

Closeout of the Melton Valley Completion Project at the Oak Ridge National Laboratory

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ABSTRACT

The U.S. Department of Energy DOE Order 413.3A (Program and Project Management for the Acquisition of Capital Assets) identifies major milestones in a project lifecycle that require approval upon achievement, including Critical Decision-4 (CD-4), the project completion milestone. A CD-4 document is required for all DOE projects in accordance with DOE Order 413.3A, Program and Project Management for Acquisition of Capital Assets. A conditional CD-4 report was prepared for the Melton Valley Completion Project (MVCP) in order to document the completion of the remedial action in the Melton Valley watershed. Approval of the MVCP CD-4 was “conditional” pending final resolution of a small quantity of unexpected pyrophoric material, with no current disposition pathway, remaining in one of the waste trenches that were to be remediated as part of the completion project. This paper will provide an overview of the MVCP remediation work and the process successfully used to demonstrate closeout of a major CERCLA project in accordance with DOE requirements.

INTRODUCTION

A watershed-wide remedial action was recently completed at the Oak Ridge National Laboratory on DOE’s Oak Ridge Reservation in Oak Ridge, Tennessee (Fig. 1). A Critical Decision-4 (CD-4) is required for all DOE projects in accordance with DOE Order 413.3A, Program and Project Management for Acquisition of Capital Assets. This paper provides information about the report prepared in support of CD-4 decision-making for the Melton Valley Completion Project (MVCP), including transition, physical, financial and regulatory closeout. The information in the CD-4 report was developed based on guidance provided in DOE Orders DOE O 413.3 and DOE O 413.3A, which provide CD-4 general requirements and prerequisite activities, and *Closeout, Project Management Practices*, U.S. DOE, Office of Management, Budget and Evaluation, Rev. E, June 2003, which specifies the process for closing a project and preparing a CD-4 report.

The work associated with the Melton Valley MVCP remedial action was conducted in accordance with the following documents:

1. Record of Decision for Interim Actions for the Melton Valley Watershed at the Oak Ridge National Laboratory [1],
2. Record of Decision for Interim Actions in Bethel Valley [2], and
3. Dispute Resolution Agreement with the State of Tennessee for the retrieval of transuranic (TRU) wastes [3].

