4.2 Hazard Area 2 - Melton Valley

The Melton Valley watershed occupies approximately 1000 acres in the southern portion of ORNL at the southwestern boundary of the ORR. The watershed is bounded on the north by the Bethel Valley watershed and on the west by the Clinch River. It is separated from Bethel Valley by Haw Ridge. Waste management was historically the principal activity that took place in Melton Valley, although research and development for two nuclear reactors also occurred there. As a result of past operations, Melton Valley contains numerous burial grounds, seepage pits, contaminated floodplains and hydrofracture wastes. The wastes disposed in Melton Valley originated both from local operations and from other sites. The bulk of disposal activities involved shallow land burial. In some cases, wastes are in constant contact with groundwater, resulting in shallow groundwater contamination. From 1955 to 1963, Solid Waste Storage Areas (SWSAs) 4 and 5 in Melton Valley were designated by the Atomic Energy Commission (AEC) as the Southern Regional Burial Ground, and received radioactive wastes from more than 50 other facilities.

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White Oak Creek flows from Bethel Valley into Melton Valley at ORNL. Tributaries to White Oak Creek drain waste disposal areas in Melton Valley. White Oak Creek exits the ORR through White Oak Lake, over the White Oak Dam, and into the Clinch River. Strontium-90, tritium, and cesium-137 are the primary contaminants of concern in surface water leaving the Melton Valley watershed.

The *Record of Decision for Interim Actions for the Melton Valley Watershed* (DOE 2000) was approved on September 21, 2000, and an Explanation of Significant Differences (ESD) was issued in 2003 (DOE 2003c) to add remedial actions for four additional waste management units to the scope of the ROD. Remedial actions selected under the ROD include a combination of containment, stabilization, removal, treatment, monitoring, and land use controls. Remedial actions under this ROD were designed to support the following land uses: the eastern portion of the Melton Valley watershed will be remediated to permit DOE-controlled industrial use, while the western portion of the watershed, where numerous waste disposal sites are located, will continue to be a waste management area, with most wastes managed in place. The selected remedial actions are designed to significantly reduce the release of contaminants from the Melton Valley source areas into White Oak Creek, Melton Branch, their tributaries, and the Clinch River. The selected remedy leaves hazardous substances in place which require land use controls for the foreseeable future, with approximately 2 million curies of radioactivity closed in place under 128 acres of caps.

Remediation criteria are specified in the Melton Valley ROD for soils, floodplain sediments, and surface water. Remediation goals for surface water are to achieve Ambient Water Quality Criteria (AWQC) in waters of the State of Tennessee, protect an off-site resident user of surface water, and protect the Clinch River to meet its stream use classification. Remediation of surface water sediment was deferred to a future decision. Remedial action for floodplain soils at White Oak Creek, Melton Branch, and other tributaries is limited to removal of the most highly contaminated floodplain soil (i.e., soils where gamma exposure rate exceeds 2500 µR/hr) to protect site workers. Remediation criteria for soils were derived to limit potential risk to a hypothetical future worker not to exceed 1 x 10^{-4} excess lifetime cancer risk; these values are summarized in Table 4-2.

Table 4-2. Soil Remediation Criteria from the Melton Valley ROD

Principal COC in Soil	**Selected Remediation Concentration**
Carcinogens	
Aroclor 1260	47 mg/kg
Cobalt-60	7.4 pCi/g
Strontium-90	1200 pCi/g
Cesium-137	14 pCi/g
Europium-154	11 pCi/g
Lead-210	270 pCi/g
Radium-226	5 pCi/g*
Radium-228	5 pCi/g*
Thorium-228	5 pCi/g*
Thorium-232	5 pCi/g*
Uranium-233	5100 pCi/g
Uranium-234	6000 pCi/g
Uranium-235	81 pCi/g
Uranium-238	310 pCi/g
Noncarcinogens	
Arsenic	330 mg/kg

*Criteria for the Radium-226 and Thorium-232 decay series are non-risk-based values, set at 5 pCi/g above site-specific background concentrations. All other criteria are risk-based concentrations for the protection of a hypothetical future worker, and include any contributions from background.

Similarly to the exposure unit approach described previously for ETTP, both an average remediation level (averaged across the exposure unit) and a maximum remediation level (not to be exceeded at any location) is specified for each contaminant of concern. However, the method used to address multiple contaminants differs. Where multiple COCs are present within an exposure unit, a sum-of-the-ratios approach must be used to ensure that the cumulative risk to the future worker from all contaminants does not exceed 1 x 10^{-4} ELCR (excluding the radium and thorium decay series) and HI≤3.

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Melton Valley Current State:

The major areas of contamination in Melton Valley are described below:

- White Oak Creek, White Oak Lake, their tributaries and adjacent lands contain sediments contaminated with cesium-137 and cobalt-60.

- Solid Waste Storage Area 4 was used for disposal of solid low-level wastes in trenches and auger holes. This area is a significant source of strontium-90 levels at White Oak dam where surface water from Melton Valley is released to the Clinch River via White Oak Lake. Groundwater contaminants are strontium-90, tritium and transuranic elements.

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- Solid Waste Storage Area 5 was used for disposal of low-level radioactive wastes in trenches and auger holes. Approximately 1800 curies of tritium are released annually from this area to the Clinch River via White Oak Lake. The most heavily contaminated groundwater wells in Melton Valley are located in this area. Groundwater contaminants are transuranic elements, strontium-90, tritium, and volatile organic compounds.

