maintenance waste,” the latter being the

primary driver of waste actuals exceeding forecast. Since capital construction, and/or maintenance activities are line item projects the wastes generated from such activities are to be covered (i.e., accounted and paid for) by the landlord project line item – not EM. Newly generated waste in the context of the service provided by EM to other DOE elements is related to operations or mission-related activities. The BOP organization maintains a rich database of operations waste forecast and actual volumes over many years, hence, establishment of volume limits or “caps” was straightforward and fully defensible.

High-Priority Response Actions

Since there are active and vibrant missions at ORNL and Y-12, DOE-ORO and the regulators agreed that the bulk of D&D and response action work at those sites would be scheduled for beyond FY 2008. This strategy enables EM to focus its limited resources on closure of ETTP and Melton Valley and the disposition of legacy LLW and mixed LLW. There are, however, a number of high-risk, high-priority response actions planned under the BJC closure contract that could not be deferred to the out-years. These projects are the responsibility of BOP to execute and complete by FY 2008.

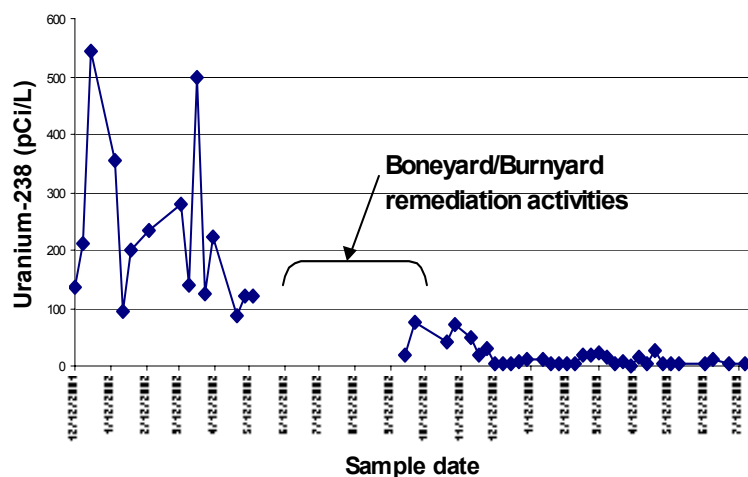
At the Y-12 Plant, high-priority risk reduction activities include:

- Design, construct and operate a mercury (Hg) treatment facility,
- Complete East End Volatile Organic Compound Bioremediation study, and
- Complete remediation of Boneyard/Burnyard (BYBY) disposal ground.

Remediation of the BYBY, including site restoration of wetlands, has been completed. A notable result of the BYBY cleanup is the uranium flux concentration to Bear Creek (west of the Y-12 Plant) has dropped significantly since the cleanup was completed. **Figure 4** shows the BYBY during remediation and the accompanying graphic illustrates the effectiveness of the response action.



Fig. 4



At ORNL, high-priority risk reduction activities include:

- Completion of the Bethel Valley Groundwater Engineering Study.
- Completion of the Corehole 8 Plume Source remediation.
- Completion of the Molten Salt Reactor Experiment fuel salt removal.
- Completion of Tower Shielding Facility Defueling.
- Completion of the Surface Impoundment Operable Unit (SIU) remediation.

BOP has completed remediation of the SIOU and all waste has been disposed. Sludges and sediments from SIOU were mixed with grout into solidified waste forms (i.e., bricks) and approximately 5400 m³ of waste disposed at both the Envirocare of Utah facility and the EMWMF.

BOP also completed the Tower Shielding Facility defueling in December 2003.

Innovation – BOP hired former (retired) workers familiar with the Tower Shielding Facility to provide valuable consultation prior to, and during, the defueling process.

The Tower Shielding Facility was an experimental reactor that operated in the 1950's. Removal of the fuel presented unique challenges as as-built drawings of the reactor core were not completely accurate, and defueling work had to be performed remotely as the reactor core was submerged in water used as shielding. The fuel was successfully removed and loaded in compliant spent nuclear fuel casks and immediately shipped to the DOE Savannah River Site.

The most important, and visible, BOP high-priority risk reduction scope is the remediation of three off-site (i.e., off the ORR) contaminated properties. They are:

- Completion of the Atomic City Auto Parts (ACAP) site remediation
- Completion of the David Witherspoon 901 (DWI 901) Site remediation
- Completion of the David Witherspoon 1630 (DWI 1630) Site remediation

Materials and waste originating from Oak Ridge Operations activities contaminated these properties, primarily scrap metal recycling work. ACAP is industrial property located in the city of Oak Ridge. The DWI 901 and 1630 sites are industrial sites located in south Knoxville. These properties are surrounded by residential and/or active industrial (non-DOE) activities, thus their cleanup is highly desired by stakeholders.

Cleanup of the ACAP site has commenced. An estimated 21,000 m³ of soil and debris waste is expected to be generated with cleanup completed in the summer of 2004.

SUMMARY

The first BOP 'closure' milestone is to complete the disposition of all legacy LLW and mixed LLW by the end of FY 2005. Rigorous planning, cost-effective subcontracting and execution vehicles, and implementation of innovative approaches has paid benefits as an early completion, under target cost, is projected.

BOP has the treatment and disposal infrastructure in place that, along with innovative planning and decision tools, will ensure more than 95% of the waste to be generated and managed in the next five years will be safely, effectively and cost efficiently dispositioned on-site. The balance of waste (5%) will be disposed off-site at DOE and/or commercial disposal outlets.

BOP high-priority risk reduction response actions are well under way, in fact, a few are already complete just a few months after the Closure Contract was signed in October 2003. The cleanups have met stated objectives of reducing risk and enabling future use as intended by the end-state objectives.

Completion of the legacy LLW and mixed LLW milestone by FY 2005 and completion of all high-priority risk reduction response actions are our explicit objectives. A BOP motto is ready, set, & go, reality is we are off and running!