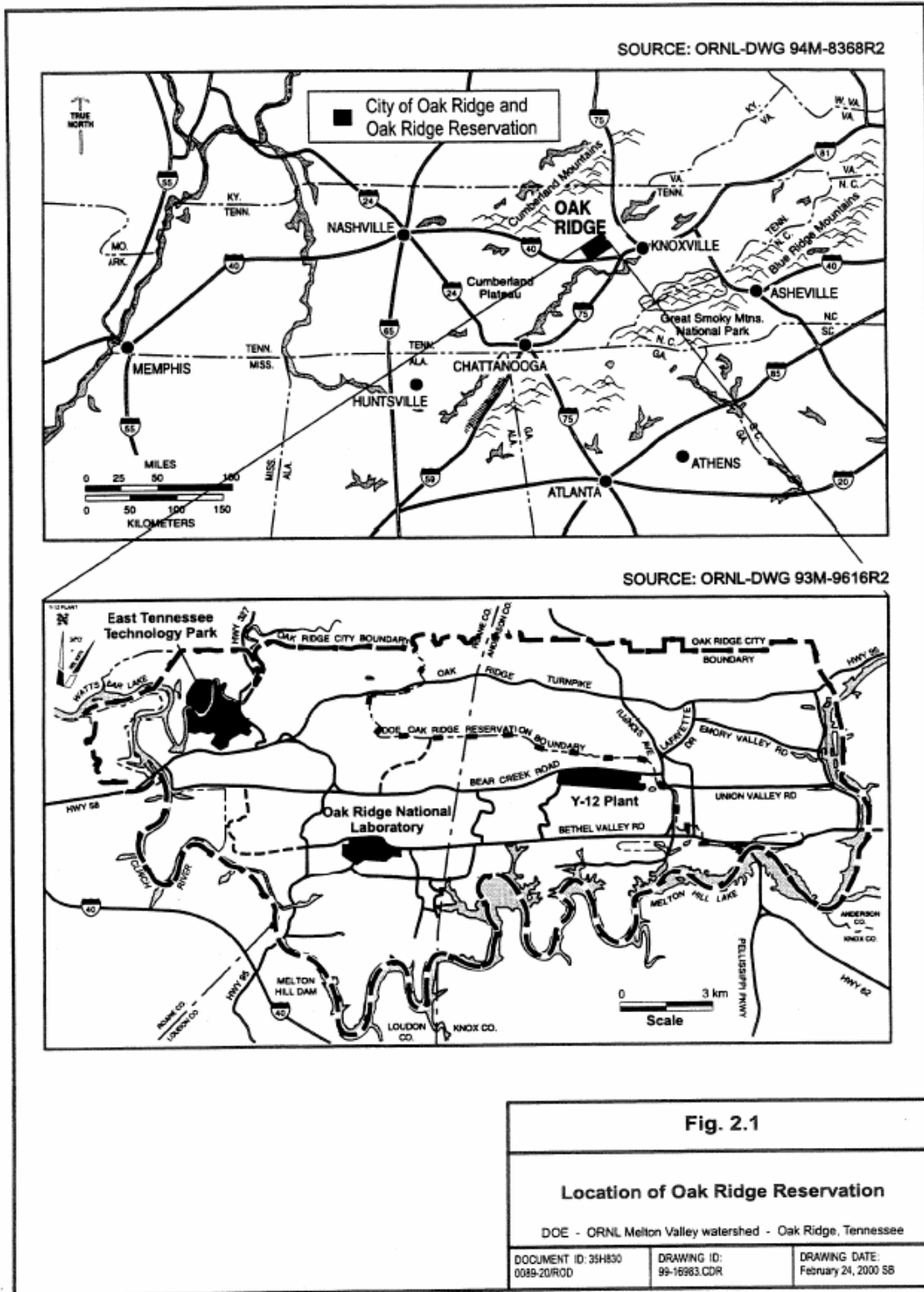


Fig. 1. Location of Oak Ridge Reservation

More than 50 years of operation, production, and research activities at Oak Ridge National Laboratory (ORNL) produced a legacy of contaminated inactive facilities and waste disposal areas. Many of the wastes and facilities are located in Melton Valley, which occupies approximately 430 hectares (1,062 acres) in the southern portion of ORNL (Fig. 2). Wastes in Melton Valley reside at a variety of locations, including trenches, tanks, landfills, pipelines, surface structures, and impoundments. The major contaminants are radionuclides (short- and long-lived) in waste, soil, groundwater, surface water, sediment, and biota. Migration from shallow groundwater to surface water was the principal migration pathway of concern.