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- Solid Waste Storage Area 6 was used for low-level waste disposal into trenches, auger holes and silos. Groundwater contaminants are organic solvents and tritium.
- Waste pits and trenches were used from 1951 to 1966 for disposal of liquid low-level radioactive wastes. Wastes were piped into these seepage pits, resulting in extensive soil contamination. Groundwater contaminants are strontium-90, cobalt-60, and transuranic elements.
- The Homogeneous Reactor Experiment (HRE) pond received contaminated condensate and shielding water during the operation of the HRE reactor from 1958 to 1962. The pond has been frozen using a cryogenic barrier demonstration to reduce the releases of radionuclides to surface water.
- Hydrofracture injection wells were used for the disposal of liquid waste. In the hydrofracture process, waste containing up to one million curies was mixed with cement grout. This mixture was pumped under pressure via injection wells into the Pumpkin Valley Shale geologic formation, located 700 to 1000 feet below the surface, where groundwater is 10 times more saline than seawater and is not part of an active groundwater flow system. There are no known releases to surface water, sediments, or surface soils from the hydrofracture process. There is some speculation that pressure below the hydrofracture zone may cause water to flow up boreholes or wells.
- Soil has been contaminated by spills and leaks from the disposal operations.

The Baseline Risk Assessment (DOE 1997a) for Melton Valley concluded that radionuclides in contaminated soils and sediments present unacceptable risk levels ($\geq$1 x 10^{-4} ELCR) for industrial, recreational and residential exposure scenarios. The predominant exposure pathway is direct external exposure to gamma radiation, primarily due to Cesium-137 (median concentration in soil = 162 pCi/g, maximum = 700,000 pCi/g) and Cobalt-60 (median concentration in soil = 15 pCi/g, maximum = 500,000 pCi/g). Potential ecological risk to terrestrial biota also was identified for radionuclides, metals, and PCBs in soil and sediment, although lines of evidence were limited. Additional ecological monitoring data which have been collected to fill data gaps and better assess risk to biota (DOE 2004), indicates that the RI may have overestimated potential ecological risk; this study identified no unacceptable ecological risks, but did not rule out the possibility of unacceptable risks to fish and other aquatic biota.

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Life-Cycle Baseline Plan for Melton Valley:

The following remedial actions are planned to be completed by 2006 in the current baseline for Melton Valley:

- Multi-layer caps will be installed in Solid Waste Storage Areas 4, 5, and 6 and in portions of the Seepage Pits and Trenches Area. Collection drains will be installed downgradient of capped areas in Solid Waste Storage Area 4, Solid Waste Storage Area 5 South, and in the Seepage Pits and Trenches Area to increase the effectiveness of hydraulic isolation. The collected groundwater will be treated to meet discharge limits.
- Readily retrievable transuranic waste will be removed from the lower 22 transuranic trenches in Solid Waste Storage Area 5 North. The removed waste will be segregated at the Transuranic Waste Treatment Facility and sent to Waste Isolation Pilot Plant for disposal.
- Sediment and soil from the Homogeneous Reactor Experiment (HRE) Pond and four High Flux Isotope Reactor (HFIR) impoundments will be excavated and disposed in the Environmental Management Waste Management Facility. Floodplain soil and sediment that exceed agreed-upon levels in the Melton Valley ROD will be excavated and either disposed in the EMWMF or used as contour fill under the various multi-layer caps. Hot spots in the waste management area (around Solid Waste Storage Areas 4, 5, and 6 and the Seepage Pits and Trenches Area) generally will be capped. Hot spots in the industrial use area (east of Solid Waste Storage Area 5) generally will be excavated and either disposed in the EMWMF or used as contour fill under the various multi-layer caps. Inactive waste pipelines will be isolated, stabilized, or removed, as necessary, to address residual contamination.
- The New Hydrofracture Facility and Waste Management Facilities in Solid Waste Storage Areas 5 and 6 will be demolished.
- In situ vitrification will be used as a cost-effective treatment for Trenches 5 and 7 in the Seepage Pits and Trenches Area.
- In situ grouting will be used for the Homogeneous Reactor Experiment (HRE) fuel wells in the Seepage Pits and Trenches Area.
- Plugging and abandonment will be used to isolate four hydrofracture injection wells and associated monitoring wells that interfere with installation of multi-layer caps and other cleanup activities.
- The Spent Nuclear Fuel will be retrieved, repackaged, and transported to the Idaho National Environmental Engineering Laboratory for disposal.
- Fuel salts from the Molten Salt Reactor Experiment (MSRE) will be removed for off-site disposal.
- Resin beads will be removed from the T1, T2, and High Flux Isotope Reactor (HFIR) tanks and the tanks grouted in place.
- Approximately 6,100 yd^3 of low-level radioactive waste stored in Melton Valley will be disposed offsite prior to capping.
- Institutional controls will be maintained in perpetuity to control future land use, to restrict access to capped waste disposal areas, and to prohibit onsite use of groundwater.

Risk-Based End State Vision for Melton Valley:

Current baseline plans for Melton Valley are designed to support the planned end use for the different areas of this site – i.e., the majority of Melton Valley will be a dedicated waste management area with restricted access, while a portion of the site will be suitable for DOE-controlled industrial use. Remediation criteria were derived to achieve an acceptably low level

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of risk to the future worker in each of these areas. In most cases, therefore, the actions planned under the current baseline are considered to be entirely consistent with remedial actions designed solely on the basis of the risk-based end state. Only one potential variance has been identified to date:

- The current baseline plan, and the selected remedy in the ROD, calls for use of in-situ vitrification (ISV) technology for remediation of buried waste at Trenches 5 and 7 located in the Seepage Pits and Trenches Area of Melton Valley. ISV was selected for use in these areas because these trenches hold a large inventory of radionuclides in a relatively small volume of waste within a small contaminated area. ISV was not proposed for use at other locations within Melton Valley because of the difficulty in using this technology in heterogeneous waste, the potential hazard of using ISV in saturated waste, and the overall high cost of ISV relative to other remediation technologies. Previous demonstration projects using ISV technology at Melton Valley sites near the Trench 5 and 7 areas were unsuccessful, partially due to high moisture content of the trench contents. Recent data indicate higher levels of moisture in Trenches 5 and 7 than previously thought, which may adversely affect the implementation of ISV technology at these sites. As a result of this and other factors, estimates for both cost and implementation time for the ISV remedy have increased significantly relative to the ROD. Selected remediation measures for adjacent areas already include use of in-situ grouting and capping using a multi-layer cover system. Implementation of the in-situ grouting remediation technologies for the Trench 5 and 7 sites, in lieu of ISV, will be protective to human health and the environment under the selected end-state land use for this area (i.e., protection of the worker in this dedicated waste management area), with less schedule risk, reduced risk to workers, and lower cost.

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It is important to note that the remedial actions for Melton Valley are well underway and are scheduled for completion in FY2006. Remediation of several areas has been completed (e.g., decontamination and decommissioning of the Old Hydrofracture Facility, removal of contaminated soil from the Intermediate Holding Pond) and significant construction work is currently in progress in other areas (e.g., plugging and abandonment of the Hydrofracture wells, capping and hydraulic isolation of SWSA 4). Due to the advanced stage of remedial actions and the accelerated schedule for completion, as well as the heavy emphasis on end use controls already in the selected remedy, Melton Valley does not appear to be a good candidate for change based on the RBES Vision, with the exception of the variance noted above, which is expected to have a beneficial schedule impact.

Maps of the Melton Valley watershed under current and RBES conditions are provided in Figures 4.2a1 and 4.2b1. Conceptual site models under current state and RBES conditions are illustrated in Figures 4.2a2 and 4.2b2, respectively. Baseline and RBES scenarios for Melton Valley differ only with respect to the technology used for stabilization of buried wastes in a small portion of the site. In either case, a long-term stewardship program will ensure the continuing protectiveness of the remedy, including continuing surveillance and maintenance. The containment system for capped areas throughout Melton Valley will require periodic maintenance and repair to minimize the potential for failure. Groundwater monitoring wells will require periodic maintenance and replacement at longer intervals (~30 years). Since contaminants will remain on site above levels suitable for unlimited use and unrestricted

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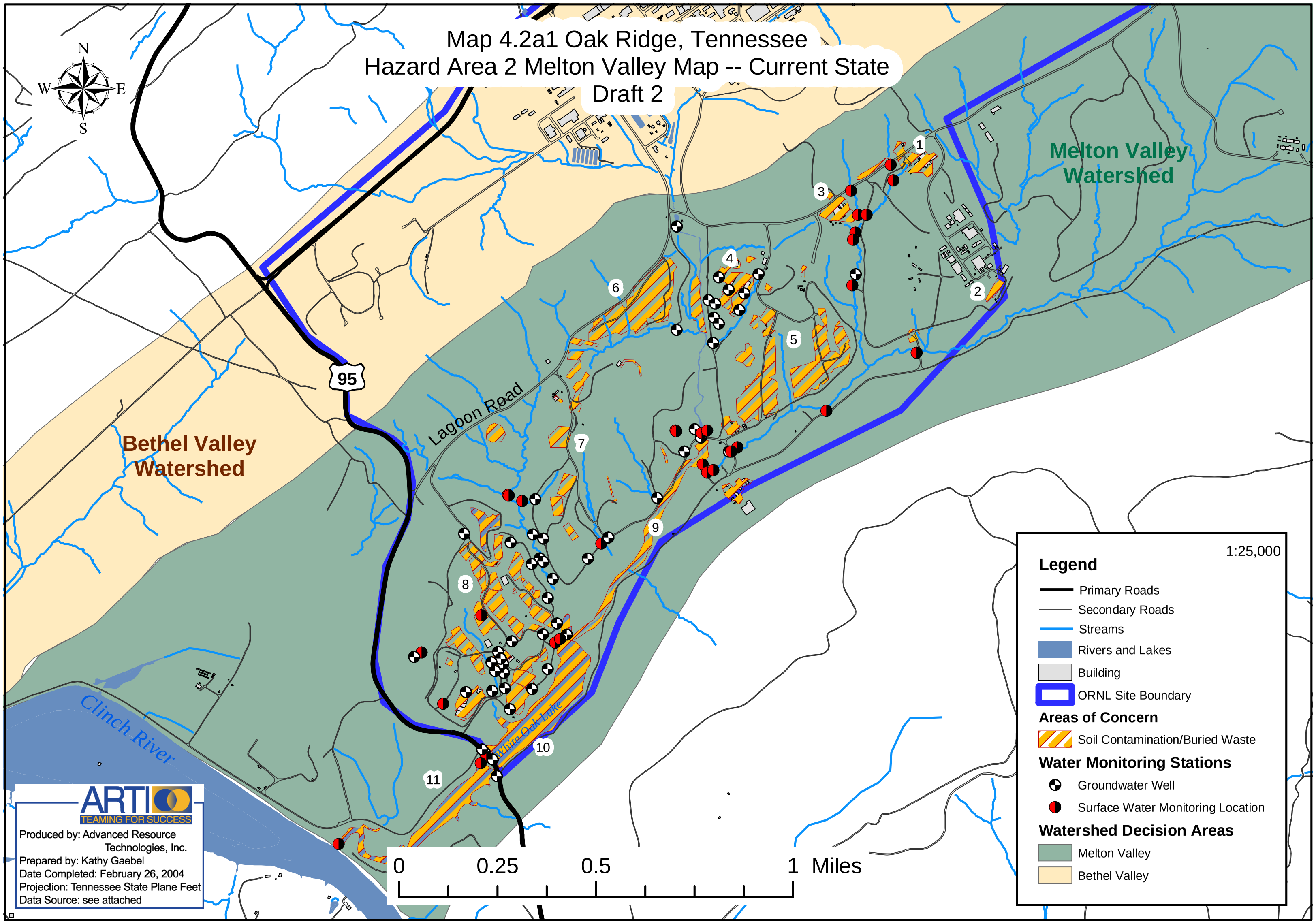
exposure, a statutory review will be conducted at least every five years to ensure that the remedy continues to be protective of human health and the environment. The DOE Office of Science will retain ownership of the Melton Valley watershed and the remainder of ORNL for the foreseeable future.