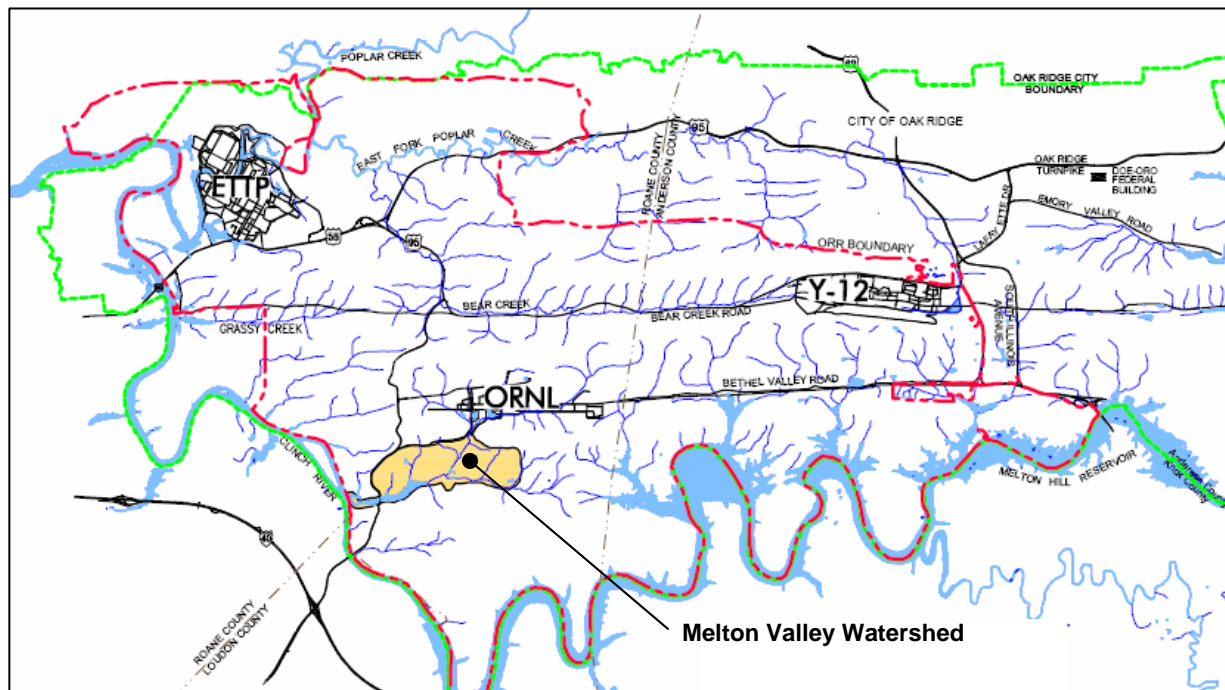


Fig. 2. Location of Melton Valley Watershed on Oak Ridge Reservation

The MV ROD was signed in September 2000 and included a combination of remedial activities such as containment, stabilization, removal, treatment, monitoring, and land use controls (LUCs) that addressed contaminant releases and potential risk. The remedy is interim until a final ROD is completed for MV. Remediation of sediment, groundwater, and floodplain soils exhibiting <2500 uR/h radiation was deferred until the effectiveness of interim actions is evaluated.

MELTON VALLEY COMPLETION PROJECT

The ROD requirements (and Dispute Resolution Agreement) were incorporated into a prime contract between DOE and Bechtel Jacobs Company, LLC as part of an Accelerated Closure Contract (ACP). The contract was signed on September 30, 2003 by DOE and BJC. Regulatory requirements were incorporated into the prime contract as part of the accelerated cleanup contract. BJC was to be fully responsible and accountable for the safe accomplishment of all work, whether performed by its own personnel or subcontractors. The statement of work was divided into scope sections for each of four major project milestones as well as a general description and a section on general project support. MVCP was one of the four major project milestones. The scope section for Melton Valley was then further divided into

scope items, for example, Melton Valley Hydrologic Isolation. Highlights of the MVCP remedial actions are presented below. Site locations are shown on Fig. 3.

Hydrologic Isolation

The Hydrologic Isolation project included the installation of modified RCRA-type multi-layer caps over waste disposal areas in the Melton Valley watershed. This action also included the installation of upgradient diversion and downgradient interception trenches, plugging and abandonment monitoring wells, wetland restoration, stream relocation, borrow area development, construction of a haul road, utility relocation, and demolition of several small buildings

The specific site areas were Solid Waste Storage Area (SWSA) 4, SWSA 5, SWSA 6, Seepage Pits 1, 2, 3, and 4, and Trenches 5, 6, and 7. There were 13 individual caps constructed during this remedy consisting of 58 hectares (144 acres) requiring 1.5 million cubic meters of soil placement and 544,000 tons of rock for slope stability transported by 140,000 truck loads driven a cumulative 1.9 million kilometers. Four kilometers of upgradient and downgradient trenches were constructed to manage groundwater movement in and out of capped waste areas. The 11 hectare Copper Ridge Borrow Area was developed in the east end of Melton Valley. A 5 kilometer Haul Road was constructed to supply the soil and rock to the capped areas. Before cap construction, 30 hectares of land were cleared, over 900 monitoring wells were plugged and abandoned, and 12 small buildings were demolished. The borrow area site was reclaimed at the completion of the project.

TRU Trenches Waste Retrieval

The TRU Trenches Waste Retrieval project included site preparation, excavation, waste retrieval, overpacking of waste containers, staging of retrieved (and overpacked) waste, and site restoration. As part of site preparation, a moveable enclosure with controlled ventilation was installed over the excavation areas. The enclosure was moved three times during the project as the excavation areas changed. During the implementation of this remedy, 204 concrete casks, 18 steel or wooden boxes, 12 drums, and 15 cubic meters of TRU waste were removed from 22 trenches. The casks were placed in overpacks and stored pending treatment at DOE's TRU Waste Processing Facility in Oak Ridge.

Tanks Remediation

The Tanks Remediation project included the three LLLW tanks associated with ORNL High Flux Isotope Reactor (HFIR) complex. The three tanks were designated T-1, T-2, and HFIR tanks, consisting of two tanks with a capacity of 57 kiloliters and one with a capacity of 47 kiloliters, respectively. The remedy consisted of sludge content removal and tank shell stabilization. The tank sludge was removed utilizing remotely-operated devices and the tanks were stabilized by filling with grout.