Map 4.2a1 Oak Ridge, Tennessee
Hazard Area 2 Melton Valley Map -- Current State
Draft 2
N
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Melton Valley Watershed
Bethel Valley Watershed
95
Lagoon Road
Clinch River
White Oak Lake
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Primary Roads
Secondary Roads
Streams
Rivers and Lakes
Building
ORNL Site Boundary
Areas of Concern
Soil Contamination/Buried Waste
Water Monitoring Stations
Groundwater Well
Surface Water Monitoring Location
Watershed Decision Areas
Melton Valley
Bethel Valley
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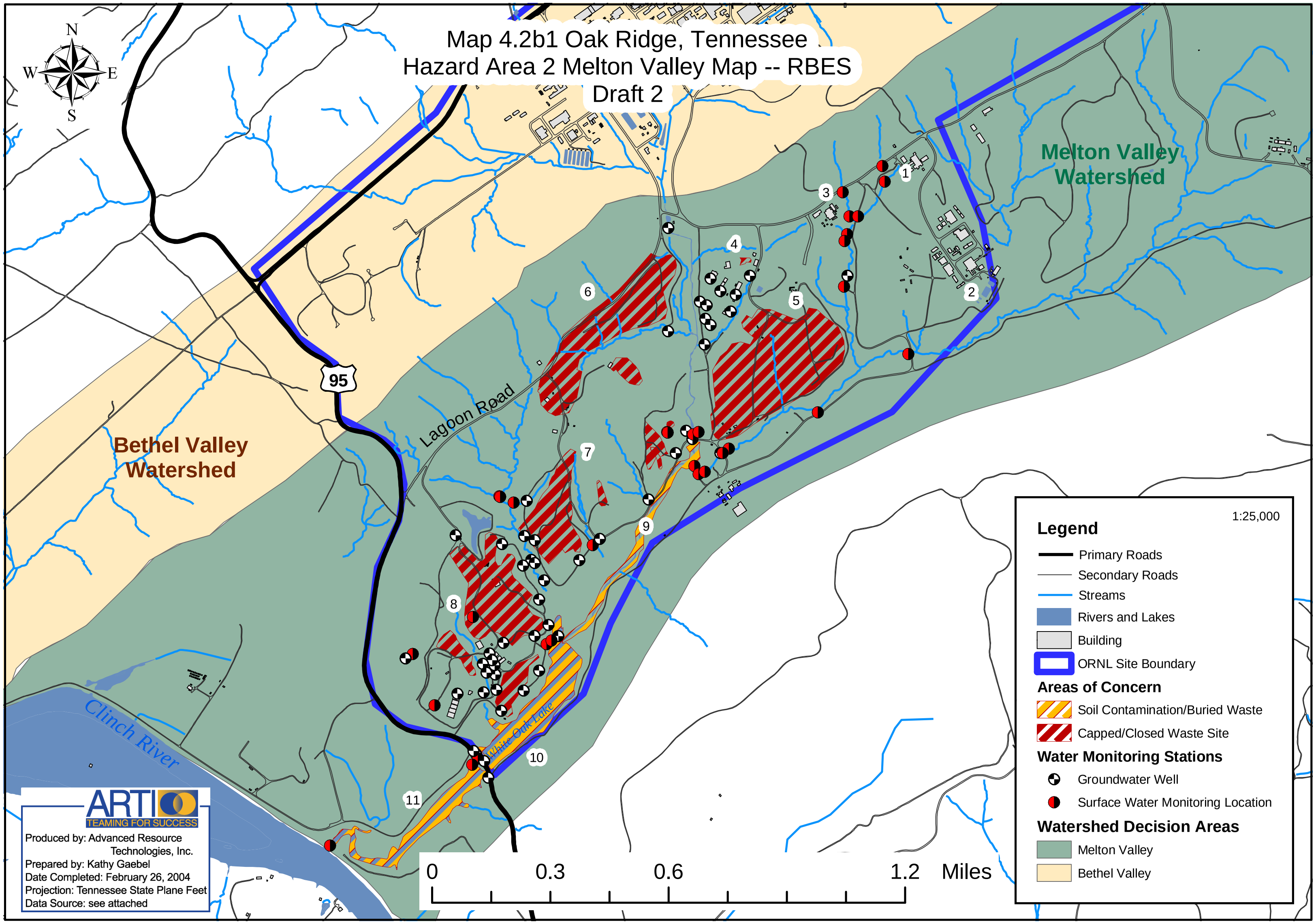
TEAMING FOR SUCCESS
Produced by: Advanced Resource Technologies, Inc.
Prepared by: Kathy Gaebel
Date Completed: February 26, 2004
Projection: Tennessee State Plane Feet
Data Source: see attached