Soils and Sediments Remediation

Soils and Sediments Remediation project included the excavation of the HFIR ponds, the Homogeneous Reactor Experiment (HRE) pond, excavation of contaminated soil sites, stabilization of Inactive Waste Pipeline system in Melton Valley, removal of buried waste and soil from the Engineered Test Facility, and the final verification surveys and sampling across all of Melton Valley. The project remediated five inactive waste ponds, 10 contaminated soil sites, and 25 hot spot sites that were identified during the final verification surveys. A total of over 23,000 cubic meters of contaminated soil and waste was excavated and transported by 3,258 truckloads. Nearly 10 kilometers of inactive liquid waste lines were stabilized by grouting.

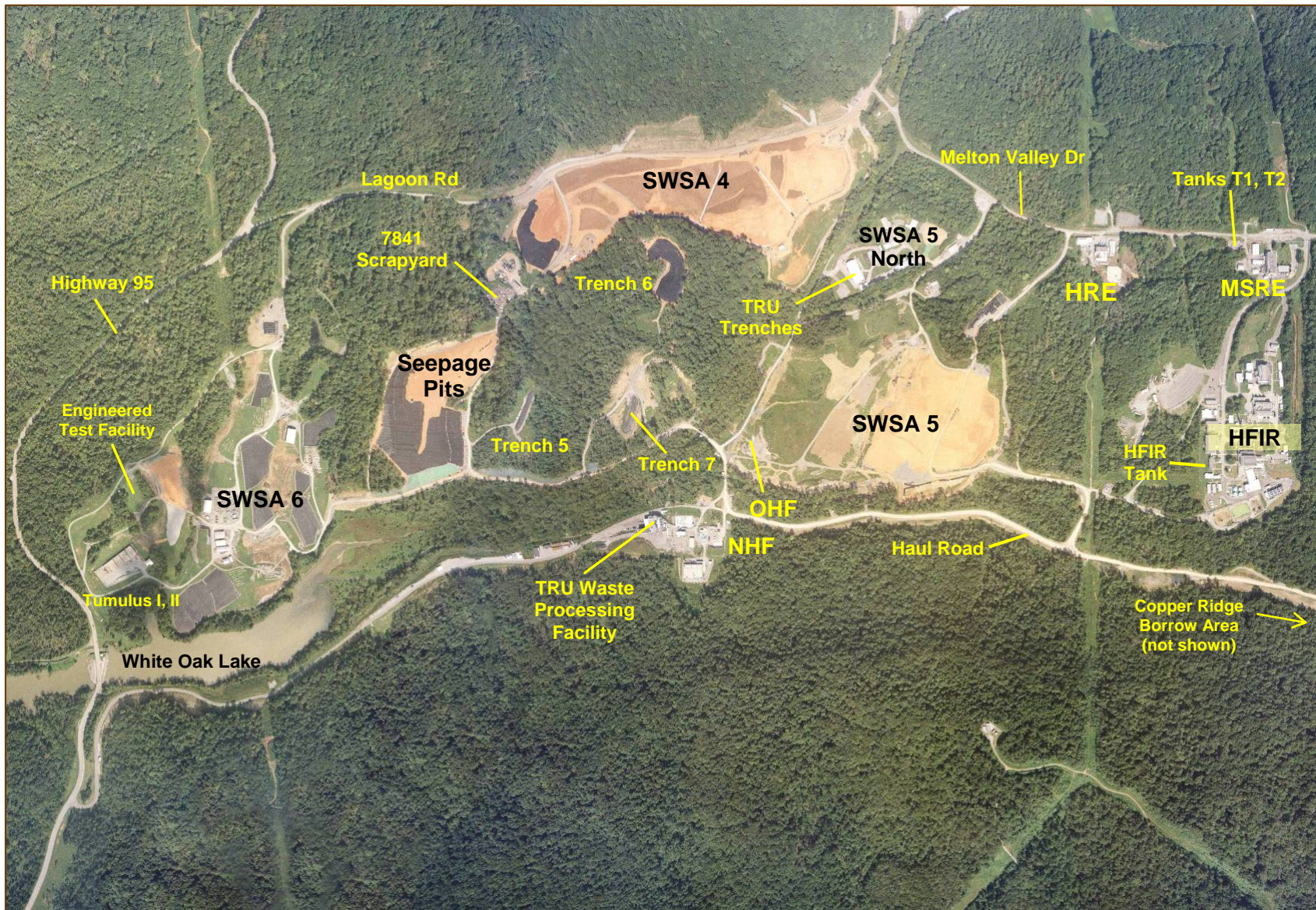


Fig. 3. Location of Contaminated Sites and Remedial Actions in the Melton Valley Watershed.