Figure 4.2a1 Continued

Notes for Melton Valley current state map:

1. Molten Salt Reactor Experiment (MSRE) area – The MSRE operated at ORNL from 1965 to 1969 to test the molten salt concept. In response to surveillance activities that indicated migration of radioactivity from drain tanks to other process lines, the MSRE remediation project was initiated in 1994. A series of interim actions have been completed to stabilize the charcoal beds, remove UF_6 and fluorine from the off-gas system, and remove contaminated charcoal, and actions are planned to remove fuel salt for permanent disposal. Remediation of contaminated soils and ancillary structures are addressed under the Melton Valley ROD.
2. High Flux Isotope Reactor (HFIR) waste collection basins – a series of four natural clay surface impoundments used for collection of wastewater from the HFIR operations; the HFIR cooling tower surface impoundment was used for study of chromate removal from cooling tower blowdown and was filled with soil after use.
3. Homogeneous Reactor Experiment (HRE) pond and contaminated soils – unlined, natural clay pond received contaminated condensate and shielding water from during the operation of the HRE reactor from 1958 to 1962. The HRE pond has been filled and capped with asphalt and has been cryogenically isolated in a technology demonstration pending final remediation. Support facilities associated with HRE have been determined to have no future use.
4. Solid Waste Storage Area 5 North (SWSA 5 North) – 26 unlined trenches used for disposal of alpha-contaminated radioactive waste, including transuranic (TRU) wastes, from 1970 to 1979.
5. Solid Waste Storage Area 5 South (SWSA 5 South) – includes 110 unlined auger holes and 12 unlined trenches used for disposal of solid radioactive waste from 1959 to 1973. This area also includes the Fissile Storage area, with 151 unlined auger holes and 2 unlined trenches used for disposal of fissile waste, a large landfill trench, and a 0.5-acre "ravine" landfill. Also, the hydrofracture injection well facilities (Old Hydrofracture Facility and New Hydrofracture Facility) are located just to the south and west of SWSA 5 South; these facilities were used to inject a mixture of grout and liquid radioactive waste approximately 800-1000 ft underground, where it was dispersed laterally in "grout sheets" that extend for an undetermined distance in the subsurface beneath Melton Valley.
6. Solid Waste Storage Area 4 (SWSA 4) – a 23-acre area containing unlined trenches and auger holes used for disposal of solid low-level radioactive waste from 1951 to 1974.
7. Seepage Pits and Trenches Area – a total of 7 seepage pits and trenches were used for disposal of liquid radioactive waste from ORNL from 1951 to 1966 when the hydrofracture method of liquid waste disposal became operational (see note 5 above).
8. Solid Waste Storage Area 6 (SWSA 6) – a 68-acre area that includes numerous facilities used for disposal of radioactive and hazardous wastes from 1969 to 1994. Waste was disposed in unlined trenches until 1986. Beginning in 1986, greater confinement disposal techniques were used, including concrete silos and pipe-lined auger holes for below grade disposal, and concrete-lined disposal areas for below-grade and above-grade (tumulus) disposal operations. Interim corrective measures under RCRA were conducted in 1989 to cover facilities containing RCRA-regulated wastes with high-density polyethylene covers, but maintenance and repair activities for these covers were discontinued in 1996, pending the installation of permanent multi-layer caps under the CERCLA remedial actions.
9. White Oak Creek - sediments and floodplain soils contain radiological and chemical contaminants of concern; the most highly contaminated floodplain soils are located in the area of the former Intermediate Holding Pond east of SWSA 4.
10. White Oak Lake – sediments contain radiological and chemical contaminants of concern.
11. White Oak Embayment – sediments contain radiological and chemical contaminants of concern.

In addition to the hazards listed above, Melton Valley contains an extensive system of buried pipelines used for transport of liquid radioactive waste from generator facilities to storage tanks, seepage pits/trenches, or hydrofracture injection sites for disposal. Also, as noted in item 5 above, grout sheets resulting from hydrofracture injection operations underlie a large portion of the Melton Valley watershed, approximately 800-1000 ft bgs.