Facilities Decontamination and Decommissioning (D&D)

Facilities Decontamination and Decommissioning project included the New Hydrofracture Facility, Homogenous Reactor Experiment Ancillary Facilities, Hydrofracture Well Plugging and Abandonment, and the 7841 Scrap yard. This project demolished 14 facilities and disposed of the contaminated materials, including 227 cubic meters of solids and 11,000 liters of waste liquids. The 7841 Scrap yard comprised of over 1,400 cubic meters of contaminated metal, equipment, tanks, drums, boxes, and debris in a one acre site. The scrap yard work also included the opening, waste characterization and disposition of 840 containers, including naval reactor carriers and in some cases, unknown waste types. The Hydrofracture Well Plugging and Abandonment (P&A) effort included the grouting 112 wells, including those previously used to inject wastes underground, to cut off further subsurface contaminant migration.

In-situ Grouting of Trenches 5 and 7

In-situ Grouting project included the remediation of Trenches 5 and 7 and the HRE Fuel Wells. The project was conducted to decrease hydraulic conductivity and thereby decrease water flow and contaminate migration from the trenches. The original MV ROD specified in situ vitrification (ISV) for Trenches 5 and 7. During data collection and evaluation for the design phase, it was determined that the thickness of the saturated zone in several areas of the trenches was greater than previously thought. Due to the concerns associated with performing ISV in the saturated zone, it was determined that in situ grouting would satisfy the ROD criteria and it was selected as a replacement for the preferred remedy. A ROD amendment was prepared and subsequently approved by the regulators in August 2004.

The remedy was accomplished by filling the void space within the crushed stone section of each trench with 458 cubic meters of cementitious grout. The contaminated soil surrounding the trenches (~1 meter perimeter) was then grouted with 356 kiloliters of polyacrylamide grout to further reduce water infiltration. Soil backfill above each of the seven HRE fuel wells was removed to a depth of approximately 1 meter by augering, and the soils were replaced with a cement plug to prevent water infiltration from migrating down the original borehole. Soil surrounding the fuel wells was then grouted with polyacrylamide to ensure water infiltration through the HRE wells is prevented. After successful completion of in situ grouting of both trenches and the HRE fuel wells, the areas were covered with the modified-RCRA caps to further prevent surface water infiltration into the area surrounding these disposal sites.

Modifications to Approach

Several modifications to the approach for the MVCP, resulting from changed conditions, alternate methods of accomplishment, and added/deleted contaminated facilities, occurred over the life of the project. These changes were formally documented via one ROD Amendment, four ROD Explanation of Significant Differences (ESDs), and one prime contract modification to the statement of work. Two of these changes resulted in lifecycle cost avoidance (ROD Amendment for Trenches 5/7 change from in situ vitrification to in situ grouting and alternate method for processing residual waste from spent nuclear fuel). These are briefly summarized below.

- MV ROD ESD (DOE/OR/01-2040&D2, dated March 2003) – The ESD added three facilities in SWSA 6 to the remedy, including the Interim Waste Management Facility, Tumulus 1 and Tumulus II. These units were considered active at the time the ROD was

signed but were later transitioned to inactive status and thus eligible for remediation. The selected remedy for all three units was capping (hydrologic isolation).

- MV ROD ESD (DOE/OR/01-2165&D1, dated July 2004) – This ESD added 11 units to the remedy for the watershed including the Engineered Test Facility in SWSA 6. Seven of these units were considered active at the time the ROD was signed but were later transitioned to inactive status and identified for remediation. Four additional units that were not identified in the ROD were included to support remediation activities at SWSA 5 and 6.
- MV ROD Amendment (DOE/OR/01-2170, dated August 2004) – Changed the remedy for Trenches 5/7 from ISV to in situ grouting (ISG). This was based on further evaluation of the feasibility of ISV and the technical demonstration that ISG could achieve the specified ROD remedial action goals.
- MV ROD ESD (DOE/OR/01-2249&D1, dated August 2005) – The ESD deleted the D&D of 7 ancillary facilities at the MSRE facility that were expected to become inactive but that remained active and thus ineligible for remediation.
- MV ROD ESD (DOE/OR/01-2333&D0, dated October 2006) – Removed the scope for disposition of the Shielded Transfer Tanks (STTs). During additional process knowledge evaluations to demonstrate waste acceptance criteria attainment, it was determined that four of the STTs may be classified as high-level waste (HLW) due to their association with Hanford tanks. Also, it was determined that the fifth STT was classified as TRU waste. DOE plans to complete a Waste Incidental to Reprocessing (WIR) determination for the four tanks and further evaluate the disposition pathway for the fifth tank containing TRU waste. The MV ROD assumed that the STTs would be classified as low level waste and could be disposed in the onsite disposal facility.
- Alternate Disposition Path for Secondary Waste from Spent Nuclear Fuel (SNF) Re-packaging - DOE acknowledged that a portion of the secondary waste was not acceptable for processing at the TRU Waste Processing Facility and that a small volume appeared to have no path to disposition. BJC was requested to evaluate alternatives and subsequently negotiated an approach with ORNL operating contractor UT-Battelle (UT-B) to consolidate this waste with similar waste generated from ongoing UT-B operations.
- 22-Trench Area in SWSA 5 North, Trench 13 Pyrophoric Material - The Dispute Resolution Agreement required removal of buried TRU waste from the 22-Trench Area in SWSA 5 North. The TRU waste, including 204 casks and associated debris, was removed with the exception of 8 drums containing glass jars of pyrophoric material encountered during the excavation of Trench 13. The baseline planning documents assumed that no pyrophoric material would be encountered in the 22-Trench Area. With written concurrence from the Tennessee Department of Environment and Conservation (TDEC), DOE has stabilized the eight drums of pyrophoric material in place, pending the identification and execution of a disposition pathway by September 30, 2009.

EXIT STRATEGY

Section C.1.2 of the prime contract required that “A comprehensive exit plan/strategy shall be prepared by the Contractor and approved by DOE to define the process, plans and other deliverables necessary to meet this requirement, including interim completion notices. This plan shall be completed within six months of the award of this contract. The exit strategy shall also define specific end states for each facility or activity which comprise each of the four end states.” The following discussion summarizes the Melton Valley implemented activities as required by the exit strategy.

Transition to Surveillance and Maintenance (S&M)

Transition of MV facilities to ORNL S&M was performed in accordance with the project procedures. MVCP was responsible for the identification of facilities to transfer, preparation of an index of transition information to identify its location, completion of Remedial Actions per the ROD, and preparation of transition forms, as appropriate. ORNL S&M worked with MVCP to facilitate the transition. Both MVCP and ORNL S&M created a team that was responsible for the coordination of transition activities. Subsequently, BJC and DOE validated completion of the work by means of a facility inspection and walkdown. Site inspections and walkdowns are recorded in DOE's ORION system, a database that tracks assessments, assessment-related documentation, walkthroughs, findings, corrective actions, and lessons learned associated with assessments and other oversight activities at DOE facilities in Oak Ridge. As appropriate, MVCP and ORNL S&M resolved any open items and performed additional walk-downs, if necessary.

Completion Letters and Phased Construction Completion Reports (PCCRs)

As required per the contract, BJC issued completion letters to DOE. Per the Exit Strategy, the completion letters document the completion of a scope item that is not addressed in a regulatory document. The Phased Construction Completion Reports (PCCRs) were produced for reporting the completion of major units of remediation activities specified in the MV ROD. Each PCCR became an enforceable milestone within the framework of the Federal Facility Agreement (FFA). A total of 12 PCCRs were prepared for MVCP (Table II).

Table II. Melton Valley Completion Project Documents

Completion Document	Actual Completion Date
MV Land Use Controls Completion Letter	5/16/2006
Spent Nuclear Fuels Shipment Completion Letter	1/21/2004
Tank W-1A Waste Disposition Completion Letter	5/16/2005
Guniting and Associated Tanks Waste Disposition Completion Letter	5/16/2005
FFA Tanks Waste Disposition Removal action Report Revision	5/16/2005
T1, T2, and High Flux Isotope Reactor Tanks PCCR	9/26/2005
Ecological Monitoring Plan Completion Letter	4/6/2006
MV Surface Water/Groundwater Monitoring Completion Letter	4/6/2006
Hydrofracture Well P&A PCCR	5/24/2006
MV ISG Trenches 5 & 7 PCCR	6/30/2006
SWSA 6 PCCR	6/30/2006
New Hydrofracture Facility (NHF) D&D PCCR	7/14/2006
SWSA 4 PCCR	7/26/2006
Pits and Trenches PCCR	8/30/2006
SWSA 5 PCCR	8/30/2006
TRU Trenches PCCR	8/31/2006
Old Hydrofracture Facility (OHF) D&D Completion Letter	9/14/2006
HRE Ancillary Facilities D&D PCCR	9/14/2006
Soils and Sediments PCCR	9/22/2006