Map 4.2b1 Oak Ridge, Tennessee
Hazard Area 2 Melton Valley Map -- RBES
Draft 2
N
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Melton Valley Watershed
Bethel Valley Watershed
95
Lagoon Road
Clinch River
White Oak Lake
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Miles
Legend
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Primary Roads
Secondary Roads
Streams
Rivers and Lakes
Building
ORNL Site Boundary
Areas of Concern
Soil Contamination/Buried Waste
Capped/Closed Waste Site
Water Monitoring Stations
Groundwater Well
Surface Water Monitoring Location
Watershed Decision Areas
Melton Valley
Bethel Valley
ARTI
TEAMING FOR SUCCESS
Produced by: Advanced Resource Technologies, Inc.
Prepared by: Kathy Gaebel
Date Completed: February 26, 2004
Projection: Tennessee State Plane Feet
Data Source: see attached

Figure 4.2b1 Continued

<u>Notes for Melton Valley RBES map:</u>

1. Molten Salt Reactor Experiment (MSRE) area – contaminated soils to be remediated to risk-based criteria for industrial use; surface support facilities without identified future use to be demolished. Completion of actions to remove and disposition fuel salts from the reactor will be completed in FY2005 under the MSRE remediation project.

2. High Flux Isotope Reactor (HFIR) waste collection basin – waste impoundments and associated contaminated soils to be remediated to risk-based criteria for industrial use.

3. Homogeneous Reactor Experiment (HRE) pond and contaminated soils – HRE pond and associated contaminated soils to be remediated to risk-based criteria for industrial use; surface support facilities without identified future use to be demolished.

4. Solid Waste Storage Area 5 North (SWSA 5 North) – buried transuranic wastes in 22 trenches and associated contaminated soils to be removed for off-site disposal.

5. Solid Waste Storage Area 5 South (SWSA 5 South) – multi-layer cap to be installed over waste disposal sites. Old Hydrofracture Facility and New Hydrofracture Facility will be demolished, injection wells plugged; grout sheets in the deep subsurface (approximately 800 ft bgs) will remain, requiring institutional controls.

6. Solid Waste Storage Area 4 (SWSA 4) – multi-layer cap to be installed over waste disposal sites.

7. Seepage Pits and Trenches Area – multi-layer caps to be installed over waste disposal sites; Trenches 5 and 7 also are planned for in-situ treatment prior to capping (in-situ vitrification in the current baseline, changed to in-situ grouting in the RBES).

8. Solid Waste Storage Area 6 (SWSA 6) – multi-layer caps to be installed over waste disposal sites.

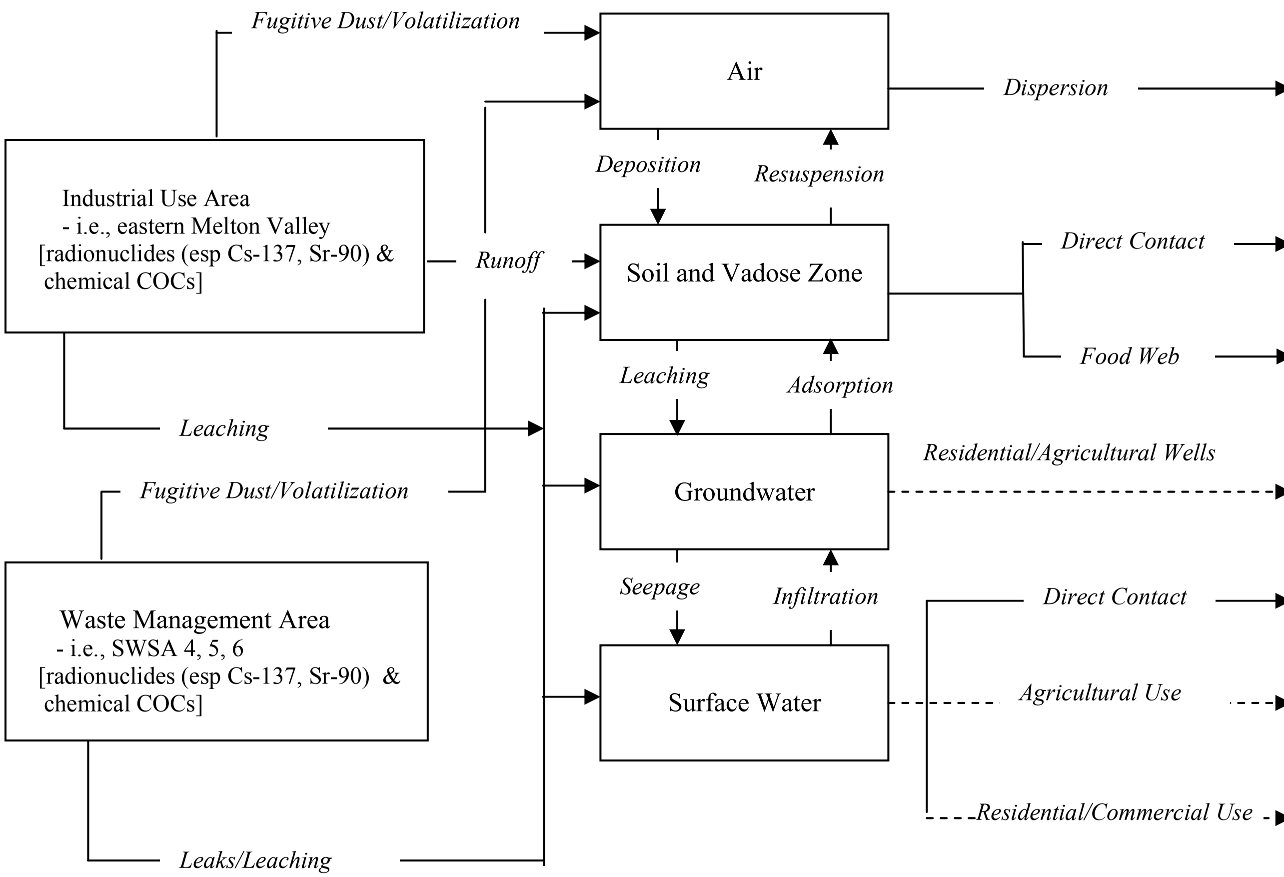
9. White Oak Creek sediments and floodplain soils – localized removal of contaminated floodplain soils; contaminated sediments and floodplain soils will remain, requiring institutional controls to prevent unauthorized use.