Completion Document	Actual Completion Date
7841 Scrapyard D&D PCCR	9/27/2006
Spent Nuclear Fuels Residual Waste Completion Letter	9/27/2006
Melton Valley Remedial Action Report (2007)	3/19/2007

As a primary document, BJC and DOE completed and transmitted D1 PCCRs to the EPA and the TDEC for review and approval in accordance with provisions included in the FFA. All PCCRs were approved by DOE and the regulators. A Remedial Action Report (RAR) compiling the documentation that all ROD-required remediation work was also completed by the FFA milestone date of May 31, 2007.

On September 30, 2006, BJC issued the Final Declaration of Completion Letter stating that it considered the MVCP to be completed. On November 13, 2006, DOE issued the Verification of Final Declaration of Completion Letter. DOE determined that the milestone has been satisfactorily completed, conditional upon the issuance of the anticipated ESD for the removal of the STTs from the MV ROD.

Cost and Schedule Performance

The project was completed within the milestone schedule date of September 30, 2006. Final costs for the project were within the expected range as shown by a final Cost Performance Index (CPI) of 0.98 (CPI = budgeted costs ÷ actual costs). All known costs related to completed scope were accrued in accordance with Generally Accepted Accounting Principles (GAAP) at the completion of the project. The Total Estimated Cost of the project was \$351.3 million (M). The Total Budget at Completion for this project was \$346.7 M. The resulting estimated cost variance is an overrun of \$4.6 M or 1.3%.

The project cost variance is attributed to a significant increase in the quantity of polyacrylamide grout, which extended the Trenches 5 and 7 subproject by two months. Additional cost increases were encountered for the disposition of contaminated lead from the 7841 Scrap Yard, which was originally planned as recyclable, and the discovery of unknown waste material at the site. There were also some savings identified due to efficient retrieval of the 204 casks from the TRU Trenches project and savings realized by the coordination of efforts with UT-Battelle on the residual waste disposition from the SNF project.

In February 2006, the existing performance baseline was increased from \$288.6M by \$58.1M resulting in an adjusted baseline of \$346.7M. There was never a contingency planned in the original baseline. However, the contractor had implemented a formal management process to capture risks and their probability of occurrence. This process provided part of the basis for the increased baseline, which accounted for: (1) cost growth for the scope that had been completed to date; (2) estimated increases for remaining scope; and (3) additional cost due to highly probable remaining risk events (e.g., weather impacts on earthwork, scheduling waste shipments to offsite disposal facilities). The changes identified in this change to the baseline did not impact the milestone contract completion date of September 30, 2006.

During performance of the MVCP, BJC received a full certification of the Earned Value Management System (EVMS). As part of this certification, an external independent review (EIR) of the baseline was conducted and a new performance measurement baseline (PMB) established. BJC also developed a Risk Management Plan to identify project risks and their probability of occurrence.

DOE Assessment and Verification

DOE conducted an independent verification assessment of the MVCP to determine if all contract requirements and milestones have been met in accordance with prime contract specifications. As stated earlier, the contract specified a completion date of September 30, 2006.

The verification assessment was conducted in multiple phases to provide independent confirmation that BJC had successfully completed contract requirements for the MVCP and those facilities and project documents have been successfully transitioned to the ORNL surveillance and maintenance (S&M) program. The phases included the following:

- Phase 1 - Review of Project Completion Documentation Milestones. This phase involved the verification that BJC had submitted appropriate documentation to demonstrate accomplishments of the scope of work specified in the prime contract.
- Phase 2 – Independent Verification of Completion Document Conclusions. DOE conducted an independent evaluation of each of the required completion documents with respect to their compliance with agreed project scope, adequacy in fulfilling the requirements of the ROD, and attainment of MV End States specified in the contract.
- Phase 3 – Resolution of Discrepancies. DOE ensured that any discrepancies were documented and in accordance with contract modifications and/or written agreements between DOE and BJC.
- Phase 4 – Confirmation of Facility Transition to ORNL S&M. DOE confirmed transition of facilities to S&M subprojects through development of Facility Transfer Authorization and Acceptance Checklists for the different facilities.