10. White Oak Lake – contaminated sediments will remain, requiring institutional controls.

11. White Oak Embayment – contaminated sediments will remain, requiring institutional controls.

Buried inactive pipelines will be stabilized in place (e.g., by grouting) or removed; those that lie beneath a multi-layer cap will be cut at the edge of the cap and plugged. Above-ground inactive pipelines will be removed.

Figure 4.2a2, Conceptual Site Model - Hazard Area 2, Melton Valley – Current State



Potential Receptor Exposed			
Onsite Worker	Offsite Recreational	Offsite Resident	Ecological
I/D/R	-	-	I/D/R
D/R	-	-	D/R/F
-	F	-	F
-	-	-	-
D/R	D/R	D/R	D/R/F
-	-	D/R/F	-
D/R	D/R	D/R/F	D/R/F

KEY

→ Active transport, uptake, or exposure pathway

- - -→ Blocked or mitigated transport, uptake, or exposure pathway

I – Inhalation
D – Dermal contact R – Direct Radiation Exposure
F – Ingestion

Figure 4.2a2, Conceptual Site Model - Hazard Area 2, Melton Valley – Current State

Narrative:

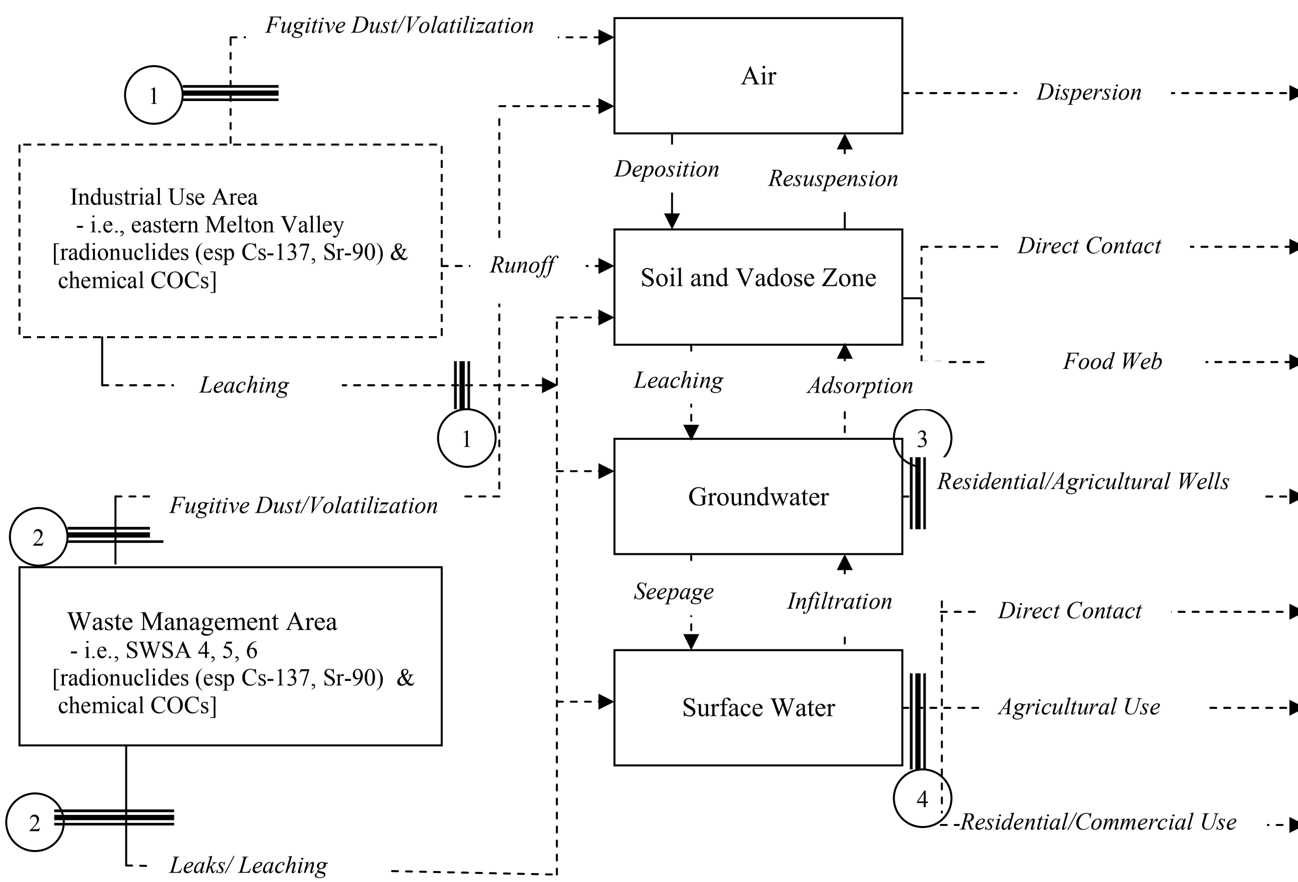
Contaminant Sources:

Melton Valley is currently undergoing an extremely aggressive remedial action program, scheduled for completion in 2006. Numerous waste management facilities within Melton Valley [i.e., Solid Waste Storage Areas (SWSAs) 4, 5, and 6] have been used for disposal of radioactive and hazardous wastes for over a half-century. While the list of contaminants of concern is understandably lengthy, a few fission products contribute the great majority of risk, notably Cs-137 and Co-60 in soil and sediments, and Sr-90 in surface water. Under the existing CERCLA ROD, remediation criteria for contaminants of concern in soil and other media were derived to limit risks to the future DOE industrial workers not to exceed 1×10^{-4} ELCR and HI<3. Institutional controls include restrictions on access to the waste management areas and restrictions on future groundwater and surface water use throughout Melton Valley.

Current State Exposure Pathways and Receptors:

Under current conditions, potentially complete exposure pathways for onsite workers include: inhalation of resuspended particulates or volatiles; and direct exposure to contaminants in soils, waste and surface water. While Melton Valley is not normally accessible to recreational users, potentially complete exposure pathways to off-site recreationists include direct contact with surface water and ingestion of fish. Ecological receptors potentially may be exposed to contaminants in air, soil, surface water and the food chain. Surface water in Melton Valley enters White Oak Creek and flows to White Oak Lake, where it exits the ORR. Potentially complete exposure pathways to offsite residents include direct contact with surface water after exiting the ORR, fish ingestion, and use of surface water for irrigation of home gardens. There is no current use of groundwater or surface water in Melton Valley for residential, commercial, or agricultural purposes.

Figure 4.2b2, Conceptual Site Model – Hazard Area 2, Melton Valley – RBES



Potential Receptor Exposed			
Onsite Worker	Offsite Recreational	Offsite Resident	Ecological
I/D/R	-	-	I/D/R
D/R	-	-	D/R/F
-	F	-	F
-	-	-	-
D/R	D/R	D/R	D/R/F
-	-	D/R/F	D/R/F
D/R	D/R	D/R/F	D/R/F

KEY

- Active transport, uptake, or exposure pathway
- Blocked or mitigated transport, uptake, or exposure pathway
- Engineered barrier or administrative control – sequentially numbered

I – Inhalation
D – Dermal contact R – Direct Radiation Exposure
F – Ingestion

Figure 4.2b2, Conceptual Site Model – Hazard Area 2, Melton Valley – RBES

Narrative:

Contaminant Sources:

Melton Valley is currently undergoing an extremely aggressive remedial action program, scheduled for completion in 2006. Under both current life-cycle baseline and Risk-Based End State conditions, a major portion of the Melton Valley watershed will be dedicated to permanent disposal of radioactive and hazardous waste, while the remainder of the site will be available for future DOE-controlled industrial use. Contaminants of concern include Cs-137 and Co-60 in soil and sediments, and Sr-90 in surface water. Remediation criteria for contaminants of concern in soil and other media were derived to limit risks to the future DOE industrial workers not to exceed 1×10^{-4} ELCR and HI<3. Institutional controls include restrictions on access to the waste management areas and restrictions on future groundwater and surface water use throughout Melton Valley.

Risk-Based End State Barriers/Interventions:

The steps taken to mitigate or remove these hazards are as follows:

1. Contaminated buildings and soils within the areas designated for future DOE-controlled industrial use within Melton Valley will be remediated such that contaminants of concern do not exceed risk-based remediation criteria for industrial use. Contaminated media above remediation criteria generally will be removed and either disposed at the EMWMF disposal facility or used as contoured fill under the various multi-layer caps (see item 2 below). Residual contaminant levels will be below levels of concern for fugitive dust emissions/volatilization or direct radiation exposure.

2. Most waste disposal areas within Melton Valley will be contained in place via installation of multi-layer engineered cover systems and other hydraulic controls - this includes waste disposal sites within SWSA 4, SWSA 5, and SWSA 6. In addition, the extensive network of underground pipelines will be grouted in place, numerous wells will be plugged and abandoned. In each case, the engineered containment systems will preclude unacceptable exposures to workers or releases of contaminants to the environment above levels of concern. Institutional controls will be maintained in perpetuity to restrict access to the capped waste disposal areas.

3. Future land use within Melton Valley will be restricted to DOE-controlled industrial use, with a major portion of the watershed dedicated to permanent waste disposal operations. Institutional controls will include permanent prohibitions on groundwater use. Long-term stewardship and institutional controls will ensure continuing protectiveness of the remedy. Surveillance and maintenance will include monitoring of surface water and groundwater, with periodic maintenance and replacement of groundwater wells and ongoing maintenance of capped areas as required.

4. Remediation of surface water and sediment in White Oak Creek has been generally deferred to a future CERCLA decision. Only limited removal of areas with elevated levels of radiological contamination in floodplain soils (>2500 uR/hr) is addressed under the existing ROD for Melton Valley. It is anticipated that the actions described in items 1 and 2 above, along with other remedial actions for Bethel Valley, will significantly reduce the flux of contaminants into White Oak Creek and White Oak Lake, which are ultimately discharged to the Clinch River upon exiting the ORR. Institutional controls include restrictions on current use of surface water within Melton Valley.