DOE's Verification Report provided independent confirmation that BJC successfully completed contract requirements and that facilities and project documents have been successfully transitioned to the ORNL S&M program. The verification report confirmed that the Melton Valley End State was achieved in accordance with the MV ROD, the DOE End State Vision, and the prime contract.

LESSONS LEARNED

The DOE lessons learned program helps to prevent the recurrence of significant adverse events/trends by sharing performance information, lessons learned, and good practices across the DOE complex. The lessons learned gathered during the life of the MVCP were summarized in the CD-4 Document and the DOE lessons learned database. Two representative lessons learned are summarized below.

Behavior Observation Safety System (BOSS) Team

The BOSS team was formed in 2005 to encourage workers to take active ownership of their own and their peer's safe work habits. The team was formed with representatives from a cross-section of laborers, operators, technicians, and management working on the various subcontracts on the Melton Valley project. The team met on at least a monthly basis to raise concerns for work practices or behavior that could lead to unsafe actions and would discuss actions to correct the practices. Since the BOSS team was comprised of workers from various positions on the project, safety ownership was encouraged at all levels and not just confined to the safety professionals. By

the end of the project, BJC and its subcontractors had compiled a safe work record of over 1 million hours, an accomplishment that was attributed largely to the influence of the BOSS team.

MV Core Team

One of the largest contributors to the overall success of the MV Completion Project was the Melton Valley Core Team (MVCT), consisting of representatives from DOE, TDEC and EPA with active participation by BJC and other contractors as appropriate. The MVCT facilitated project success on both the regulatory and technical fronts. Regular, scheduled meetings were employed to provide systematic project progress updates, promote open discussion on difficult technical issues, and provide an unhindered forum for exploration of concerns, and foster ownership that in turn facilitated decisions. The Core Team provided that forum of exchange among all project participants, whether DOE, BJC, TDEC, or EPA. On a regular basis, most documents could be approved by the regulators following one review cycle. The MVCT also allowed for agreement at meetings of minor changes in the field without formal approval through a document submittal. Both the approval of documents after one review cycle and agreement to minor changes helped tremendously in meeting the aggressive project schedule.

SUMMARY AND CONCLUSIONS

The MV ROD was planned to be completed in 12 years; however, under the ACP the remedial activities were completed 6 years ahead of schedule (September 2006). Highlights of the remedial actions include:

- Completion of remedial action activities at 219 release sites identified in the MV ROD.
- Construction of 58 hectares of multilayer caps for SWSA 4, SWSA 5, SWSA 6, Pits 2, 3 & 4 and Trenches 5, 6, & 7
- Complete excavation, retrieval and over-pack of 204 casks, 8 boxes, and 530 m³ of loose waste from the TRU waste retrieval project
- Complete demolition and disposition of approx. 557 m² of various buildings such as HRE ancillary facilities, NHF, Liquid LLW pumping stations, 7841 Scrap Yard, misc. storage buildings, and well P&A
- Removal of LLW sludges and stabilization of T-1, T-2, and HFIR tanks
- In situ grouting/stabilization of approx. 12 km of inactive waste pipelines
- Excavation and disposition of approx. 38,000 m³ of soil from HFIR impoundments, HRE cryogenic pond, IHP and contaminated soil from miscellaneous leak sites
- Completion of in-situ grouting of LLLW matrix at Trenches 5 and 7

The CD-4 document to demonstrate attainment of the project completion milestone was prepared to document close-out activities. Approval of the MVCP CD-4 was obtained but deemed “conditional” pending final resolution of a small quantity of unexpected pyrophoric material, with no current disposition pathway, remaining in Trench 13 of the 22 Trench Area in SWSA 5N. DOE is currently evaluating options for the final disposition of this material and has committed to resolution of the issue by the end of Fiscal Year 2008. At that time, all aspects of the Melton Valley Completion Project will be complete.

REFERENCES

1. Record of Decision for Interim Actions for the Melton Valley Watershed at the Oak Ridge National Laboratory, Oak Ridge, Tennessee. DOE/OR/01-1826&D3
2. Record of Decision for Interim Actions in Bethel Valley, Oak Ridge, Tennessee. DOE/OR/01-1862&D4.
3. Dispute Resolution Agreement with the State of Tennessee for the retrieval and storage of the transuranic (TRU) waste contained in casks in the Solid Waste Storage Area 5 North, 22-Trench Area.